

Atmospheric Health Effects Framework (AHEF) Model

Questions & Answers

The Atmospheric and Health Effects Framework (AHEF) model was developed by the EPA to estimate the number of skin cancer and cataract cases and deaths from skin cancer in the United States that will be prevented by protecting the ozone layer, which results in a decrease of the ultraviolet (UV) radiation reaching Earth's surface that causes these diseases. The AHEF estimates the probable difference in incidences by comparing emissions scenarios of ozone-depleting substances (ODS). Example scenarios include: no Montreal Protocol; the original 1987 Montreal Protocol; and the Montreal Protocol as amended and adjusted.

1. What is ozone and what is the ozone layer?

Ozone is a molecule that contains three oxygen atoms. Located in the stratosphere approximately 9 to 18 miles (15 to 30 kilometers) above Earth's surface, the ozone layer is an area of the atmosphere that has high concentrations of ozone that acts as an invisible shield to protect the Earth's surface by absorbing harmful ultraviolet (UV) radiation emitted from the Sun.

2. What are the effects of UV radiation?

Overexposure to UV radiation can cause skin damage (such as skin cancer), eye damage (such as cataracts), and can suppress the immune system. Overexposure to UV radiation can also interfere with environmental cycles by affecting organisms such as plants and phytoplankton that move nutrients and energy through ecosystems.

3. What are the different types of skin cancer considered by the AHEF model?

The AHEF estimates the incidences of cutaneous malignant melanoma (melanoma) and keratinocyte skin cancer. Melanoma is a potentially life-threatening disease and is the most serious type of skin cancer. It occurs most frequently in persons over age 40 with light complexion and hair color. Keratinocyte cancer, or "non-melanoma skin cancer," includes squamous cell carcinoma, basal cell carcinoma, and several other rare types.

4. What is a cataract?

A cataract is a clouding of the eye's naturally clear lens, which can block vision and cause blindness. While cataract related to age can have a number of potential causes, lifelong exposure to UV radiation can play a big role.

5. How many cases of skin cancer and cataracts have been avoided because of the Montreal Protocol?

Based on the 2020 updates to the AHEF, the Montreal Protocol as amended and adjusted is expected to prevent approximately 443 million cases of skin cancer, 2.3 million skin cancer deaths, and 63 million cases of cataract for people in the United States born in the years 1890–2100, relative to a scenario without any controls of ODS emissions. Additional estimates can be found in the report.

6. Why are you updating the AHEF model?

The AHEF model is continually being updated to use the most recent data on ODS emissions, ozone depletion, UV exposure, and human health effects. From new scientific findings to updated population data, the AHEF model has been regularly revised since it was created to present the most up-to-date information, with the previous update occurring in 2015.

7. What are the major updates?

Several updates to the AHEF model are detailed in the report, including changes to various atmospheric and chemical parameters, updated population data, changes to methodologies, and modernization and streamlining of the underlying computer code.