

NRC-RADTRAN – Introduction/ Exercise

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Outline



- Introduction
- NRC-RADTRAN Concepts
- NRC-RADTRAN Installation
- NRC-RADTRAN Use
- NRC-RADTRAN Demo
- Conclusions





Introduction



- NRC Radioactive Material Transport (NRC-RADTRAN)
- Risk and consequence analysis of radioactive material (RAM) transportation
- Modes of transportation: rail, trucks, barge, aircraft
- First released in 1977 (SNL)
- 6 versions released to date
- GUI compatibility added to RADTRAN 6.02.1 → NRC-RADTRAN v1.0





NRC-RADTRAN Concepts



- Calculations
 - With traffic
 - Opposing traffic
 - Population
- Treats shipment as a stationary object
 - Relative velocity used for everything





Taken From RADTRAN 6 Technical Manual SAND2014-0780











Example Truck Route Stop Figure from page 6-29 of U.S. **NRC Environmental Impact** Statement for an Early Site Permit (ESP) at the Clinch **River Nuclear Site**

NUREG-2226, Vol. 1

Figure 6-2 Illustration of the Truck Stop Model







- Two types of exposures modeled:
 - Direct exposure from loss of shielding
 - Exposure associated with release of particulates, gases, volatiles, and crud; several pathways:
 - ✓ Inhalation
 - ✓ Cloudshine
 - ✓ Resuspension
 - ✓ Groundshine







- Doses are calculated and summed for all appropriate exposure pathways for all isotopes in each material for the shipment(s) being analyzed and for all downwind isopleths for each accident severity to yield a consequence (total dose) per accident of each severity
- Probability of occurrence of each accident severity class is calculated from input values for accident rate, fractional occurrence, and distance traveled
- Total Dose is multiplied by probability of occurrence for each accident severity to yield Dose-Risk
- Results and intermediate calculations are included in the output file







- Changes in RADTRAN 6
 - Command line is no longer used for any functionalities
 - RadCat is no longer maintained, distributed, or used
 - NRC-RADTRAN 1.0 is current version

✓ Runs RADTRAN 6.02.1

✓ New Graphic User Interface for Inputs

RADTRAN/RadCat 6 User Guide and Technical Manual are still valid references





NRC-RADTRAN Installation



- Login to NRC-RAMP
 - 1. Codes
 - 2. NRC-RADTRAN
 - 3. Download

👤 Haris	h Gadey				
View pro	ofile Edit profile Log out				
	RAMP Websit Radiation Protection Con Analysis and Maintenand	te mputer Code ce Program	CODES + M	EMB	ERSH
			A to N		
			ARCON		
			DandD		
	Code Menu	NRC-	GALE		
		iiiio	GENII		
	RC-RADTRAN Overview	_	HABIT		
3.	🛓 Download	Doses	IMBA		
	Documentation	transp	MILDOS		
	🖂 Request Support	Se Sta	NRC-RADTRA	N	2
	Updates		NRCDose		





•



P to Z

PAVAN

PIMAL

Radiological Toolbox

RASCAL

RESRAD

SNAP/RADTRAD

Turbo FRMAC

. .

VARSKIN

VSP

NRC-RADTRAN Installation (cont.)



 Double click on the downloaded file to install

Name ^	R Setup - NRC-RADTRAN version 1.0 − ×
✓	Select Additional Tasks Which additional tasks should be performed?
	Select the additional tasks you would like Setup to perform while installing NRC-RADTRAN, then click Next.
	Additional shortcuts:
	Create a desktop shortcut
	Next > Cancel





NRC-RADTRAN Use

R



Defining the problem:

- 1. Type of Analysis
- 2. Units
 - Curies/ Rem
 - Bq/Sv
- 3. Item 1 selection dictates available input panels

NRC-RADTRAN											
New Open Save Save As	Close	Undo (25)	Redo (0)	Options C	heck	Run Help	About	÷			
New file* Output - None											
Input File Summary: Inciden Vehicles: 0 (0 truck, 0 rail, 0 Packages: 1 containing 0 Ci Links: 5 covering 722 km WebTRAGIS Route: NE to WY	t-Free) barge) (21 par	& Accidenta Stops: 1 Accident Release C ts) Isopleths	l Release lasting 2 hr: severities: 0 Groups: 0 : 18	s			1.	An O Inc O Ac O Bo	nalys tident cident th	is Type Free/Inta tal Releas	ac se
Vehicles	Vehicl packa	e parameters ges.	s determine	incident-fre	e dose	to the publi	c, vehicle o	crew, and i	nspect	ors during	tra
Links		Name	Transport Mode	Exclus- ive use?	Size (CD) (m)	Dose Rate at 1 m (mrem/hr)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	V F
Stops	A	dd Vehicle							_	+	
Handling								TI at from	t 1 meter n cask	0.5 CD = "\ Cask Radiu	/irt us
Packages	3.	I.					6				
Accidents							Ş			X	
Radionuclides					T		ÐĽ	1	205		
Loss of Shielding				A radioa	ctive I	naterial pa	ickage or	n a vehicl	e (rail	car) show	/in
Economic Model				which is	the de	ose rate 1 r	n from th	ne surfac	e in m	rem/hr.	ar c
Default Parameters											







New Open Save Save As Close Undo (0) Redo (0) Options Check Run

- Basic functions: opening, closing, and saving files
- Undo/ Redo: maintains list of prior 99 actions
- Options: display, file, open/save, and other legacy options
- Check: Indicates any file errors (errors, warnings)
- Help/ About: opens the viewer and provides basic information about NRC-RADTRAN

Input File Summary: Incide Vehicles: 0 (0 truck, 0 rail, 1	nt-Free 0 barge) Stops: 0	lasting 0 h	irs	Anal	ysis Type	e Ca	se Title:	Curi-		Text Outer	.+
Packages: 0 containing 0 Ci Links: 0 covering 0 km	Accident Release (severities: Groups: 0	0	Accid	ental Relea	ase	tput onnes.	Curie/	KEIVI	lext Outpt	
WebTRAGIS Route: None	Isopleths	: 18		Both		Co	mments:				
Vehicles	Vehicle parameters packages.	s determine	e incident	-free c	lose to the p	ublic, veh	icle crew, a	and insp	pectors du	ring transp	01
Links	Name	Transport Mode	Exclus- ive use?	Size (CD) (m)	Dose Rate at 1 m (mrem/hr)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Width Facing Crew (m)	1
Stops	Add Vehicle						TIa	t 1 meter			
Packages	-					1	fror	n cask	0.5 CD = " Cask Radio	Virtual" us	
Accidents						F					}
Radionuclides				(F)		ROL		701		$\mathbf{\mathbf{\nabla}}$	
Loss of Shielding			A radio	active	e material I	package	on a veh	icle (ra	ailcar) she	owing	N
Economic Model			dimens which i	ions (s the	used in the dose rate 1	inciden I m from	t-free mo the surfa	del. T ace in	l is Trans mrem/hr	port Inde	x,
Default Parameters											













