American Conservation Film Festival
In the Classroom

Pandora's Promise

2013 Festival Official Selection
Filmmaker: Robert Stone
Length: 80 Minutes

Summary: Our ability to generate electricity via atomic fission was developed in concert with atomic weapons. This technology was once touted as a possible remedy for our insatiable appetite for electricity, but the problems associated with safely storing radioactive waste for long durations and the meltdowns at Chernobyl, Three Mile Island, and Fukushima have demonstrated the grave dangers that accompany nuclear power. But, what if climate change is the greater danger? And, what if the relatively low carbon emissions of nuclear power can help us prevent global warming? Would the risks of nuclear energy be justified?

Course Mapping: Physics, Chemistry, Environmental Science

Curricular Keywords: Nuclear Energy, Radioactivity, Climate Change, Greenhouse Gas Emissions

Suggested Discussion Topics

Pandora's Promise gets its name from the Greek myth of Pandora who opened a jar releasing many evils into the world but in doing so discovered hope at the bottom of the jar. In the context of the film, humanity's development of nuclear power is like Pandora opening the jar. Many dangers have been unleashed into the world, but humanity has also discovered a means to generate large quantities of electricity with relatively low greenhouse gas emissions.

- According to the US Nuclear Regulatory Commission, a person living within 50 miles of a coal power plant receives an annual radiation dose (0.03 mrem) about 30 times higher than the dose received by a person living within 50 miles of a normally functioning nuclear power plant (0.009 mrem) because the fly-ash released by a coal plant contains radioactive isotopes. Discuss whether either of these doses alone are cause for concern. Debate whether individuals would rather live near a coal power plant or a nuclear power plant. Consider the other risks aside from radiation associated with these two choices.
- After discussing the physics of radioactive decay, half-life, and biological effects of ionizing radiation, and radiation shielding, discuss the problems associated with the long-term storage of radioactive waste from nuclear power plants.
- Ecologist Barry Commoner wrote in *The Closing Circle* that healthy ecological systems are characterized by closed loops that recycle everything in biological timeframes. Discuss Nuclear Energy from this ecological perspective.
- According to the IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (2012), the lifecycle greenhouse gas emissions of nuclear energy are about the same as that for solar photovoltaics (Fig. SPM.8). Discuss why both of these technologies result in greenhouse gas emissions when neither involve burning fuel to generate electricity.

Suggested Activity

Radiation is a ubiquitous part of our environment. However, with the exception of visible light, which we can see, and infrared light, which we can feel, most forms of radiation (electromagnetic waves and particles) are invisible to our senses. Use a Geiger counter or a radon meter to search for radioactive sources in the environment. The Safety Siren Pro Series3 Radon Detector and the MightyOhm.com Geiger Counter kit (detects beta particles only) are good low cost instruments for such an investigation. A geologist's core collection is a good place to look for good natural sources of beta decay like strontium-90.

Perform a Google search for images of the Chernobyl exclusion zone today. The images of the abandoned and overgrown remnants of buildings and towns are both disturbing and hauntingly beautiful. Discuss a 2015 publication in *Cell Biology* (Deryabina et al.) that explores the resurgences of wildlife populations in the Chernobyl exclusion zone. What does this tell us? Do animals like the elevated radiation levels near Chernobyl?

Additional Resources: Several other recent selections to the American Conservation Film Festival explore other dimensions of nuclear energy. *Yellow Fever* (2013 Festival) investigates the long-term effects of uranium mining on communities of Navajo. *In My Lifetime* (2013 Festival) takes a comprehensive look at the nuclear age and the efforts by scientists and citizens to eliminate radioactive threats to our environment including the atmospheric testing of nuclear weapons.

Around the time of the Fukushima nuclear disaster, the XKCD web comic produced a very informative and interesting infographic comparing the radiation doses from myriad sources (https://xkcd.com/radiation).