American Nuclear Society

American Nuclear Society Nuclear Energy Classroom Presentation

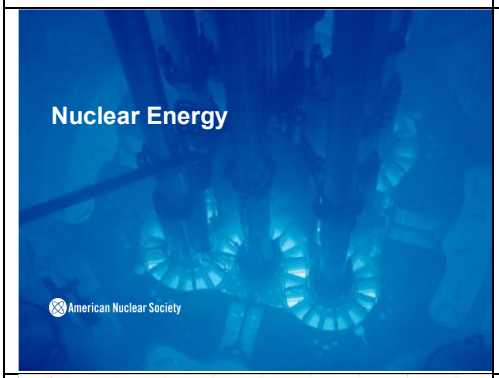
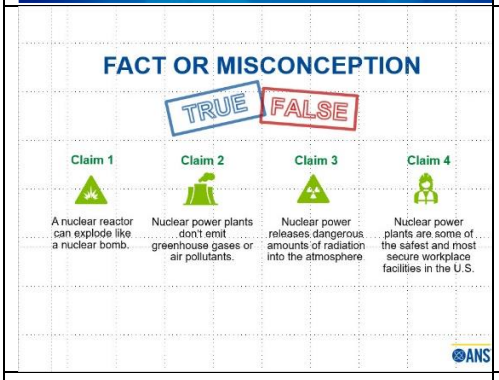
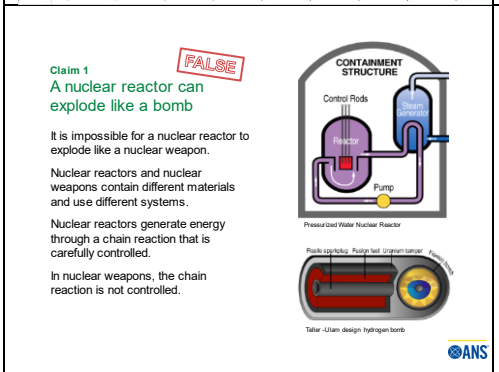
This PowerPoint deck is intended for presentation to students in middle- and high school. It is based on the Nuclear Energy lesson in Navigating Nuclear: Energizing Our World. You can find the lesson and the accompanying Educator Guide on the ANS website. Navigating Nuclear also includes a virtual field trip of the Palo Verde Generating Station in Arizona; you may want to share it with the classroom teacher.

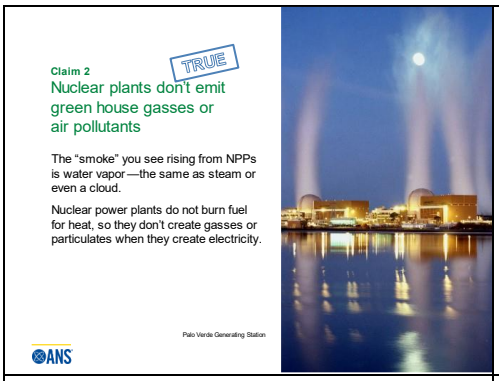
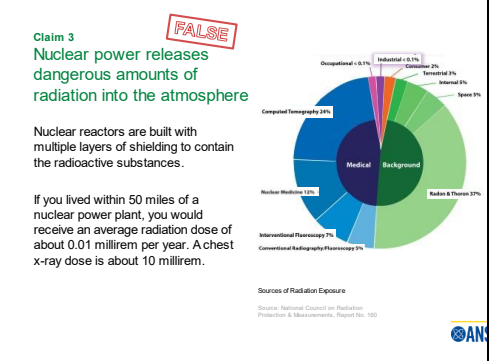
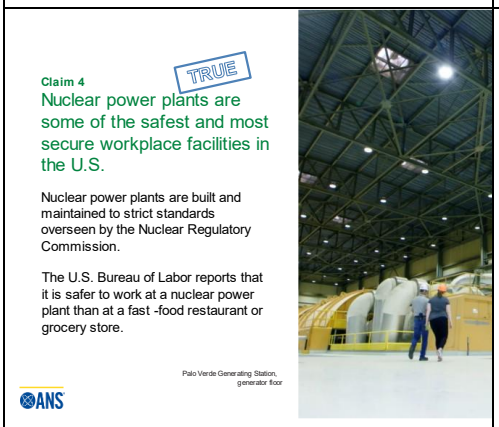
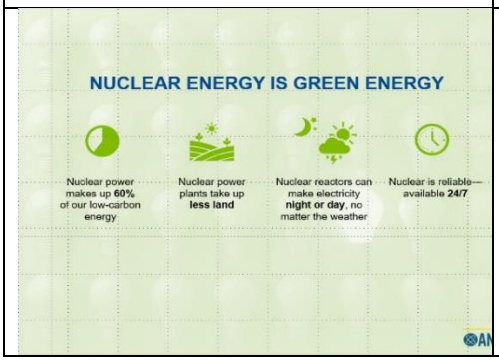
Following is a slide-by-slide overview of the presentation, their animations and presenter notes. The presentation notes include suggestions for activities to make the presentation interactive for students.