	Name	Transport Mode	Exclus- ive use?	Size (CD) (m)	Dose Rate at 1 m (mrem/hr)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Width Facing Crew (m)	Crew Shielding Factor (1=None, 0=Fully shielded)	Number of Shipments
0	Vehicle_1	Rail ~		1	0	1	0	0	0	0	0	1
	Add Vehicle											

- Transport Mode: highway, rail, waterway
- Size (CD): Largest dimension of package (max. 9 m)
- Gamma/ Neutron Fraction: split between gamma and neutron external package dose (must add to unity)

- Crew Distance: Average distance of crew to nearest radioactive package
- Width Facing Crew: largest dimension of the cargo facing crew
- Crew Shielding Factor: fraction of radiation exposed to the crew
- Number of Shipments: values calculated for single shipment and multiplied







	Name	Vehicle	Mode	Length (km)	Speed (km/hr)	Adjacent Vehicle Occupants	Pop.Density People/km²	Traffic (vehicles /hr)	Accidents per km	Deaths per accident	Population Type	Farm fraction if rural
\otimes	NE_Rural_H	Vehicle_1 ~	NonRoad ~	628.9	110.3	1	39.8	0	0	0	Rural ~	0.5
\otimes	NE_Subur_H	Vehicle_1 ~	NonRoad ~	21.14	115.5	1	1361.4	0	0	0	Suburban ~	0
\otimes	WY_Rural_H	Vehicle_1 ×	NonRoad ~	57.61	122.4	1	4.9	0	0	0	Rural ~	0.5

- Mode: highway, secondary road/ non road. Do not select unknown
- Adjacent Vehicle Occupants: average number in vehicles
- *Traffic*: number of vehicles travelling per hour on the link
- *Traffic*, *Accidents per km*, and Deaths per accident are user defined

- *Population Type*: Either rural, suburban or urban. Affects shielding factors and dose to pedestrians
- Farm fraction if rural: fraction of surrounding area used for agriculture (only for rural)





- Creation of Links using WebTRAGIS
 - Limited to contiguous 48 states
 - Requires US
 Government
 Sponsorship
 - Populations are not currently being updated
- Creation of Links in Google Earth
 - Requires population density files
- Manual Entry









- WebTRAGIS information is intersection based
- Each link is the distance between two intersections
 - Uses known
 - ✓ Population density
 - ✓ Distance
 - ✓ Speed
 - \checkmark Time of transit



Segment ID	State	Rural Dist. (km)	Suburban Dist. (km)	Urban Dist. (km)	Rural Pop./km²	Suburban Pop./km²	Urban Pop./km²	Speed (km/hr)	Duration (hr)	X1	X2	Y1	Y2	
31000007797	NE	2.8264033	4.7247969	0	14.3115268	369.41164(0	151.02400	0.050000	-96.643	-96.715	40.896	40.862	\sim
3100007800	NE	0	3.2056443	0	0	821.170013	0	96.169325	0.033333	-96.715	-96.739	40.862	40.839	
3100007816	NE	0	2.8434462	0	0	316.27792	0	85.303393	0.033333	-96.739	-96.75€	40.839	40.8175	
3100007817	NE	28.228306	0.8998866	0	5.8528358	254.36806	0	124.835116	0.233333	-96.75€	-97.101	40.8175	40.822	
31000007812	NE	41.6221994	0	0	2.0012392	0	0	118.92057 [.]	0.349999	-97.101	-97.597	40.822	40.821(
31000007813	NE	33.619273!	0	0	1.6860701	0	0	118.65624	0.283333	-97.597	-97.99€	40.8210	40.8219	
31000007814	NE	32.135462	0	0	1.6035867	0	0	120.50798	0.266666	-97.99€	-98.378	40.8219	40.820 ⁻	
31000007838	NE	62.165907	1.0555628	0	3.5758565	103.58322!	0	122.36413	0.5166666	-98.378	-99.085	40.820 ^r	40.669	
31000007837	NE	24.3591311	0.6319524	0	4.0554827	92.303971	0	124.95538	0.200000	-99.085	-99.38(40.669	40.690	
31000007835	NE	31.125923(0.5881252	0	1.9347366	99.471993	0	118.92768	0.266666	-99.38(-99.74(40.690	40.741€	
31000007828	NE	93.125263	3.17303911	0	3.2147720	159.50306	0	120.37288	0.7999999!	-99.74(-100.76	40.741 (41.11121	
31000007780	NE	78.903204	1.95711837	0	1.7693489	129.63676	0	121.29046	0.666666	-100.76	-101.71!	41.11121	41.1150	
31000007783	NE	38.479319	0	0	1.2944100	0	0	121.513573	0.3166668	-101.71!	-102.15	41.1150	41.0264	
31000007784	NE	68.228934	0.1666873	0	0.322960€	67.267824	0	120.69817	0.566666	-102.15	-102.94	41.0264	41.1131(
31000007778	NE	0.1945772!	1.8506766	0	33.157266	129.515910	0	122.717105	0.0166664	-102.94	-102.97	41.1131(41.1132	
31000007776	NE	5.2526765	0	0	5.9683196	0	0	105.05313	0.050000	-102.97	-103.03	41.1132	41.1263	
31000007645	NE	55.501630	0	0	0.6387937	0	0	57.415477	0.966666	-103.03	-103.66	41.1263	41.2162	
31000007762	NE	33 126076.	0.0415692	0	0.8/07031	62 170092	0	124 38216.	0.266666	-103 66	-104.05	A1 2162	41 1806	~







- Summarized into three links per state
 - Rural
 - Urban
 - Suburban

Vehicles	To sp Title	of link section	port route, (optional):	you can create links ı	manually	and/or im	port a route	from a WebT	RAGIS out	put file.				
Links		Name	Vehicle	Mode	Length (km)	Speed (km/hr)	Adjacent Vehicle Occupants	Pop.Density People/km ²	Traffic (vehicles /hr)	Accidents per km	Deaths per accident	Population Type	1	Farm fraction if rural
Stops	\otimes	NE_Rural_H	~	PrimaryHighway ~	628.9	110.3	1	39.8	0	0	0	Rural	0	0.5
Usedlas	$\overline{\otimes}$	NE_Subur_H	v	PrimaryHighway ~	21.14	115.5	1	1361.4	0	0	0	Suburban	0	0
Handling	$\overline{\otimes}$	WY_Rural_H	~	PrimaryHighway ~	57.61	122.4	1	4.9	0	0	0	Rural	0	0.5
Packages	$\overline{\otimes}$	WY_Subur_H	×	PrimaryHighway ¥	13.51	99.9	1	870.7	0	0	0	Suburban	0	0
	\otimes	WY_Urban_H	Ŷ	PrimaryHighway ¥	0.85	77.9	1	1501.6	0	0	0	Urban	0	5
Accidents		Add Link		Import from We	bTRAGIS	7								
Radionuclides	High	way route	C:\Users\na	pi143\OneDrive - PNN in RADTRAN Input Fil	NL\Docun	nents\NRG	C\RAMP\NR(C-Tran\jonatha	an.napierd	ownload\hi	ghway_rou	te_1\highway	rou	ute_1.kml
Loss of Shielding	R	WASHINGTON	A.C.	MONTANA	IORTH DA	KOTA	Si	~	*	(the)		m		
Economic Model		Card and				MIN	NESOTA	10	3		Ottawa	MAINES		
Default Parameters		OREGON	IDAHO	WYOMING	SOUTH DA	KOTA	IOWA	MICH	IGAN	S N.Y.	N.H MASS			
		CALIFORNIA	ADA			D ST ANSAS OKLAHOM TEXAS	ARKANSAS MISSI LOUISIAN	KENTU TENNESSEE ALABAMA ISSIPPI GI A	OHIO VIRGI CKY V SC EORGIA	PA ST MD NIA DELA VIRGINIA NC	NJ WARE			
	Raw	Route File Dat	a											











