

GRADES
6-8

NAVIGATING™ NUCLEAR



Energizing Our World

Virtual Field Trip

EDUCATOR GUIDE

Overview

The American Nuclear Society Virtual Field Trip takes your students on a tour of the Palo Verde Generating Station in western Arizona. Students meet the team at the Palo Verde site to learn how nuclear technologies are helping to develop more environmentally favorable electrical power.

The Virtual Field Trip illustrates a variety of interesting highly skilled careers that deal with technology, data analytics, operations, and sustainability in nuclear power. It also showcases how new technologies support safety at the plant. Finally, it highlights how the nuclear power plant utilizes controlled fission to produce energy in the form of heat and convert it to electricity while using recycled city waste water as a coolant. The companion activities help engage students prior to and during the Virtual Field Trip, and they extend the learning from the Virtual Field Trip to the classroom.

Objectives

Students will:

- Explain how nuclear technologies support the development of more environmentally friendly electrical power.
- Explain the role technology plays in supporting excellent operations at a nuclear power plant.
- Examine innovations and technologies that gather data to solve problems.

Materials

- Copies of *Lessons Learned from Fukushima* handout, one per student
- Copies of *8 Step Engineering Design Process*, one per student
- White paper, rulers, colored pencils
- Copies of *Careers in Nuclear Energy* capture sheet, one per student
- Internet access
- Copies of *Career Profile Research* sheet, one per student
- Copies of *Nuclear Technologies* capture sheet, one per student

Engage

1. Begin class by handing each student a copy of the *Lessons Learned from Fukushima* handout.
2. Prior to showing the video, provide some background information on the Fukushima Daiichi nuclear accident by sharing the following information with students. On March 11, 2011, a magnitude 9.1 earthquake, the largest ever to hit Japan, generated a tsunami that reached as much 30 feet and resulted in the deaths of 15,800 people. The earthquake caused the Fukushima Daiichi nuclear power plants to automatically shut down safely, as they were designed to do during in an earthquake. Electric power lines throughout the area were damaged, cutting the power supply to homes, hospitals and the nuclear power plants. At the plants, backup power from diesel generators came on automatically, providing power and cooling to the reactors. Forty-five minutes after the initial quake, a tsunami brought waves up to 30 feet high as much as six miles inland. The waves flooded the Daiichi plants, disabling the diesel generators. Without power, cooling to the nuclear reactors stopped. After the Fukushima Daiichi accident, nuclear power plants all over the world, including the Palo Verde site, evaluated how they would respond disasters that result in no electrical power being available.
3. Show the video <https://www.youtube.com/watch?v=5ZTeTWsmRPw> (2 min. 32 sec.). As they watch the video, ask students to complete the *Lessons Learned from Fukushima* brainstorm wheel based on what they hear in the video.
4. Call on students to share what they have written using equitable calling strategies. Use the teacher version of the handout to ensure that all of the key points from the video are addressed.
5. Introduce students to the Virtual Field Trip by highlighting the following key points:

- Nuclear technologies support the development of more environmentally friendly electrical power by producing fewer greenhouse gas emissions during electricity production as compared to traditional fossil sources.
- Technology plays an important role in supporting safety at nuclear power plants.
- Professionals at a nuclear generating station must be able to identify problems, create solutions, think critically, effectively communicate as part of a team, and apply new technologies and skills.

During the Virtual Field Trip

- 1 Distribute the *Careers in Nuclear Energy* capture sheet to students and review the background information.
- 2 Direct students to watch the American Nuclear Society Virtual Field Trip. While they watch, they should list two background experiences/training opportunities each professional highlighted as influential or helpful in their current career.
- 3 Then, students should look to match some of their personal background and training opportunities with the careers featured in the presentation and answer the other questions on the last page of the capture sheet.

After the Virtual Field Trip

Two activity options are available for students to apply and summarize their learning.