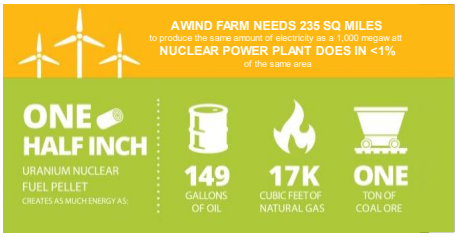
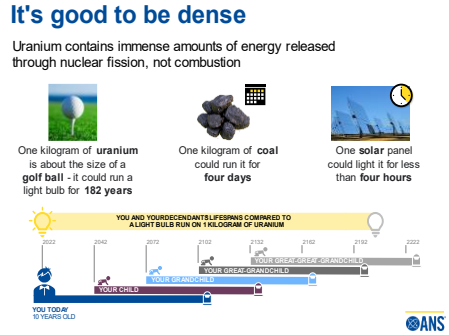
Materials you may wish to bring to your presentation are a set of 28 dominos and enough copies of ANS's Radiation Dose Calculator for each student to have one.

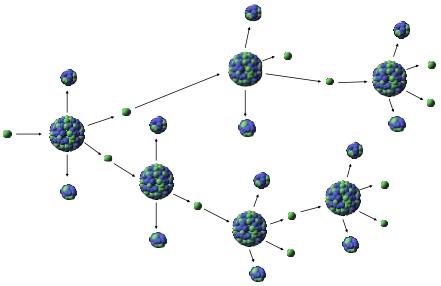
The slides include many animations, so we recommend you review the deck in Slide Show mode to get acquainted with it before presenting.

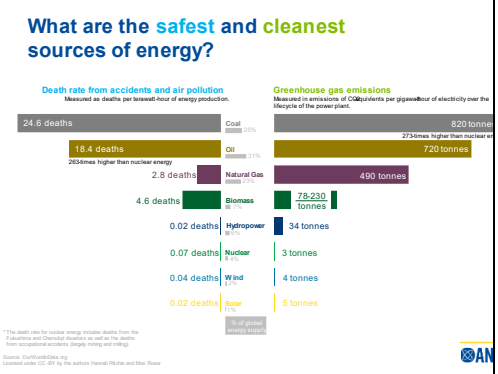
For more information, contact Janice Lindegard (jlindegard@ans.org).

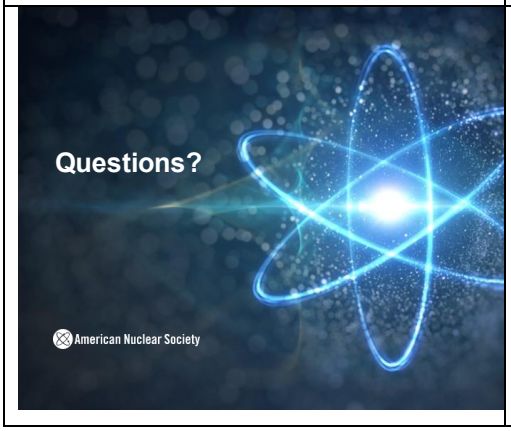
Slide	Notes
	This title slide is followed by a customizable presenter slide
	Prior to beginning presentation, place students into teams and have them get out a piece of paper. Ask them to write down their guesses on a sheet of paper as you reveal the claims. Go through all the claims before revealing the answers. These slides are animated to show the claims until all four are revealed. The answers will be revealed in the following slides.
	Ask students how many thought the statement was true and how many thought it was false. They can do this by raising hands. Before reading the statements, ask the students if they notice differences in the two illustrations. Review the statements, pointing out features like control rods as well as lack of control in the bomb. Note that fusion is happening in the bomb as well as fission, another difference from a reactor. If students ask, explain that creating the conditions that allow a fusion is much more difficult when the fusion must be sustained.