	Name	Vehicle	Pop.Density People/km²	Inner Radius (m)	Outer Radius (m)	Shielding Facto (1.0 = none, 0 = fully shielded)
\otimes	Stop_1	Vehicle_1 ~	2	1	2	0
	Add Stop					

- Vehicle: select any vehicle defined in the vehicles tab
- *Population Density*: the population density in # per km²
- Inner Radius: minimum distance from where dose to public is calculated

- Outer Radius: maximum distance till where dose to public is calculated
- Shielding Factor: used for dose calculations during a stop
- *Duration*: time period for a given stop in hours







Largest (critical) dimenson (m): 1 Dose rate 1 m from surface (mrem/hr): 5 Gamma fraction: 1 Package 1

Add Package

 \otimes

Vehicle Packages (determines radionuclides for accident analysis)

Enter the number of each type of package on each vehicle (leave blank for none).

	Package_
Vehicle_1	1

- Optional for incident free analysis
- Required for accident analysis
- Enter the critical dimension in meters
- Package Dimensions greater than 9 m should not be used

- Enter dose at 1 m from surface and gamma/ neutron fraction
- Enter number of packages of given type in each vehicle







Neutron fraction: 0



Sever	ity F	Probabilities		Release Groups			Weather	Isopleths (Dispersion Areas)
The Prob that a ve the prob radioact	babili ehicle babili ive m	ties tab specifie accident happe ty of an accident naterial. Probabil at of probabiliti	s the ens. T t not lities	con hese affe may	dition are cting dep	nal probabilit also referred the package end on trans	ty of an accident to as "severity f ; the others com portation mode	t of a particular severity, given iractions". One row is typically respond to releases of and rural/suburban/urban.
Mode O Hig O Ra	ghwa il (2)	y (1)		Viode) Hi) Ra	grou e ghwa iil (2)	ps ay (1)		
Popu O Ru	aterw latio Iral (1	vay (3) n)	F) W Popu) Ri	aterw I latio Iral (1	vay (3) n)		dd Graup
● Su ○ Ur	burb ban (Sev	an (2) 3) Conditional) Su) Ur	iburb ban (Sev	an (2) (3) Conditional	Remove	Selected Group
Del ⊗	Lvi 1	0.5			Lvi 1	0.3	-	
\otimes	x 2 0.3 x 3 0.2			(×) 2 0.4 (×) 3 0.3				
	Ad	d Severity Level						

	Severity Pr	obabilities	Releas	Release Groups					
ſ	Group Name:	Group_1							
	Severity Level	Release Fraction	Aerosol Fraction	Respirable Fraction	Depo Veloc				
	1	0.2	0.4	0.2	0.01				
	2	0.3	0.1	0.7					
	3	0.1	0.6	0.8					
	Group Name:	Group_2							
	Severity Level	Release Fraction	Aerosol Fraction	Respirable Fraction	Depo Veloc				
	1	0.4	0.2	0.5	0.03				
	2	0.2	0.3	0.7					
	3	0.1	0.3	0.9					
l									

- Optional for incident free analysis
- Required for accident
 analysis

- Enter dose at 1 m from surface and gamma/ neutron fraction
- Enter number of packages of given type in each vehicle







rom surface on fraction ckages of /ehicle

Severity Probabilities	Release Groups	Weather	Isopleths (I	Dispersion Areas
eather option: 💿 Nationa	Average (0) 🔿 Pasqui	ll Class (1) 🔿 U	Jser-defined (2)	
Pasquill Stability Class Fract	ions			
-1 B -1 C -1 D -	1 E -1 F -1			
User-Defined Weather Para	neters			
	Parameter		Value	
Release Height (m)			-1	
Heat Release (cal/sec)			-1	
Source Width (Cask Length)	(m)		-1	
Source Height (Cask Radius)	(m)		-1	
Wind Speed at Anemomete	r (m/s)		-1	
Anemometer Height (m)			-1	
Ambient Temperature (K)			-1	
Atmospheric Mixing Height	(m)		-1	
Rainfall Rate (mm/hr)			-1	
elease point: 🔘 (0) Allow	elevated (preferred)	(1) Ground leve	(only if release	height is less than 3ı
ispersion coefficients:	(1) Pasquill-Gifford	(2) Briggs	-	_
asquill stability class: A				

- National Average (0): simplest and requires no inputs
- Pasquill Class (1): requires values for each Pasquill stability class
- User-Defined (2): allows more detailed analysis

Se	everity Pr	obabilities	Release Groups	Weather
Nu	umber of Is	opleths: 18	·	Population D
4	Add Isoplet	h Remo	ve Isopleth	Fopulation D
√ I	Edit isopletl	h information		Rural
	• • • >	Centerline	Dilution Factor	Populatio
	Area (m ²)	Distance (m)	(Ci-s/m³/Ci released)	Density
\otimes	0	0	0	0.0
\otimes	0	0	0	0.0
\otimes	0	0	0	0.0
$\overline{\otimes}$	0	0	0	0.0
$[\otimes$	0	0	0	0.0
$[\otimes$	0	0	0	0.0
$\overline{(\otimes)}$	0	0	0	0.0
$[\otimes$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes]$	0	0	0	0.0
$[\otimes$	0	0	0	0.0
\otimes	0	0	0	0.0
\otimes	0	0	0	0.0

- Define area, centerline distance, and dilution factor of each isopleth (max. number of isopleths: 18)
- NOTE: if population density is being used, first two isopleths shall have same population density







Isopleths (Dispersion Areas)

nsity (ISOPI FTHP)

ble 🔘 Custom	
Suburban	Urban
Population Density	Population Density
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0



Assign radionuclides to packages

Define new radionuclides

Assign isotopes to each package, from both the default isotope list (in the isotope

Packages: (to add/remove packages use the Packages tab)

Package_1							
	lsotope	Release Group	Inventory (Ci)				
\otimes	NA22 🔻	Group_1 ▼	40000				
\otimes	CS137 🔻	Group_2 ▼	200000				
Add Isotope to Package_1							

- Radionuclide inventory can be defined for package
- Isotope inventory assigned according to release group
- Each package has independent isotope inventory

Assign radionuclides to packages				oackages D	Define new radionuclides		
Add	Add user-defined radionuclides here, including dose conversion factors.						
	lsotope	Half Life (days)	Gamma Energy (MeV)	Cloudshine DCF (rem-m³/Ci-s)	Groundshine DCF (rem-m²/Ci-day)	Effective Inhalation DCF (rem/Ci)	
	Add Ra	adionuclid	e				

- User-defined radionuclides can also be defined
- Half-lives, energies, and Dose Conversion Factors (DCFs) are required to be specified







- Conditional Probability and Fractional Loss are defined
- Probability for all scenarios shall sum to unity
- Parameters for stop are defined

These three tables can list the probability of various degrees of shielding loss when an accident occurs.

