Radiation Team
Mission Day Instructions

Overview

NASA places a high priority on the health and safety of astronauts. It constantly monitors radiation levels around the astronauts while they live on the space station.

Using the Internet, your team will receive real-time readings from two radiation monitors on the station. These monitors are called **TEPCs** (tissue equivalent proportional counters). There are two TEPCs on board the station. One is **stationary** (located in the Destiny module). The other is **portable** for the astronauts to carry with them when radiation levels are a concern.

Mission Day Materials

One computer for real-time data
Radiation reference guide
11 blank report forms on colored paper to deliver to the Communications Team and Crisis Management Teams
Calculators
Mission day instructions (one per team member)
Radiation data graphs and instructions (one per team member)
Radiation data tracking tables (one per team member)

Your Task

By the time the mission starts, the Radiation Team should be able to:

- Receive real-time data, record it, graph it, and make calculations.
- Monitor radiation levels. If the levels are dangerous, decide what to do about it and tell Mission Control.
- Use the radiation reference guide to understand radiation and its effects on the human body.
- Review the ALARA guidelines. How would these be used on the space station?
- Learn the names and locations of the station's modules. What shielding options are there in each module?

Team Tasks

These tasks are listed in priority order. Next to each task, assign a team member. Depending on the size of your team, you may need to assign two tasks to one person.

_____ **Team leader:** Makes sure the team is working quickly and efficiently. Determines whether there are any concerns and helps the team decide what to do about them.

_____ **Data graphing:** Records real-time data on graphs and makes predictions. (May be combined with data analysis tasks if necessary.)

_____ **Data analysis (TEPC1):** Records real-time data in data tracking tables and conducts analyses. Completes report forms every few minutes.

_____ **Data analysis (TEPC2):** Records real-time data in data tracking tables and conducts analyses. Completes report forms every few minutes.

_____ **Crisis management data runner:** Completes report forms every few minutes and delivers the forms to the data officer. Reports verbally to Crisis Management. Writes down questions from Mission Control and responds. (May be combined with team leader tasks if necessary.)

_____ **Data recording:** Records real-time data from the computer. The data will be accessed and downloaded after the start of the mission. (May be combined with other tasks if necessary.)

_____ **Research and reference:** Reads and understands information provided in the reference guide to make recommendations. (May be combined with other tasks if necessary.)

Reporter/Graphic Organizer: Takes notes during the mission like a newspaper or TV reporter would. Writes down all the emergencies, recommendations, choices, and successes. May want to use a white board or chalkboard posted on the wall to inform other teams about what is going on with your team.