	Continue as before, asking students if they thought the statement was true or false. The photo is of Palo Verde Generating Station. Ask students what they think the "smoke" arising from the power plants is before revealing the supporting statements. Point out some of the structures visible in the photo. You may wish to point out that ANS has a virtual field trip of the Palo Verde Generating Station at https://www.ans.org/nuclear/navigatingnuclear/virtualfieldtrips/#paloverde
	Before revealing the answer, ask students which portion of the pie they think nuclear power falls into. It isn't labeled as such. Nuclear power plants are listed in with industrial exposure. That portion of the pie will glow when the slide is advanced.
	Point out that NPPs are regulated and overseen by the. Nuclear Regulatory Commission and that such standards are set for worst case scenarios. Note that the people in the picture are not wearing hazmat suits because they are not in a high-exposure area. They are wearing head protection and safe shoes. They are also wearing ear protection, which can't be seen in the photograph.
	The above statement points out how nuclear energy compares to other green energy sources. You may also wish to point out that nuclear energy is available right now at significant capacity.

 Energy Equivalents ANS	Ask the students their thoughts about these statements. You may ask one or more to read the statements and have the class comment on the comparisons.
	This is a complicated slide. It contains numerous animations that demonstrate the advantage of uranium's density. The lightbulb timeline will appear in stages, starting with the bulb turning on, then the first person. Each person is followed by another, the yellow timeline bar grows with each additional person until it goes out after 182 years. The timeline is based on a 100-watt bulb glowing continuously. Lifespan of each individual is 80 years, and each has a child at 30 years of age. Ask the students if they are surprised at the amount of time any of the energy sources can keep the bulb lit.
	The statements in this slide are out of order. Ask the students if they can figure out, based on the illustration, what order the statements should be in. Give the students about 30 seconds to write down what they think is the proper order. Students are more likely to do this in groups. When the students are ready, ask the groups to tell you what should go first. Then click to reveal the answer. Continue in the same way until all of the answers have been revealed. You can ask students if any of them got the whole order correctly.

The Chain Reaction 	This slide is animated. The title and a single uranium atom will appear, followed by a single neutron that strikes the atom. You will need to click through to complete the chain. You can use the following description to explain the chain reaction. Neutrons are released in the reactor core. The neutrons released strike other uranium atoms, causing them to fission. This fissioning continues in a chain reaction, like dominos falling.
ACTIVITY BREAK	At this point, you may wish to demonstrate a chain reaction with dominos. Make a domino chain and ask a student to start the reaction. All the dominos should fall. Rebuild the chain, then challenge students to control the chain, making it stop or slow. Give the students about a minute to consult and figure out a solution. Afterwards, explain how fission is controlled in a reactor. You may use the following explanation. Neutrons are fast, so a moderator is used.The moderator slows neutrons to ensure they strike ^{235}U atoms, continuing the chain reaction. Control rods keep the reaction in check. Reactor operators raise or lower them depending on the need. When the reaction is self-sustaining, the reactor has achieved criticality.
What happens in a nuclear reactor? 	There is a video embedded in this slide. It is an mp4 format that will play on a Mac or PC. The video explains what happens in the reactor core as well as what happens to the steam created in the core. Note that the water that circulates in the reactor core is completely isolated from the water outside the core.

<table>
<tr>
<td> 
</td>
<td>This slide is animated. First, it will show the percentage of energy world-wide generated by source. Then, it will show the rate of deaths caused by each source, followed by the number of emissions per source. This is a slide using global data, so tons is spelled tonnes.

Before proceeding to reveal safest sources, ask students to predict what the safest and most dangerous might be. Do the same with emissions per source.</td>
</tr>
<tr>
<td> 
</td>
<td>Take students questions. If time permits, use the ANS Radiation Dose Calculator to calculate each students' annual radiation dose. You may also leave copies with students to use later.</td>
</tr>
</table>