Rura	I (NPOP=1)			Suburban (NPOP=2)			Urban	
	Conditional Probability	Fraction Lost		Conditional Probability	Fraction Lost		Condi Proba	
\otimes	0.01	0.2		0.03	0.02		0.06	
\otimes	0.9	0.03		0.92	0.03		0.93	
\otimes	0.09	0.3		0.05	0.05		0.01	

Add Loss of Shielding Probability

	Name	Vehicle	Pop.Density (People/km²)	Inner Radius (m)	Outer Radiu
\otimes	Stop_2	Vehicle_1 ×	2	1	2
	Add Loss of	Shielding Event			







ing loss when an accident occurs.(NPOP=3)litional
abilityFraction
Lost0.030.030.00010.00010.060.06

- Values of "-1" mean NRC-**RADTRAN** defaults shall be used
- Potential user defined options include:
 - Residential shielding factors
 - Distance from radioactive packages
 - Dispersion options
 - Transfer coefficients
- REGCHECK: used to force regulatory limits for external dose and crew dose



Optional Parameters (-1 means RADTRAN default will be used)

	Treat input units as SI	(Bq/Sv) instead o	of Ci/REM (SI INPUT).	Warning:	changing	this optic	n w
. 1	fieat input units as 5	(bq/3v) instead t		31_INF01).	warning.	changing	uns optic	

Residential shielding option (IUOPT):	\bigcirc Total (1)	\bigcirc Default (2)	○ None (3)

Residential shielding factors (RR, RS, RU): Rural -1	Suburban	-1	Urban	-1

ail option (ITRAIN): \bigcirc General freight/common carrier (1) \bigcirc Dedicated	freight (2)
---	-------------

Force vehicle external dose and crew dose to comply with regulatory limit. May override dose rates and/or dimensions

MODSTD Inputs:

Distance from radioactive package, m (DISTOFF/DISTON)

If package/vehic	le is on:		Freeway	City St
	to pe	destrians	-1	-1
	to right-of-	way edge	-1	-1
	max exposure	distance	-1	-1
to vel	nicle going opposite	direction 🗌	-1	-1
to	vehicle going same	direction	-1	
Fraction of aerosols that get into u	urban buildings (BDF	·): -1		
Fraction of urban area/people in	sidewalks (USWF):	1 Duil	dings (UBF): -1
Ratio of pedestrian density near ro	oads to residential p	opulation den	sity (RPD):	-1
Minimum small package dimensio	on for handling (SMA	LLPKG): -1	m	
Minimum perpendicular distance	from package to bys	tander (MITDI	DIST): -1	m
Minimum vehicle speed (MITDVEL	.): -1 km/hr			
Average breathing rate (BRATE):	-1 m³/s			
Cleanup Level (CULVL): -1	μCi/m²			
Interdiction Threshold (INTERDI	CT): -1 Ci/mC	i		
Evacuation time for groundshin	e (EVACUATION):	-1 days		
Survey interval for groundshine	(SURVEY): -1	days		
Distance-dependent rail worker	exposure factor (D	DRWEF): -1	inspe	ctions/km
Latent cancer fatalities per pers	on-REM (LCFCON)	for Occupat	tional: -1	Publ
Duration of shipping campaign	(CAMPAIGN): -1	yr		
REMs per Curie thyroid via inha	lation (RPCTHYRO	D): -1 for	· ·	
Dispersion option (IACC): Gauss	ssian (2) 🔿 No di	spersion (1) -	not recom	mended/no
Transfer coefficients	Mu	A(1)		A(2)
Gamma:	-1	-1	-	1
Neutron:	-1	-1	-	1





vill not convert previously-entered numbers.





longer used



- Check button changes color based on potential Errors and Warnings
- Be certain to resolve errors/ warnings before running or saving
 - Some saved files may not be recoverable without editing the saved text files
- Default save location is not OneDrive









About ₌					
Output - No	one				
	•	Analysis Ty Incident Free Accidental Re Both	/ pe /Intact elease	Case Control	Title:
			<u></u>		×
					-
calculated.					



- Click the Run button
- Output window will populate
 - Input Echo text version of all inputs into the GUI
 - NRC-RADTRAN Output standard text output also viewable in spreadsheet form
 - ✓ Non-rad incident summary
 - ✓ Exposure Summary for links and Rural, Suburban, Urban transit zones
 - \checkmark Input sensitivity analysis (effect of 1% change of input value)
- Automatically saves each run in a new output file







RADTRAN Output: Save Output as CSV	RADTRAN Output: Save Output as CSV			
Text Output Spreadsheet	Text Output Spreadsheet			
NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)	c1 NON-RADIOLOGICAL DATA (ACCIDENTS and FATALITIES)	c2	сЗ	c4 (
HIGHWAY VEHICLE_1	*****			
LINK ACCIDENT RATE ACCIDENTS FATALITIES NE_RURAL_H 1.00E-04 6.29E-02 6.29E-06 NE_SUBUR_H 1.00E-04 2.11E-03 2.11E-07	HIGHWAY VEHICLE_1			
WY_RURAL_H 1.00E-04 5.76E-03 5.76E-07 WY_SUBUR_H 1.00E-04 1.35E-03 6.75E-07 WY_URBAN_H 1.00E-04 8.50E-05 8.50E-09	LINK	ACCIDENT RATE	ACCIDENTS	FATALITIES
	NE_RURAL_H	1.00E-04	6.29E-02	6.29E-06
TOTALS: 7.22E-02 7.76E-06	WY_RURAL_H	1.00E-04	5.76E-03	5.76E-07
REGULATORY CHECKS	WY_SUBUR_H	1.00E-04	1.35E-03	6.75E-07
	WY_URBAN_H	1.00E-04	8.50E-05	8.50E-09
INCIDENT-FREE SUMMARY	TOTALS:	-	7.22E-02	7.76E-06
IN-TRANSIT POPULATION EXPOSURE IN PERSON-REM	REGULATORY CHECKS			
CREW OFF LINK ON LINK NE_RURAL_H 5.17E-04 1.06E-05 5.52E-05 NE_SURUR H 1.66E-05 1.01E-05 2.54E-06	INCIDENT-FREE SUMMARY			
WY_RURAL_H 4.27E-05 1.08E-07 4.09E-06	****** ****			
WY_URBAN_H 9.90E-07 1.38E-08 3.04E-07	IN-TRANSIT POPULATION EXPOSURE IN PERSON-REM			
ZONE RURAL 5.60E-04 1.07E-05 5.93E-05				
SUBURB 2.89E-05 1.49E-05 4.71E-06 URBAN 9.90E-07 1.38E-08 3.04E-07		CREW	OFF LINK	ON LINK
TOTALS: 5.90E-04 2.57E-05 6.43E-05		5.1/E-04	1.06E-05	5.52E-05
	WY RURAL H	4.27E-05	1.08E-07	4.09E-06
MAXIMUM INDIVIDUAL IN-TRANSIT DOSE	WY_SUBUR_H	1.23E-05	4.79E-06	2.18E-06
VEHICLE_I 0.00E-05 KEM	WY_URBAN_H	9.90E-07	1.38E-08	3.04E-07