Activity #1 (Career Investigation)

- 1 Remind students that during the VFT, they met many professionals who are dedicated to ensuring the production of safe and environmentally friendly energy to help solve the complex power needs of business and private consumers. From designers and engineers, to data analytics, operations, and sustainability experts, each career plays a unique role in addressing consumers' needs by identifying problems, creating solutions, thinking critically, effectively communicating as part of a team, and applying new technologies and skills.
- 2 The VFT highlighted several of these careers. Ask students to share what they remember about these jobs:
 - Nuclear Engineer
 - Data Analyst
 - Crane Simulator
 - Virtual Reality Trainer
- 3 Then, challenge students to learn more about one of the two careers they listed on the back of their *Careers in Nuclear Energy* capture sheet. Pass out the *Career Profile*, direct them to conduct a web search, and invite them to record their research.
- 4 Once research is completed, invite students to identify a gap in their school's course offerings and write a persuasive letter to the principal asking that the school offer more opportunities in this area, either directly or through partnership with outside groups.

Activity #2 (Nuclear Technologies)

- 1 Students will use the analogy sentence starters to analyze the technologies featured in the different career spotlights. Students will compare a technology they are familiar with to one they will observe during different segments of the VFT. Students will use the second column sentence starters to evaluate and summarize the technologies they observed.

HS National Standards Next Generation Science Standards

Students who demonstrate understanding can:

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Standards for Technological Literacy—International Technology and Engineering Educators Association (ITEEA)

Standard 5: Students will develop an understanding of the effects of technology on the environment.

D. The management of waste produced by technological systems is an important societal issue.

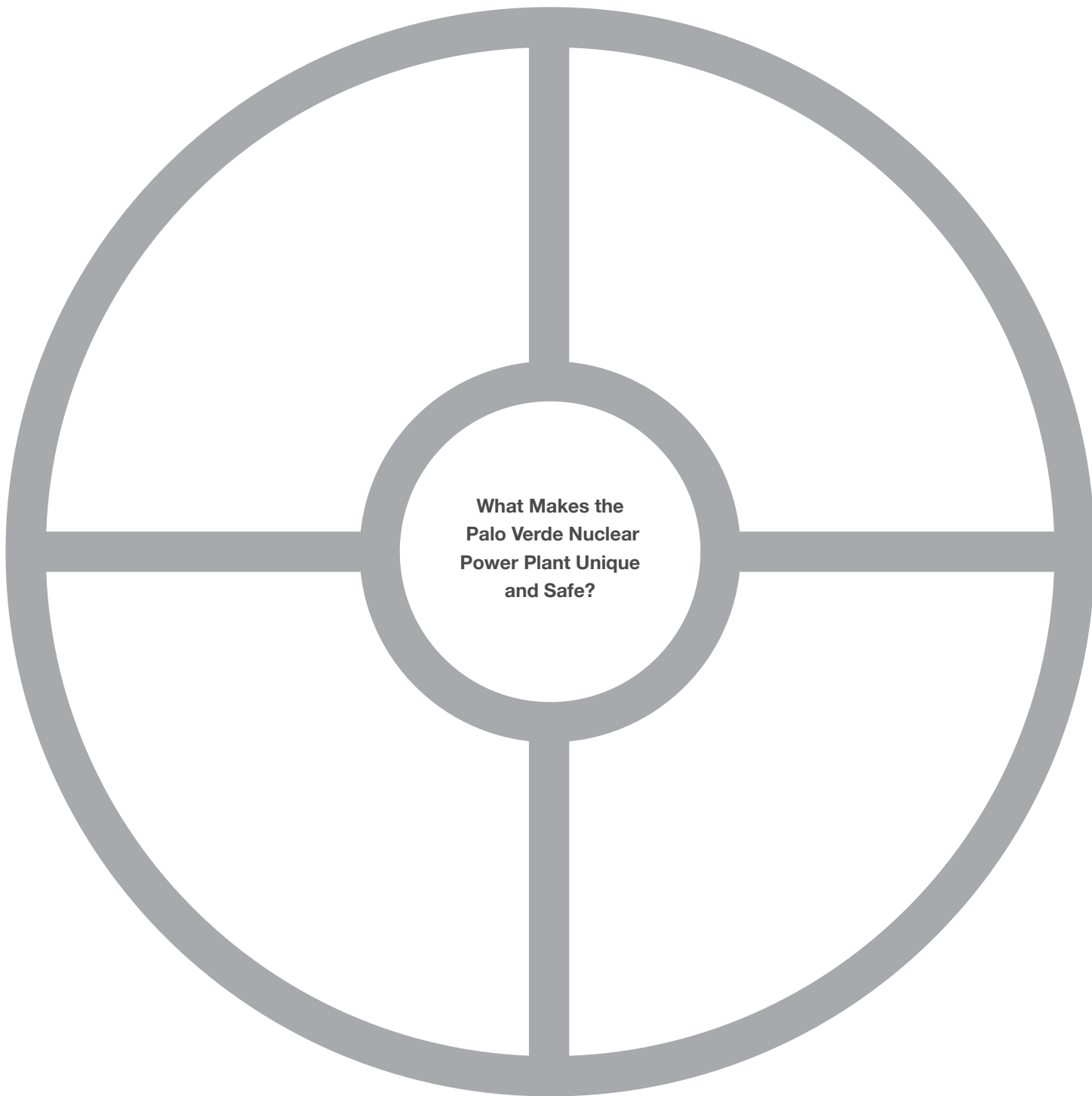
F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.