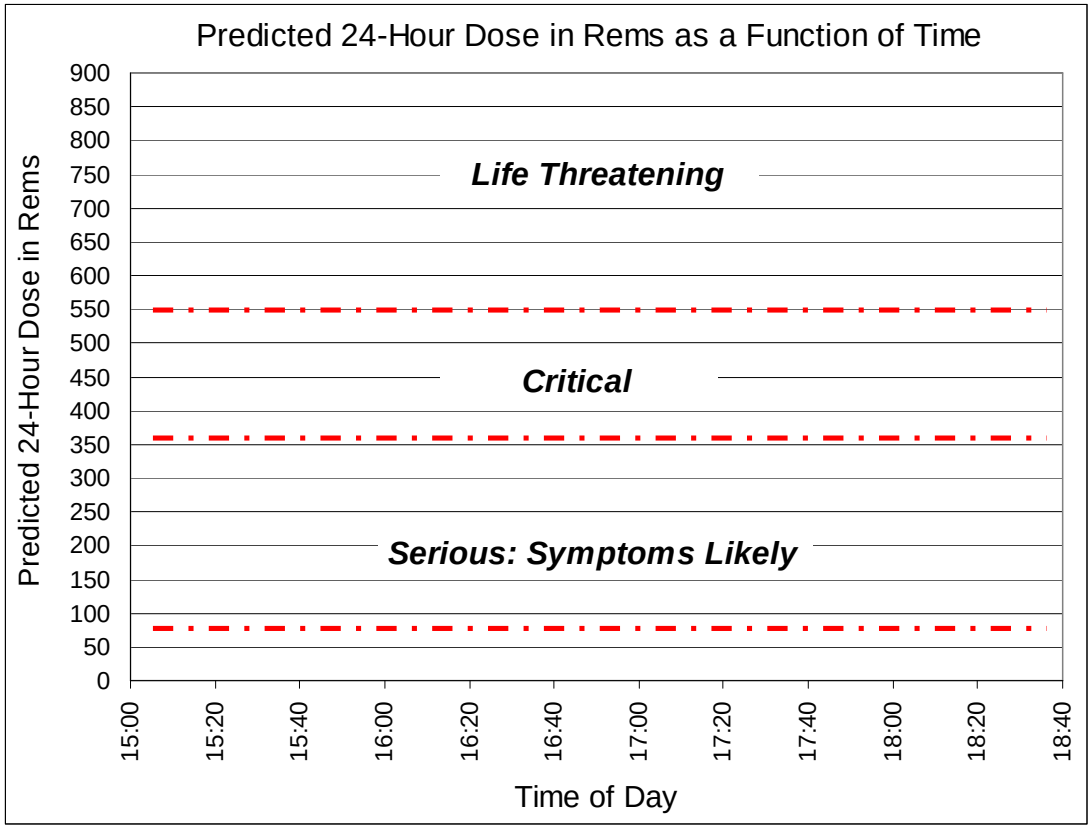
Radiation Team Graphs and Instructions

Instructions
You need to create graphs of the predicted radiation levels. Use the data from **Column F** on each data tracking table for the y-axis values and plot them along the x-axis by the time of day.

TEPC1

Predicted Level ►

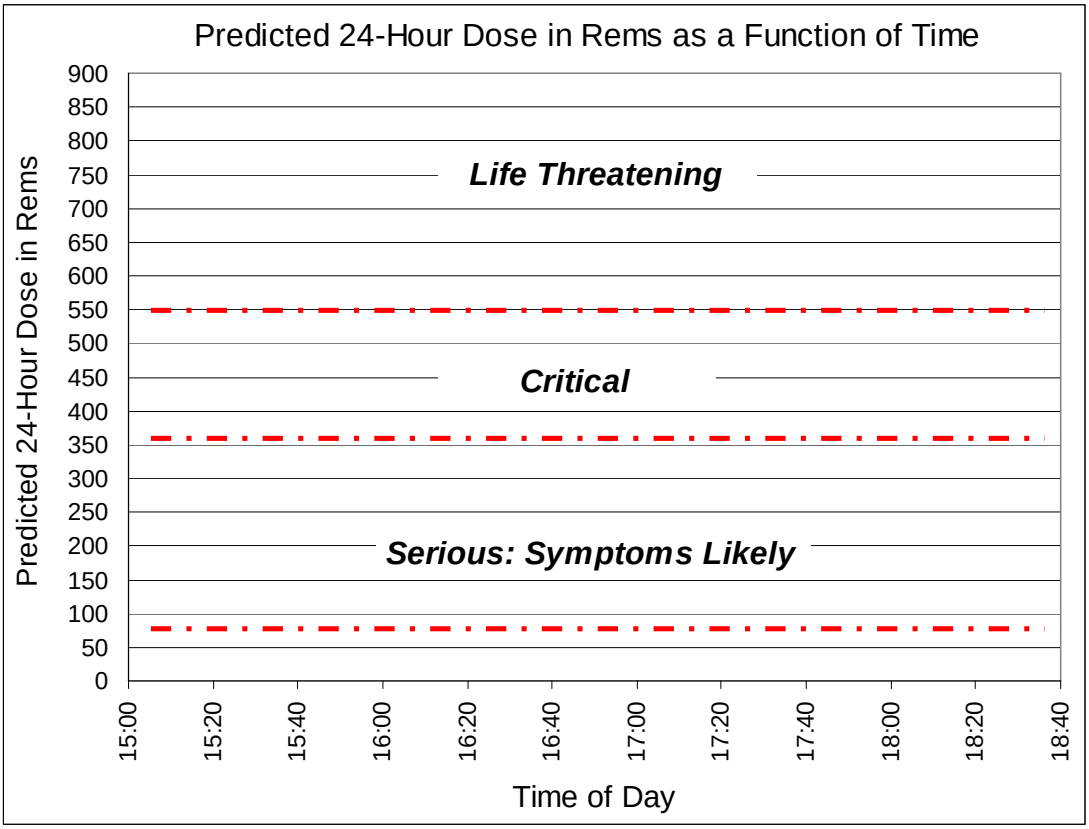
If the storm stays at current levels, then in 24 hours this would be the level.