NRC-RADTRAN User Awareness



- Shielding Factors: two runs should be completed using 100% neutron or 100% gamma emissions and the results ratioed externally
- Incident-Free Off-Link Neutron Doses: hand-calculated MEI results do not match NRC-RADTRAN results. Until this issue is investigated and resolved, it is recommended that NRC-RADTRAN should be used to estimate incident-free off-link doses through gamma radiation only
- Rail Crew Doses: for the rail crew gamma and neutron doses calculating a stop with duration of transit will provide a more representative crew dose estimate
- MEI In-Transit Doses: the MEI in-transit doses estimated by NRC-RADTRAN cannot be duplicated using spreadsheet calculations. In addition, gamma and neutron MEI in-transit doses are estimated using the same equations. For this reason, it is recommended that the MEI in-transit doses not be used currently





NRC-RADTRAN User Awareness



- The LOS model was developed for gamma radiation exposures and does not consider neutron radiation exposures
- The LOS model was based on modeling simulations performed for a generic 5.21-meter-long steel-lead-steel spent nuclear fuel truck transportation cask, and Dennis et al. (2009) states that the model should only be applied to truck transportation casks
- For the inhalation, resuspension, and immersion pathways, NRC-RADTRAN calculates doses using the geometric mean of the depleted atmospheric dilution factors (χ/Qs). For the groundshine pathway, NRC-RADTRAN calculates doses using the depleted χ/Qs , not the geometric mean of the depleted χ/Qs
- For accident risks, NRC-RADTRAN output does not provide totals for the expected values of population risks across all links, and users must sum these quantities externally





NRC-RADTRAN Updates



- PNNL is actively working to identify solutions to previously noted
- These activities will be covered in the Friday presentation NRC-RADTRAN Future Work





ed C-RADTRAN –

Conclusion



- History of RADTRAN was explored
- High-level understanding of RADTRAN concepts were gained
- RADTRAN download and installation procedures covered
- Options and RADTRAN screens explored
- Incident Free and Accident Analysis were covered





e gained ered

31

Break until 15:30 KST

32

NRC-RADTRAN Demo – Incident Free and Accident Analysis

Spring RUG 2024 Demonstration



- Analysis Type
 - Both

- Model Inputs
 - Vehicles
 - Links
 - Stops
 - Handling
 - Packages
 - Accidents
 - Radionuclides
 - Loss of Shielding
 - Default Paraments





Starting File



C:\Users\napi143\OneDrive -	PNNL\RAD	OTRAN\Pre	esentations\Spri	ng RUG 24	t\Exam	ple - IF & Ac	cident.inp	ut* Outp	out - No	one					
Input File Summary: Incide	nt-Free &	Accident	al Release					A	nalys	is Type	Case	Title:	April RUG E	xample 2024	4
Vehicles: 1 (1 truck, 0 rail, Packages: 0 containing 0 Ci	0 barge)	Stops: 0	lasting 0 hrs					⊖ Inc	ident	Free/Inta	act Output	ut Units:	Becquerel/	Sievert ×	Text C
Links: 0 covering 0 km WebTRAGIS Route: None		Release Isopleth	Groups: 0 s: 18					⊙ Ac ⊚ Bo	cident th	tal Relea:	Comr	nents:	IF/Accident	Example for	Spring
Vehicles	Vehicle package	parameter es.	rs determine inc	ident-free	e dose	to the public	c, <mark>vehic</mark> le c	rew, and i	nspecto	ors during	transport o	of one o	or more radic	oactive	
Links	Na	ame	Transport Mode	Exclus- ive use?	Size (CD) (m)	Dose Rate at 1 m (mrem/hr)	Gamma Fraction	Neutron Fraction	Crew Size	Crew Distance (m)	Width Facing Crew (m)	Crew S Factor 0=Ful	Shielding (1=None, Ily shielded)	Number of Shipments	s
Stops	(x) Tru	ick_1	Highway ~		3	12	1	0	2	3	3	0.4		1	
	Ada	d Vehicle													
Handling	Aut							That	t 1 meter	1					
Handling Packages	Au						1	Ti at from	t 1 meter n cask	0.5 CD = "\ Cask Radiu	Airtual"				
Handling Packages Accidents	Aut							Tiat	t 1 meter	0.5 CD = "\ Cask Radiu	Airtual"	- cr	ritical Dimensio	n	
Handling Packages Accidents Radionuclides					100			Tiat	t 1 meter n cask	0.5 CD = " Cask Radiu	Artual"	- 67	ritical Dimensio		
Handling Packages Accidents Radionuclides Loss of Shielding					T			Ti at from	t 1 meter n cask	0.5 CD = " Cask Radiu	Airtual' Is	G	nitical Dimension		Đ
Handling Packages Accidents Radionuclides Loss of Shielding Economic Model				A radioa	Ctive r	material pa ed in the in	ckage or ncident-f	n a vehicl	e (raile el. TI is	0.5 CD = "\ Cask Radik	Artual as ving ort Index,		Distance to Rec	n Ceptor	