G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.

J. The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.

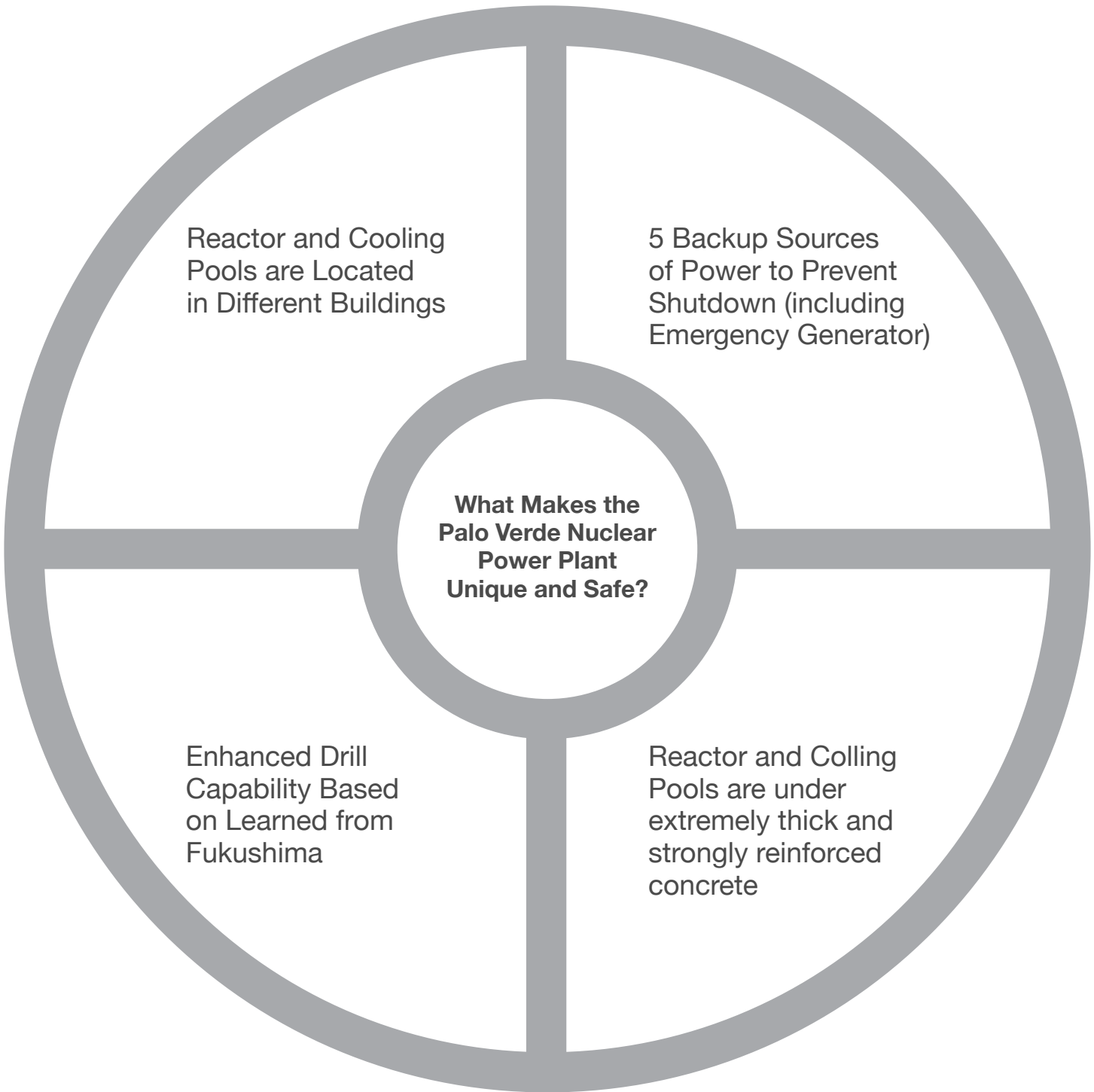
Lessons Learned From Fukushima

Instructions: As you watch the video, list features of the Palo Verde nuclear plant that make it unique and safer than the Fukushima plant.



Lessons Learned From Fukushima

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Careers in Nuclear Energy Capture Sheet

(To be completed during the virtual field trip)

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The Virtual Field Trip illustrates a variety of interesting highly-skilled careers that deal with technology, data analytics, operations, and sustainability in nuclear power. It also showcases how new technologies support safety at the plant. Finally, it highlights how the nuclear power plant uses fission to produce energy in the form of heat and convert it to electricity while using recycled city waste water as a coolant.

All the professionals you will hear from during the Virtual Field Trip will mention the background required for their careers, as well as high school courses/training opportunities that were valuable in preparing them for their field.

While watching the American Nuclear Society Virtual Field Trip, complete the table below:

| List two background experiences/training opportunities each professional highlighted as influential. | | |
|---|----|----|
| Nuclear Reactor Engineer | 1. | 2. |
| Emergency Preparedness Specialist | 1. | 2. |
| Nuclear Policy Manager | 1. | 2. |
| Virtual Reality (VR) Trainer | 1. | 2. |

Now, match your own background/opportunities to the careers highlighted.

Which background experiences of yours mirror any that you heard during the video? List two or three below.

Have you heard of any of the high school courses or training opportunities mentioned by any of the professionals as being available at your school? If yes, list them below.

