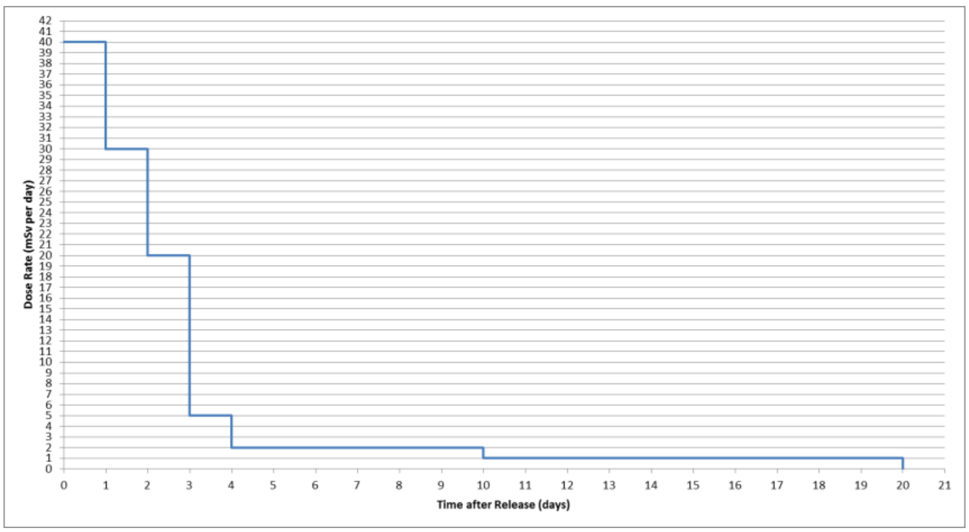
Breakout Activities

Module 6-1 – Emergency Preparedness Programs

The graph below represents the predicted dose rate at a location as a function of time following an accident. You estimate that by implementing “Plan X” the population would spend 1 day at this location before you can move them to an area with a constant residual dose rate of 1 mSv/day and that you can accommodate them there for 3 days before they return to the original location. What is the Projected dose? Assume plan X is implemented – what is the averted dose and estimated dose?



117 mSv projected, 65 mSv estimated, 52 mSv averted

Module 6-2 – Doses from Accidental Releases

CASE #1 – General Case Release – Gaussian Plume Model

Assume a plume is described by the Gaussian plume model. If the release rate from a 50 m stack is 2 Bq/s, the mean wind speed is 1 m/s and the weather is Class B, what is the concentration at a point x = 1 km, y = 100 m, and z = 10 m.

Weather Class B
Q = 2 Bq/s
u = 1 m/s
h = 50 m
z = 10 m
y = 100 m → σ_y = 165 m
z = 10 m → σ_z = 110 m
2.6E-5 Bq/m^3

CASE #2 – Dose from Ground Deposition

The final deposition level of Cs-137 is 10,000 Bq/m^2 following passage of a plume. The release duration was 1 hour. The travel time was 1 hour. What is the effective dose from ground deposition only at the end of the third hour?

ω = 10,000 Bq/m^2
DCF_g = 5.9E-16 Sv-m^2/Bq-s
t_r = 3h = 10,800 s
t_t = 1h = 3,600 s
t_R = 1h = 3,600 s

From Table 10.1: 5.3E-16 Sv m^2 / Bq s

$$D_g = \omega(DCF)_g\left(t_r - t_t - \frac{t_R}{2}\right)$$
$$D_g = (10{,}000\ Bq/m^2)\left(5.3E-16\ \frac{Sv\cdot m^2}{Bq\cdot s}\right)\left(10{,}800\ s - 3{,}600\ s - \frac{3{,}600\ s}{2}\right)$$
$$D_g = 3E-08\ Sv$$

CASE #3 – CSA N288.2 Model – Radioiodine Release

A release of I-131 has occurred from your facility. The time integrated concentration at the nearby village that results is 1E10 Bq-s/m^3.

Given that:

- You can ignore decay
- You can neglect the dose from ground deposition
- You are to use the parameters and methodology of the CSA N288.2 standard

(a) CALCULATE an estimate of the effective and thyroid dose that would have resulted to adults and infants from being present, unprotected in the village.
(b) LIST what short term interventions should be considered under the Province of Ontario Nuclear Emergency Response Plan, and for each, STATE whether or not it should be implemented. JUSTIFY your answer.

Part (a)

χ = 1E10 Bq-s/m^3

Dose = $D_a + D_i$
Dose = $\chi DCF_a + \chi DCF_i$

DCF Summary	E (Sv-m^3/Bq-s)	H_T (Sv-m^3/Bq-s)
DCF_a (Infant & Adult)	1.7E-4	1.8E-14
DCF_i (Infant)	3.9E-12	1.3E-10
DCF_i	2.9E-12	9.9E-11

Dose Summary	E (mSv)	H_T (mSv)
Adult	29	990
Infant	39	1380

Part (b)

Protective Action	PNERP	Justification
Sheltering	10 mSv in the first 2 days (E)	>10 mSv projected, so we must shelter
Evacuation	100 mSv in the first 7 days (E)	<100 mSv projected, so can be considered, but is not required
Thyroid Blocking (KI)	50 mSv in the first 7 days (H_T)	Needs to be implemented as projected dose is >50 mSv