tput Size:	3 (Full)	~
UG Meet	ing in 2024	

Links



									12		il puis s	1.000		
Input File Summary: Incide Vehicles: 1 (1 truck, 0 rail, Packages: 1 containing 0 C	ent-Free 0 barg	e & Accidental e) Stops: 2 l Accident	Release asting 4 hrs				Ana O Incide	ent Free/Int	Case	ut Units: B	ecquerel/Si	evert × Te	ext Output S	ize: 3 (Fu
Links: 5 covering 722 km WebTRAGIS Route: NE to W	/Y (21 pa	Release G arts) Isopleths:	roups: 2 18				 Accid Both 	ental Relea:	Comr	nents:	Accident Ex	ample for Sp	oring RUG N	eeting in
Vehicles	To sp Title	pecify the trans	port route, y (optional):	ou can create links n	nanually ar	nd/or impo	ort a route fr	om a WebTRA	GIS outpu	t file.				
Links	_	Name	Vehicle	Mode	Length (km)	Speed (km/hr)	Adjacent Vehicle	Pop.Density People/km ²	Traffic (vehicles	Accidents per km	Deaths per	Population Type	Farm fraction	1
Stops	⊗	NE_Rural_H	Truck_1 ~	PrimaryHighway	~ 628.9	110.3	2	39.8	0	1.55E-06	0.0353	Rural	~ 0.5	
Handling	\otimes	NE_Subur_H	Truck_1 ~	PrimaryHighway	~ 21.14	115.5	2	1361.4	0	1.55E-06	0.0353	Suburban	~ 0	
	\otimes	WY_Rural_H	Truck_1 ~	PrimaryHighway	· 57.61	122.4	2	4.9	0	2.04E-06	0.0353	Rural	~ 0.5	
Packages	\otimes	WY_Subur_H	Truck_1 ~	PrimaryHighway	× 13.51	99.9	2	870.7	0	4.78E-06	0.0353	Suburban	~ 0	4
	(Y)	WY Urban H	Truck 1 Y	PrimaryHighway	~ 0.85	77.9	2	1501.6	0	9.58E-07	0.0353	Urban	~ 0	
Accidents		Add Link		Import from Web	TRAGIS	2								
Accidents Radionuclides	High	Add Link way route C	Users\napi	Import from Web 143\OneDrive - PNN RADTRAN Input File		2 N\KML Fil	es\Lincoln to	Cheyenne - H	lighway\hi	ighway_rou	ite_1.kml			
Accidents Radionuclides Loss of Shielding	High	Add Link way route C mbed WebTRA	Users\napi	Import from Web 143\OneDrive - PNN RADTRAN Input File	DTRAGIS		les\Lincoln to	Cheyenne - H	lighway\hi	ighway_rou	ite_1.kml	m		
Accidents Radionuclides Loss of Shielding Economic Model	High	Add Link way route C imbed WebTRA	GIS Route in	Import from Web 143\OneDrive - PNN RADTRAN Input File MONTANA		2 N\KML Fil		o Cheyenne - H	lighway\hi	ighway_rou	tawa	MAINE		
Accidents Radionuclides Loss of Shielding Economic Model Default Parameters	High	Add Link way route C Embed WebTRA WASHINGTON OREGON	GIS Route in	Import from Web 143\OneDrive - PNN RADTRAN Input File MONTANA N WYOMING S	DTRAGIS	2 N\KML Fil MINNE DTA	es\Lincoln to	NSIN MICHIGA	lighway\hi	ighway_rou Ot	tawa VT. N.H. MASS	LAINE		
Accidents Radionuclides Loss of Shielding Economic Model Default Parameters		Add Link way route C imbed WebTRA washington	C:\Users\napi	Import from Web 143\OneDrive - PNN RADTRAN Input File MONTANA N WYOMING	DITRAGIS			NSIN MICHIG	lighway\hi	ighway_rou Ot N.Y. PA	tawa VT. N.H. KARS	MINE		
Accidents Radionuclides Loss of Shielding Economic Model Default Parameters	High	Add Link way route C imbed WebTRA WASHINGTON OREGON	IDAHO	Import from Web It43\OneDrive - PNN RADTRAN Input File MONTANA N WYOMING S WYOMING				Dis Cheyenne - H	lighway\hi	ighway_rou Ot N.Y. PA MD, N A DELAW	tawa VT. N.H. MASS. R.I.	AINE		
Accidents Radionuclides Loss of Shielding Economic Model Default Parameters	High	Add Link way route C mbed WebTRA washington OREGON NEVA CALIFORNIA	IDAHO	Import from Web It43\OneDrive - PNN RADTRAN Input File MONTANA N WYOMING S WYOMING NH NEW MEXICO		2 NKML FIL MINNE DTA MINNE DTA KA SAS	es\Lincoln to	D Cheyenne - F	HID VIRGINIJ VIRGINIJ VIRG	Ot N.Y. PA MD. N. DELAW SINIA NC	te_1.kml	MINE		





Stops



Input File Summary: Incident-Free & Accidental Release Vehicles: 1 (1 truck, 0 rail, 0 barge) Accident severities: 0 Release Groups: 0 WebTRAGIS Route: NE to WY (21 parts) Isopleths: 18 Stop: 2 lasting 4 hrs Accident severities: 0 Both Case Title: Output Units: Comments: April RUG Example 20 Output Units: Comments: Vehicles Name Vehicle Pop.Density People/km ² Radius (m) Output Units: Shielding Factor (10 = none, 0 = Duration (hr) (10 = none, 0 = Duration (hr)	\Users\napi143\OneDrive	PNNL\	RADTRAN\P	resentations\Sprin	g RUG 24\Exam	nple - IF & Ad	cident.input*	Output - None				
Vehicles: 1 truck (0 rail, 0 barge) Accident severities: 0 Releases Groups: 0 WebTRAGIS Route: NE to WW (21 parts) Isopleths: 18 Stops: 2 lasting 4 hrs Accidental Release © Both Output Units: Becquerel/Slevert v OAccidental Release © Both Vehicles Name Vehicle Pop.Density People/km Inner Output Shielding Factor full = none, 0 = Duration (hr) fully shielded) If/Accident Example fill Links Stop_1 Truck 1 v 9900 1 30 0.25 2 Stops Add Stop Stop_2 Truck 1 v 9900 30 800 0.25 2 Accidents Radionuclides Example of a Stop configuration for a highway vehicle Imters Im	put File Summary: Incid	ent-Free	& Acciden	tal Release				Analysis	Туре	Case Title:	April RUG Example 202	24
Accidents Accidents Accidents If/Accident Example f Vehicles Name Vehicle Pop.Density Inner Outer Shielding Factor If/Accident Example f Links Stops Name Vehicle Pop.Density Inner Outer Shielding Factor If/Accident Example f Stops Name Vehicle Pop.Density Inner Outer Shielding Factor If/Accident Example f Handling Stop.1 Truck 1 9900 1 30 0.25 2 Inner Outer Accidents Accidents Redigens Accidents Rest/Refueling Building Inner	ehicles: 1 (1 truck, 0 rail,	0 barge	e) Stops:	2 lasting 4 hrs				O Incident Fre	ee/Intact	Output Units	Becquerel/Sievert *	Text Or
Vehicles Name Vehicle Pop.Density Inner Outer Shielding Factor (1.0 = none, 0 =) Duration (hr) Links Stop 1 Truck 1 × 9900 1 30 0.25 2 Stops Add Stop Add Stop Example of a Stop configuration for a highway vehicle Rest / Refueling Building Radionuclides Residents Near Stop 800 meters Stop - 2 or use or op - o	nks: 5 covering 722 km /ebTRAGIS Route: NE to W	' Y (21 pa	Release irts) Isoplet	e Groups: 0 hs: 18				AccidentalBoth	Release	Comments:	IF/Accident Example fo	r Spring
Links Stop_1 Truck 1 9900 1 30 0.25 2 Stops Add Stop Handling Example of a Stop configuration for a highway vehicle Rest / Refueling Building Accidents Residents Near Stop Residents Near Stop Image: Stop for the stop configuration for a highway vehicle Loss of Shielding Economic Model Stop for the sto	Vehicles		Name	Vehicle	Pop.Density People/km ²	Inner Radius (m)	Outer Radius (m)	Shielding Factor (1.0 = none, 0 = fully shielded)	Duration (hr)		
Stops Inuck 1 9900 30 800 0.25 2 Handling Example of a Stop configuration for a highway vehicle Rest / Refueling Building Accidents Residents Near Stop 800 meters Interference Interference Interference Radionuclides Loss of Shielding Interference Interference Interference Interference Economic Model Interference Interference Interference Interference Interference	Links	\otimes	Stop_1	Truck_1	9900	1	30	0.25	2			
Stops Add Stop Handling Example of a Stop configuration for a highway vehicle Rest / Refueling Building Accidents Residents Near Stop 800 meters I meters I meter from cask Radionuclides Soft meters J meters J meter from cask Economic Model Soft meters Soft meters Soft meters		\otimes	Stop_2	Truck_1	9900	30	800	0.25	2			
Handling Example of a Stop configuration for a highway vehicle Rest / Refueling Building Accidents Residents Near Stop 800 meters I meters B00 meters 8 I meters 800 meters 90 meters 90 meters 90 meters 90 meters 90 meters <th>Stops</th> <td></td> <td>Add Sto</td> <td>p</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Stops		Add Sto	p								
Packages Accidents Radionuclides Loss of Shielding Economic Model	Handling	Exa	ample of a	Stop		Rest / Refu	eling Building					
Accidents Radionuclides Loss of Shielding Economic Model	Packages	co a h	nfiguration nighway ve	n for ehicle	Ć	15 meters	Cart					
Radionuclides Source Loss of Shielding 30 meters Economic Model 30 meters	Accidents		Residents Near	r Stop	T Č		1 me	eter in cask				
Loss of Shielding Economic Model	Radionuclides	1			6.			0 00	00			
Economic Model	Loss of Shielding	_		30 /	neters							
	Economic Model			1	0 00	00 00 00	00 0	00 00	/			
Default Parameters	Default Parameters				0.00	00 000	00	00:00				