If not, which courses or opportunities would you be interested in exploring further to see if they could be offered at your school or through an extension/partnership program?

List **two** careers from the Virtual Field Trip that are most interesting to you based on your background and the training opportunities available to you.

How do these careers support energy sustainability?

Career Profile Research

Directions: Conduct internet research to further explore a career that you learned about in the Virtual Field Trip. Record your notes below.

| | |
|--|-------|
| CAREER NAME | _____ |
| Brief Description | |
| Training & Skills Required | |
| Salary Range | |
| Related Careers | |
| Current job openings, if available | |
| Current classes I am taking that impact this career | |
| How this career matches my interests/skills/strengths | |
| Training opportunities I would need in the future to pursue this career | |

Directions: Complete the first column of the graphic organizer after you watch the Virtual Field Trip. Each video segment identifies a specific innovation that functions in a similar way to an everyday technology. Complete the second column to summarize your learning.

| During the Virtual Field Trip | After the Virtual Field Trip |
|--|--|
| <p>Measuring instruments are used in class to measure things we can't see like _____,</p> <p>just like Geiger-Müller counters are a tool to measure _____.</p> <p>Video games simulate _____,</p> <p>just like Nuclear Reactor Operations use Virtual Reality to simulate _____.</p> <p>Remote control drones are used as a toy to fly and film by _____,</p> <p>just like the Palo Verde nuclear power plant generating station uses drones to _____.</p> | <p>I observed professionals using innovative solutions by _____.</p> <p>I expected to see _____,</p> <p>but I also saw _____.</p> <p>I was really surprised when _____</p> <p>_____.</p> <p>_____.</p> <p>This Virtual Field Trip relates to the things we have been learning in class because _____</p> <p>_____.</p> <p>_____.</p> <p>I would like to learn more about _____</p> <p>_____.</p> <p>_____.</p> |