TEPC2

Predicted Level ►

If the storm stays at current levels, then in 24 hours this would be the level.



Radiation Team
Data Analysis Instructions

You will receive radiation readings every few minutes from the TEPCs. Analyze them quickly. **Important! Before mission day use the practice worksheets and practice graphs to prepare yourself.** The instructions below explain how to complete the data tracking table on the next page.

Find the sheet labeled "Radiation Team-Data Tracking Table." Make one copy for the TEPC1 and one for the TEPC2.

Column A: Time of Day

This is like military time. Time is given using a 24-hour clock with no "a.m." or "p.m." For example, 1 o'clock in the morning is 01:00, 4:20 in the afternoon is 16:20, and 11:15 at night is 23:15.

Column	A	B	C	D	E	F (Graph this column)
Table Readings	Time of Day	20 min Dose Total	Cumulative Dose	Dose Rate	Trend	24 hour Projected Total
Units	24 Hour Clock	rems	rems	rem/hr	Is the dose increasing or decreasing?	rems
Calculations	From Data	From Data	C= B+ Previous C	D= B / 0.33		F = (D X 24) + C
Practice	15:00	0.43	(previous dose assume 0 rems) 0.43	1.30	n/a	31.63
	15:20	0.58	1.01	1.76	increasing	43.25
	15:40	1.67	2.68	5.06	increasing	124.13

Column B: 20-minute Dose Total

Record the real-time data in column B. This is the dose that was received over the last 20 minutes. Rems are the unit of measure used to describe radiation exposure.

Column C: Cumulative Dose

C = Column B + Previous Column C

Monitor the cumulative dose every reading. This is the actual exposure the crew has received since 15:00.

To calculate, add the cumulative dose from the previous reading with the current 20-minute dose and record this value.

For the first reading, assume a previous dose of zero.

Column D: Dose Rate

Column D = Column B divided by 0.33 hour

Find the rate of change to determine how fast levels are changing. Take the current reading from column B and divide by the amount of time. There has been 0.33 hours since the last reading. This is the rate of change in rems/hr.

Column E: Trend

Is the dose increasing or decreasing?

Write down the word "increasing" or "decreasing" to describe whether the dose rate is higher or lower than the last reading. If it is higher from one reading to the next, then the rate is increasing.

Column F: 24-hour Projected Total Rems

F = (Column D x 24 hrs) + Column C

Predict the total 24-hour dose. Multiply the current dose rate from column D by 24 hours. Add the current cumulative dose from column C. This information will be plotted on graphs.

Note: At a dosage of 100 rems, you might start to see the first physiological symptoms as well as decreases in performance.

Radiation Team – Data Tracking Table

Circle one: **TEPC1 (Portable)** **TEPC2 (Stationary)**

Column	A	B	C	D	E	F (Graph this column)
Table Headings	Time of Day	20 min Dose Total	Cumulative Dose	Dose Rate	Trend	24-hour Projected Total
Units	24-hour Clock	Rems	Rems	Rem/Hr	Is the dose increasing or decreasing?	Rems
Calculations	From Data	From Data	C = B+ Previous C	$D = \frac{B}{0.33}$		F = (D X 24) + C
Examples and Practice	15:00	0.43	(previous dose assume 0 rems) 0.43	1.30	n/a	31.63
	15:20	0.58	1.01	1.76	increasing	43.25
	15:40	1.67	2.68	5.06	increasing	124.13
	16:00	3.56				
	16:20	5.01				
	16:40	4.20				
	17:00	1.83				

Note: Round all calculations to two decimal places.

Column	A	B	C (Graph this column)	D	E	F (Graph this column)
Table Headings	UTC	20-min Dose Total	Cumulative Dose	Dose Rate	Trend	24-hour Projected Total
Units	24-hour Clock	Rems	Rems	Rem/Hr	Is the dose increasing or decreasing?	Rems
Calculations	From Data	From Data	C = B+ Previous C	$D = \frac{B}{0.33}$		F = (D X 24) + C
For the Mission	15:00		(previous dose assume 0 rems)			
	15:20					
	15:40					
	16:00					
	16:20					
	16:40					
	17:00					
	17:20					
	17:40					
	18:00					
	18:20					
	18:40					
	19:00					
	19:20					

Note: Round all calculations to two decimal places.