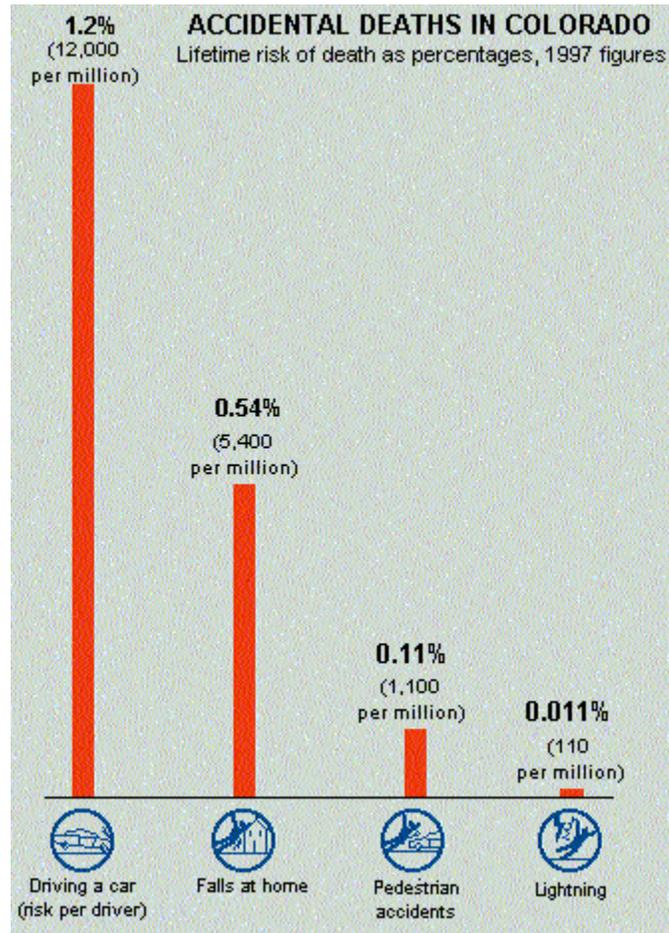


## Putting risk in perspective

Risk is defined as the likelihood that negative effects will result from a specific activity. We tend to ignore everyday risks like driving to the grocery store or riding a bike. Risks imposed upon us are less acceptable.

The following chart lists the risks for several types of accidental deaths in Colorado.



Source: Developing Comparisons for Risk Due to Plutonium and Carbon Tetrachloride Exposure, Institute for Science and International Security, 1999

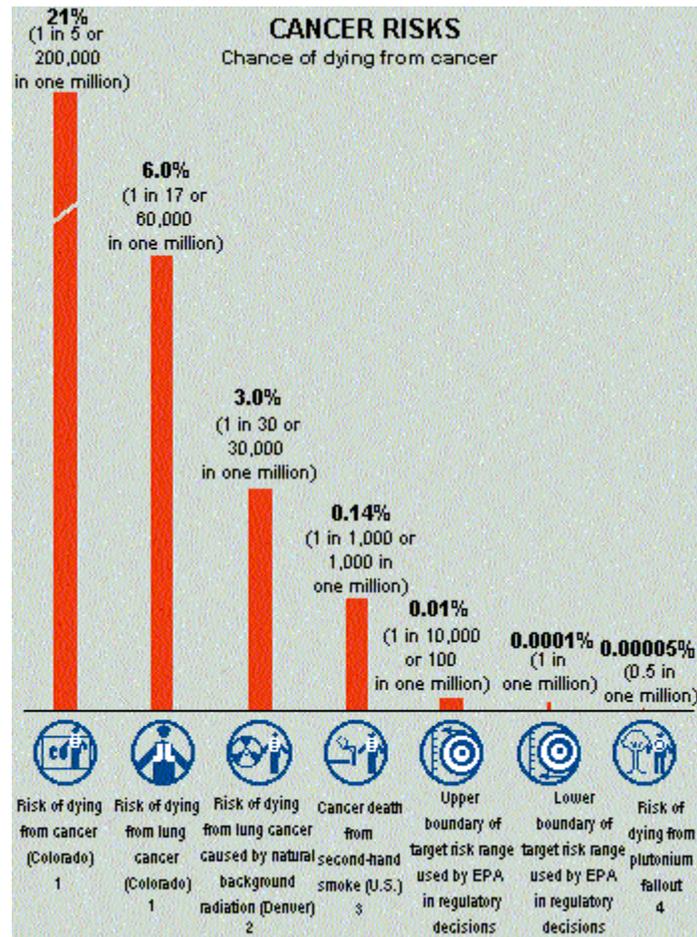
### Accidental Deaths in Colorado

Statistics compiled on the numbers and causes of deaths and risks are calculated from these data. For example, the probability of dying in a car accident is calculated by comparing the number of motor vehicle deaths in a year to the total number of drivers. This number is the annual risk of driving a car. The annual risk can then be multiplied by the estimated duration of the risk, to find the lifetime risk of death.

