

Teacher's Guide

Cosmic Radiation Creates Unfriendly Skies

Introduction

On the Earth's surface, we are protected from the harmful effects of cosmic rays by the atmosphere. During a trip in a jet plane at altitudes of 30,000 feet, cosmic rays and other energetic particles pose a great problem and can lead to significant health risks, especially for airline pilots.

Objective

The student will read to be informed, and write a letter to persuade based on the article that was read.

Procedure

1) Students read the article "Cosmic radiation creates unfriendly skies".

2) Allow sufficient time for the students to complete questions #1 through #10.

3) Discuss the student responses to questions #1 through #10.

4) Allow students a sufficient amount of time to prewrite the letter.

5) Group students in pairs. Assign one member of the pair to be "A" and the other member to be "B". Student "A" reads the letter to student "B" and receives suggestions. Allow five minutes for the peer review. Then student "B" reads the letter to student "A" and receives suggestions. Allow five minutes for the peer review.

6) Separate the students for individual work.

7) Students complete the final copy of the letter.

Materials

—"Cosmic radiation creates unfriendly skies"

—Student question sheet

—Lined paper

Scoring rule: Writing to persuade.

2=Consistently addresses audience's needs by identifying a clear position and fully supporting or refuting that position with relevant information. Text is uniformly organized, and language choices often enhance the text.

1=Sometimes addresses the audience's needs by identifying a somewhat clear position and partial supporting or refuting that position with relevant information. Text is generally organized, and language choices sometimes enhance the text.

0=Rarely or never addresses audience's needs by failing to identify a clear position or failing to adequately support or refute a position that is identified. Text lacks organization and language choices seldom, if ever, enhance the text.

Cosmic Radiation Creates Unfriendly Skies

Dr. Sten Odenwald (Raytheon ITSS and NASA Goddard Space Flight Center)

A trip on a jet plane is often taken in a party-like atmosphere with passengers confident that, barring any unexpected accidents, they will return to earth safely and with no lasting physical affects. But depending on what the sun is doing, a solar storm can produce enough radiation to equal a significant fraction of a chest X-ray's dosage even at typical passenger altitudes of 35,000 feet. The situation is even worse for airline pilots and flight attendants who spend over 900 hours in the air every year. According to a report by the Department of Transportation (Science News magazine, vol. 137, p. 118), the highest dosages occur on international flights passing close to the poles where the earth's magnetic field concentrates the dosages. Estimates suggest that for such polar routes, flight crews can receive nearly 910 millirems of cosmic radiation dosage per year. The annual federal recommended limit for pregnant women is 500 millirems. Even at these levels, it has been estimated that there will be on the average four extra cases of mental retardation per 100,000 women due to this exposure between weeks 8 to 15 in the gestation cycle.

Although the dosage you receive on a single such flight per year is very small, frequent fliers who amass over 480 hours of flight per year would statistically expect to suffer from 500 extra cancer deaths per 100,000 travelers over a 20 year period. Airline crews who spend 960 hours in the air on such polar routes would have over 1000 additional cancer deaths per 100,000 crew members over a 20 year period of travel.

By comparison, the typical cancer rate is about 22,000 deaths per 100,000. This means that instead of a 22 in 100 chance of cancer, airline crews and frequent fliers would have as much as a 23 in 100 chance of cancer death. This doesn't sound like much, but for a population as large as the United States with nearly 300 million people, this means an additional 3 million people would die if they all traveled on such routes. Of course only a small number of people are this well-traveled, but nevertheless, without proper safeguards, hundreds of additional people would die from such radiation exposure.

Matthew H. Finucane, air safety and health director of the Association of Flight Attendants in Washington DC, as quoted in Science News (vol. 137, p. 118), advocates asking the FAA to monitor and regulate radiation exposure and, if possible, to warn crews of unusually intense bursts of cosmic radiation, or solar storm activity. Currently, the FAA guidelines are written in too technical a language to be readily useful to pilots and flight attendants so that they need to be re-written.

Name _____

Date _____

Writing to Persuade

“Cosmic radiation creates unfriendly skies”

1. What is the central idea of the reading selection?
2. How does the central idea relate to the title of the article?
3. In regards to a crew that spends 960 hours in the air each year for 20 years, how many total hours are spent per person in the air?
4. If this crew received the highest annual dose of cosmic radiation, 910 millirems, how many total millirems do they receive in a day assuming an equal amount per day.
5. Suppose that 910 millirems are spread equally over 32 routes from New York to Athens. How many millirems do they receive per trip?
6. If the crew had flown on September 29, 1989 and they received 110 millirems from the solar event, how might they have received the remaining dosage of the 910 millirems?
7. What is the expected cancer rate for a frequent flier over a 20 year period according to the article?
8. What is the percentage for the overall cancer rate in the general population, and how does it compare to the cancer rate for frequent fliers?
9. Determine the percentage for the typical cancer rate, and compare this to the cancer rate for the airline crews. Is this a significant threat to them? If so, explain your reasoning.
10. What could be the implications for solar weather forecasting?
11. Write a letter to the Federal Aviation Administration or the Department of Transportation why, or why not, it is important to educate, to predict, and to notify the public, about the effects of solar radiation. Be sure to include details from the text that support your reasoning.