

## Tundra Puzzler 2

### IS TUNDRA RADIOACTIVE?

#### *What Ecologists Have Learned*

**(a)** Once released into the atmosphere, cesium-137 molecules are spread widely by air currents. These radioactive molecules settle back to earth, mainly in rain drops and snow flakes.

Because lichens get their minerals from rain and snowmelt water, and cesium-137 mimics potassium (a mineral they need), lichens rapidly take up and hold cesium-137 in their body tissues. Plants also take up and hold cesium-137, but at a slower rate than do lichens because they absorb water and minerals from the soil rather than directly from rain and snowmelt.

The soil itself traps and filters out some of the cesium-137, and some never reaches the soil as it flows away in run-off water. In addition, many plants die back and shed their leaves each winter. Most lichens, by contrast, hold the same tissues for years or even decades and thus may accumulate much of the cesium-137 they absorb.

During some winters, caribou eat mainly lichens. Their bodies respond to cesium-137 as they would react to potassium, by absorbing and holding it in their body tissues and fluids. The amount of cesium-137 held by a caribou depends on its diet and other factors.

When caribou feed mainly on contaminated lichens, they absorb and hold some of the cesium-137 that was originally taken up by the lichens. Humans and wolves who eat the caribou take up and hold the cesium-137 from the caribou tissue.

Humans and wolves who eat a lot of caribou that have fed upon heavily contaminated lichens can end up with surprisingly high levels of cesium-137 in their bodies.

In one study, scientists found concentrations of cesium-137 in lichens to be five times that found in rain and snow, and that in caribou four times greater than that in lichens. Humans and wolves had levels similar to or greater than those found in caribou.

It is important to note, however, that the retention of cesium-137 by lichens and other members of this food chain varies considerably. Cesium-137 is always transferred through lichen food chains, but concentration does not always occur.

The amount and rate of cesium-137 exchange through tundra food chains depend on many factors, including the amount of precipitation, the level of lichen contamination, the proportion of contaminated lichens in caribou diets (and what else is in their diet), plus the proportion of contaminated caribou and the kinds of other foods in the diet of the consumers of caribou.

**(b)** The level of cesium-137 in northern Alaska Natives has dropped because the amount of radioactive fallout has declined since atmospheric testing of nuclear weapons has become less common.

Also, Native people are eating more foods imported from elsewhere and fewer caribou, particularly in spring when concentrations of cesium-137 in caribou are highest (lichens are the main winter food of caribou).



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## IS TUNDRA RADIOACTIVE?

### Background Information

- The **radioactive isotope cesium-137** is a product of atomic fission reactions such as those in the explosion of nuclear weapons and in nuclear power plants. It has a **half-life** of 30 years, which means that it loses half of its radioactivity every 30 years. After 60 years, it still has 1/4 of its original radioactivity, and after 90, it has 1/8 its original radioactivity.

Cesium-137 has been released into the atmosphere by the testing of atomic weapons along the Pacific Rim and from the 1986 explosion at Russia's Chernobyl nuclear power plant. Much of the atmospheric testing occurred in the late 1950s and early 1960s.

- Cesium-137 has chemical properties that make it react with other chemicals in ways similar to the way potassium reacts with other chemicals.

- **Lichens** get the minerals they need mainly from rain and snowmelt.

- Potassium is an essential mineral for living things, including lichens. It occurs in the cells and fluids of living things. In mammals, the amount of potassium in the blood is regulated by the kidneys. Excess amounts are excreted.

- Rain and snow form around particles of dust in the air.

- The air in the earth's atmosphere circulates around the globe.

- The lifestyles of northern Alaska Natives have been changing. They have become more dependent on foods shipped in from elsewhere and rely less on subsistence hunting.

### THE PUZZLE

Based on what you know about tundra ecology, the food chain, and the information given, **(a)** explain why higher concentrations of cesium-137 might be found in the tissues of humans and wolves who live in the arctic tundra than in the rain or soil of tundra. **(b)** Why do you think that the levels of cesium-137 in arctic people have declined in recent years?