This same approach is used to evaluate the risk of getting cancer. However, cancer risks are less straightforward for several reasons. First, there can be multiple causes of the same type of cancer that cannot always be sorted out from each other and individually assessed. Second, cancer can appear decades after the initial exposure.

Cancer may be the result of many different causes. The Historical Public Exposures Studies were designed to evaluate the additional risk of developing cancer, above the average cancer rate. The Colorado Central Cancer Registry's statistics indicate that 46 percent of the people in Colorado (about 1 in 2) will develop cancer in their lifetimes. Twenty-one percent of the population (1 in 5) will die from cancer. The risk to off-site residents of developing cancer from Rocky Flats contaminant releases is small when compared to the cancer risk from all other causes.

For the Historical Public Exposures Studies on Rocky Flats, risks were calculated for developing lung and other cancers. The lung is the primary organ affected by inhaled plutonium. Scientists calculated the risks associated with past releases from Rocky Flats based on the incidence rate or chance of *developing* cancer. Most available data on cancer are presented as mortality rates or the chance of *dying* from cancer. The chart below shows various cancer risks that Coloradans face.



- 1) Colorado Department of Public Health and Environment Central Cancer Registry.
- 2) *Developing Comparisons for Risk Due to Plutonium and Carbon Tetrachloride Exposure*, Institute for Science and International Security, 1999.
- 3) U.S. Environmental Protection Agency, *Respiratory Health Effects of Passive Smoking: Lung Cancer and Disorders*. Report EPA/600/6-90/006F, USEPA Office of Research and Development, 1993.
- 4) Calculated based on Radiological Assessments Corporation Task 4 Report, Rope et al, 1994 and Plutonium Risk Report, Sinclair, Grogan and Volleque, 1999.

### Cancer Risks

One cancer risk that people face is from daily exposure to natural background radiation. This background radiation comes from sources such as cosmic radiation, radiation from rocks and soils including radon, and radioactive materials within our bodies, such as potassium-40. A person's exposure to cosmic radiation is greater at higher altitudes so residents of cities like Denver receive twice the cosmic radiation compared to people who live at sea level. Due to local geology, Colorado also has higher-than-average levels of indoor radon and radiation from rocks and soils.

Another source of radiation dose comes from man-made materials. This radiation includes exposure primarily from diagnostic x-rays and nuclear medicine procedures. Secondary sources include various consumer products. Of all these sources of background radiation, radon is estimated to contribute the greatest amount, about 55 percent of people's average radiation dose.

One way to look at risks is to divide them into two distinct types: voluntary and involuntary. Voluntary risks are undertaken with knowledge of the possible consequences. Before participating in such activities (flying across the country or scuba diving), people are aware of the chance of injury or death and accept the risk. In contrast, involuntary risks are those that are unwittingly taken or are outside the public's control. Examples of involuntary risk are exposure to air pollution or lightning strikes. Plutonium exposure from Rocky Flats has been an involuntary risk.

The Health Advisory Panel discussed at length the appropriate risks to compare to plutonium exposure from Rocky Flats. Exposure to plutonium from past nuclear weapons testing was determined to be a useful comparison, because it involves exposure to the same type of radiation, and exposure from nuclear weapons testing is an involuntary risk.

Of all the scenarios modeled, the laborer was selected for comparison because this individual had the highest estimated levels of exposure to Rocky Flats plutonium releases. The overall risk to the laborer from plutonium released from Rocky Flats between 1953 and 1989 is about the same as a person's risk from plutonium released during past nuclear weapons testing.

### **What about the risks to people living near Rocky Flats today?**

The focus of the Historical Public Exposures Studies has been on past releases and risks, and it is clear from the results that people living in the Denver region during the 1957 fire, or during the late 1960s, were put at higher risk than those who moved into the area in the 1970s. There is still Rocky Flats plutonium in the soil off-site, but movement of the settled and re-vegetated soil by the wind occurs at a very low rate, even during windstorms.

### **How certain are the results?**

Because there is no way to be certain how much contamination someone was exposed to, there is a level of uncertainty associated with the studies' results. It is common practice for scientists to provide an estimate of the level of confidence they have in their results. Determining the uncertainties associated with the quantities of materials released and the estimated cancer risks has been an important part of the studies.

Scientists calculated the quantity of contaminants released and the possible cancer risks using many different assumptions. These calculations produced a distribution of possible results. Scientists often describe these distributions using three values: the 5th, 50th and 95th percentiles of the distribution. The median or 50th percentile is the number in the middle of the distribution. Half the estimates are higher than that value, and half are lower. The 5th and 95th percentile values are used to indicate the spread of the estimates. Only 5 percent of the estimates lie below or above those values. Scientists say they have high confidence (90%) that the estimated risk lies between the 5th and 95th percentile values.

The panel has worked to ensure that the methods used to calculate risks associated with uncertainties are comprehensive and reliable. There also has been extensive peer review of the research by internationally recognized experts and members of various public interest groups.