tput Size:	3 (Full)	~
RUG Meet	ing in 2024	

Handling



onathaninapier@phini.gov) is	signed in Accidenta	Release				Analysis Type	Case Title:	April RUG Example 202	4
/ehicles: 1 (1 truck, 0 rail, 0 'ackages: 0 containing 0 Ci .inks: 5 covering 722 km WebTRAGIS Route: NE to WY (barge) Stops: 2 Accident Release G (21 parts) Isopleths:	lasting 4 hrs severities: 0 froups: 0 : 18				 Incident Free/Intact Accidental Release Both 	Output Units: Comments:	Becquerel/Sievert ×	Text Output Size: 3 (Full)
Vehicles	Name	Vehicle	Persons	Distance (m)	Duration (hr)				
venicies	Handling_1	Truck_1 ~	2	1	1				
Links	Handling_2	Truck_1 ~	3	2	2				
Packages									
Packages									
Accidents									
1									
Radionuclides									
Radionuclides Loss of Shielding									





Packages



New Open Save Save As	S Close Undo (82) Redo (0) Options Check Run Help About	
C:\Users\napi143\OneDrive - I	PNNL\RADTRAN\Presentations\Spring RUG 24\Example - IF & Accident.input* Output - None	
Input File Summary: Incider Vehicles: 1 (1 truck, 0 rail, 0	Analysis Type Case Title: April RUG Example 2024 Ca	0
Links: 5 covering 722 km WebTRAGIS Route: NE to WY	Accident seventies: 0 Release Groups: 0 (21 parts) Isopleths: 18	9
Vehicles	Add packages/casks here (optional for incident-free analysis, required for accidental release). The parameters in each package row determine the incident-free dose to handlers. If there is only one package on the vehicle, then package parameters (length, dose rate, gamma/neutron fractions) should match the vehicle.	
Links	Package 1 Largest (critical) dimension (m): 3 Dose rate 1 m from surface (mrem/hr): 12 Gamma fraction: 1 Neutron fraction: 0	
Stops	Add Package Add Package	
Handling	Vehicle Packages (determines radionuclides for accident analysis)	
Packages	Enter the number of each type of package on each vehicle (leave blank for none).	
Accidents	Truck_1	
Radionuclides		
Loss of Shielding		
Economic Model		
Default Parameters		





tput Size	: 3 (Full)	~
RUG Mee	ting in 2024]

Accidents



\Users\napi143\OneDrive -	PNNL\RADTRAN\Presentations\	Spring RUG 24\Example - IF &	Accident.input* Output - I	None	C:\Users\napi143\OneDrive -	PNNL\RADTRAM	NPresentations	Spring RUG	24\Example - IF	& Accident.input	* Output - None
put File Summary: Incider ehicles: 1 (1 truck, 0 rail, 0 ackages: 1 containing 0 Ci nks: 5 covering 722 km /ebTRAGIS Route: NE to WY	ht-Free & Accidental Release barge) Stops: 2 lasting 4 h Accident severities: Release Groups: 2 (21 parts) Isopleths: 18	rs 3	Analy Incider Accide Both 	rsis Type Case Title: Apri output Units: Bec ntal Release Comments: IF/A	Input File Summary: Incide Vehicles: 1 (1 truck, 0 rail, 0 Packages: 1 containing 0 Ci Links: 5 covering 722 km WebTRAGIS Route: NE to W	nt-Free & Accid 0 barge) Stop Acci Rele Y (21 parts) Isop	ental Release os: 2 lasting 4 dent severities: ase Groups: 2 leths: 18	hrs 3			Analysis Type Case Title: O Incident Free/Intact O Accidental Release Both Comments:
Vehicles	Severity Probabilities	Release Groups	Weather Isopleths	(Dispersion Areas)	Vehicles	Severity I	Probabilities	Releas	se Groups	Weather	Isopleths (Dispersion Areas)
Links	The Probabilities tab specifie	s the conditional probability o	of an accident of a particular as "severity fractions". One	severity, given	Links	Group Name	PART	_			Add Group
Stops	the probability of an acciden radioactive material. Probabi	t not affecting the package; the lities may depend on transpo	ne others correspond to rele rtation mode and rural/subu	ases of irban/urban.	Stops	Severity Level	Release Fraction	Aerosol Fraction	Respirable Fraction	Deposition Velocity	Remove Selected Group
Usedline	✓ Use one set of probabiliti	es for all groups				2	0	1	0.05	0.01 m/s	To add/remove rows (severity levels)
Handling	Mode	Mode	Mode		Handling	3	0.25	1	0.90		use the Severity Probabilities tab.
Packages	 Highway (1) Rail (2) Waterway (3) 	 Highway (1) Rail (2) Waterway (3) 	 Highway (1) Rail (2) Waterway (3) 		Packages	Group Name	GAS	Assessed	Perminahla	Deposition	
Accidents	Population	Population	Population		Accidents	Level	Fraction	Fraction	Fraction	Velocity	
	Rural (1) Suburban (2)	O Rural (1)	O Rural (1)	Add Group	Accidents	1	0	0	1	0 m/s	
Radionuclides	Urban (3)	Urban (3)	 Suburban (2) Urban (3) 		Radionuclides	3	1	1	1		
Loss of Shielding	Del Lvl Probability	Del Lvl Probability	Del Lvl Probability	Remove Selected Group	Loss of Shielding						
Economic Model	∞ 1 0.75 ∞ 2 0.2	∞ 1 0.75 ∞ 2 0.2	⊗ 1 0.75 ⊗ 2 0.2		Economic Model	-					
Default Parameters	× 3 0.05	× 3 0.05	S 3 0.05		D.(-					





Accidents



New Open Save Save A	s Close Undo (99) Redo (0) O	Options Check Run	Help About	=		New Open Save Save A	s Close Undo (0) Redo (0) O	otions Check Run
C:\Users\napi143\OneDrive -	PNNL\RADTRAN\Presentations\Spr	ring RUG 24\Example - I	F & Accident.inpu	it* Output -	None	C:\Users\napi143\OneDrive -	PNNL\RADTRAN\Presentations\Sp	ring RUG 24\Example -
Input File Summary: Incide Vehicles: 1 (1 truck, 0 rail, Packages: 1 containing 0 Ci Links: 5 covering 722 km WebTRAGIS Route: NE to W	ent-Free & Accidental Release 0 barge) Stops: 2 lasting 4 hrs Accident severities: 3 Release Groups: 2 Y (21 parts) Isopleths: 18			Analy O Incide O Accide O Both	ysis Type Case Tit nt Free/Intact Output Un ental Release Comment	Input File Summary: Incide Vehicles: 1 (1 truck, 0 rail, Packages: 1 containing 0 Ci Links: 5 covering 722 km WebTRAGIS Route: NE to W	ent-Free & Accidental Release 0 barge) Stops: 2 lasting 4 hrs Accident severities: 3 Release Groups: 2 Y (21 parts) Isopleths: 18	
Vehicles	Severity Probabilities	Release Groups	Weather	Isopleths	(Dispersion Areas)	Vehicles	Severity Probabilities	Release Groups
Links	Weather option: National Pagewill Stability Class Fraction	Average (0) 🔿 Pasqu	iill Class (1) 🔿 (Jser-defined (2)	Links	Number of Isopleths: 18	
Stops	A -1 B -1 C -1 D -1	E -1 F -1				Stops	Add Isopleth Remove	lsopleth
Handling	User-Defined Weather Param	Parameter		Value	1	Handling	Area (m ²) Centerline I Distance (m)	Dilution Factor
Packages	Release Height (m) Heat Release (cal/sec)			-1 -1		Packages		cr-sfill ferreleased)
Accidents	Source Width (Cask Length) (Source Height (Cask Radius) Wind Speed at Apercometer	(m) (m)		-1 -1	-	Accidents	-	
Radionuclides	Anemometer Height (m) Ambient Temperature (K)	(11/3)		-1	-	Radionuclides	-	
Loss of Shielding	Atmospheric Mixing Height (Rainfall Rate (mm/hr)	(m)		-1 -1		Loss of Shielding	-	
Economic Model	Release point: (0) Allow e Dispersion coefficients: (1)	levated (preferred) 🤅 1) Pasquill-Gifford 🔵	(1) Ground leve (2) Briggs	l (only if releas	se height is less than 3m)	Economic Model	-	
Default Parameters	 Pasquill stability class: A Release location: (1) Rura 	BCD (2) Urban/Suburt	◎ E ◎ F ban			Default Parameters	-	



	Output - None	
	Analysis Type	Case Tit
	O Incident Free/Intact	Output Ur
	 Accidental Release Both 	Comment
Weather	Isopleths (Dispersion A	(reas)
opulation Densi	ty (ISOPLETHP):	
	e Calon	

Radionuclides

e. (osers (naprilis (oneonic	PNNL\KAL	/IKAN\Presen	itations\Spr	Ing KUG 24\EX	ample - IF & Accident.input*	Output - None			2 10
Input File Summary: Incide Vehicles: 1 (1 truck, 0 rail.	nt-Free &	Accidental R Stops: 2 las	elease ting 4 hrs			Analysis Type	Case Title:	April RUG Example 202	24
Packages: 1 containing 19 (]	Accident se	verities: 3			 Accidental Release 	Output Units:	Becquerel/Sievert *	Text Out
WebTRAGIS Route: NE to W	r (21 parts)	Isopleths: 1	8 8			Both	Comments:	In Accident Example ic	n spring k
Vehicles	Assig	n radionu	clides to p	oackages	Define new radionue	clides			
Links	Assign i	sotopes to ea	ach package	, from both th	he default isotope list (in the	isotope file) and any user-de	efined radionu	iclides.	
Stops	Package	e_1	nove packa	iges use the Pa					
Handling		Isotope	Release Group	Inventory (Ci)					
Deskamer	\otimes	H3WTR ▼	GAS 🔻	10					
Packages	\otimes	SR90 V	PART V	5					
		CS137	PART	1					
Accidents		AM241	PART V	3					
Accidents		·							
Accidents Radionuclides		Add Isotop	e to Packag	ge_1					
Accidents Radionuclides Loss of Shielding		Add Isotor	e to Packag	ge_1					
Accidents Radionuclides Loss of Shielding Economic Model		Add Isotop	e to Packag	ge_1					

put Size:	3 (Full)	~

Loss of Shielding

nput File Summary: Incide	nt-Free	& Accidental	Release					Analysis	Туре	Case Title:	April RUG Example 202	24
Vehicles: 1 (1 truck, 0 rail,	0 barge	e) Stops: 2 la	asting 4 hrs				(O Incident F	ree/Intact	Output Units	Becquerel/Sievert *	Text
Links: 5 covering 722 km WebTRAGIS Route: NE to W	((21 pa	Release Gr rts) Isopleths:	roups: 2 18				(AccidentaBoth	l Release	Comments:	IF/Accident Example fo	r Spri
Vehicles	These	e three tables o	an list the pr	rob	ability of vario	ous degrees of	shielding los	s when an acci	dent occurs.	3		
	Ru	ral (NPOP=1)			Suburban (NF	POP=2)	Urban (NPO	P=3)				
LINKS		Conditional Probability	Fraction Lost		Conditional Probability	Fraction Lost	Conditional Probability	Fraction Lost				
Stops	×	0.99	0		0.99	0	0.99	0				
	8	0.009	0.001		0.009	0.001	0.009	0.001				
Handling	8	0.0009	0.1		0.0009	0.1	0.0009	0.1				
Packagos	8	9E-05	0.5		9E-05	0.5	9E-05	0.5				
rackages	8	1E-06	1		1E-06	1	1E-06	1				
Accidents	Ad	ld Loss of Shiel	ding Probab	ility	1							
Radionuclides		Name	Vehicle		Pop.Density	Inner	Outer	Shielding Fact	or = Duration	n (hr)		
Loss of Shielding			· · · · · · · · · · · · · · · · · · ·		(People/km) Radius (m)	Radius (m)	fully shielded)				
	\otimes	LOS_1	Truck_1	~	2	30	800	1	10			
Economic Model	\otimes	LOS_2	Truck_1	×	2	30	800	0.01	10			
	\otimes	LOS_3	Truck_1	×	2	1	30	1	10			

Output Size	: 3 (Full)	.4
ng RUG Mee	ting in 2024	1

Preparing to Run the Analysis

- Verify the Economic Model is NOT in use
- Verify the Default Parameters are -1
- Current Production Version uses -1 as the indicator for use of a default value
- Click the "Check" button to observe any Errors or Warnings
- Click the "Run"
- Outputs are automatically saved in C:\Users\XXX\NRCRADTRAN\Calculations
- XXX is your username on your computer
- Output is discussed outside of this presentation but will be identical if prepared using the inputs listed.

Conclusion

- Incident Free and Accident Analysis were covered
- Included an active demonstration of Creating, Running, and understanding results reported by NRC-RADTRAN

Questions?

Thank you

