Energy Supply

Employee Newsletter
SPECIAL EDITION v.1

Our Nuclear Response To Events In Japan

Our thoughts and prayers continue to be with the people of Japan whose lives have been devastated by the March 11th earthquake, the following tsunami, and the nuclear events that have followed. We have closely monitored the situation in Fukushima day by day to assess events, share lessons learned, and offer our resources and support.

At PG&E protecting the safety of our workforce and the public are our highest priority. When we first received news of the earthquake in Japan, we worked with the Humboldt County Office of Emergency Services to comply with the Regional Tsunami Response. Humboldt Bay Generating Station was evacuated and shut down temporarily and evacuations occurred in and around the coastal Humboldt/ Eureka area. Although the plant sits higher than the predicted wave heights, the shutdown was a precaution for the safety of our employees and the public. Humboldt County customers were requested to reduce their energy usage as much as possible during this time.

Upon receiving word on the earthquake and monitoring the developing tsunami across the Pacific, Diablo Canyon Power Plant (DCPP) immediately declared an unusual event and put our emergency response procedures in place. Through careful evaluation of the safety implications, we evacuated personnel from low lying areas and continued plant operation. The unusual event was terminated that afternoon.
On the day following the earthquake, we started assessing DCPP's safety margins relative to events in Japan. On March 16, DCPP received a request from the Nuclear Regulatory Commission's Reactor Safety Team to provide boric acid and respirators to Tokyo Electric Power Company for use at its Fukushima Daiichi Nuclear Station. Boric acid slows down the rate at which nuclear reactions occur and was therefore being used to maintain a shutdown condition in the troubled reactors. Because DCPP stocks well beyond what the site needs, we were able to supply Fukushima with 13 pallets and leave well over the minimum amount needed for both of our units.

The U.S. nuclear energy industry has already started an assessment of the events in Japan and is taking steps to ensure that U.S. reactors could respond to events that may challenge safe operation of the facilities. As part of the nuclear industry's response, Diablo Canyon, as well as the other 102 nuclear units in the United States, is reviewing procedures and strategies, conducting walkdowns and assuring that the station is in a high state of readiness to respond to both design basis and beyond design basis events. This initial review will be completed by April 15.

From a regulatory standpoint, the DCPP leadership team has participated in ongoing discussions with the U.S. Nuclear Industry to assess the events in Japan, determine how we can help, and share lessons learned. The U.S. nuclear industry has a strong track record of closely monitoring issues around the world and applying lessons learned from them and at PG&E we are committed to continuous learning and will incorporate lessons from this accident as they emerge.

We know that the events in Japan have raised concerns about nuclear safety here at home. We want to ensure our customers and others that the regulations that govern the design, construction and operation of nuclear power plants in the United States are among the most stringent in the world. In a March 17th news conference, days following the Fukushima accident, President Obama stated that, "Here at home, nuclear power is part of our own energy portfolio, along with renewables like solar and wind. Our nuclear plants have undergone exhaustive study and have been declared safe in any number of contingencies."

The Diablo Canyon Power Plant was built with multiple backup safety features and designed to withstand all environmental factors, including earthquakes and tsunamis. As required by the NRC, U.S. nuclear power

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Key Points:

DCPP has in place several procedures, training and engineering strategies that are designed to prevent a situation similar to what happened with the power plant in Japan:

- Rigorous emergency plans
- Robust emergency preparedness training for personnel
- Long Term Seismic Program
- Fully-staffed geosciences department
- Seismic reinforced structures, systems and components
- Power block located 85 feet above sea level
- Redundant coolant supply systems

COVER STORY:
Nuclear Response
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plants including DCPP were designed to cope with a complete loss of offsite power supply. Additionally, we have procedures to effectively manage a loss of onsite power.

In response to concerns about radiation contamination spread across the Pacific, President Obama stated, “I want to be very clear-- We do not expect harmful levels of radiation to reach the United States, the west coast, Hawaii, Alaska or the U.S. territories in the Pacific.”

On Friday March 18th, Diablo Canyon detected minute amounts of radioactice isotypes (in the form of Iodine 131) from Japan; these concentrations were at a level just barely detectable by sensitive equipment and well below values outlined by the Environmental Protection Agency. For example if the level of Iodine 131 measured on that date stayed at the same concentration for a full year, it would only equal seven percent of the amount of exposure a person would get from a cross country plane flight.

In closing, the DCPP leadership team will continue to monitor the situation at Fukushima closely and work with our industry peers to apply lessons learned. We are committed to continuing to provide safe, reliable, greenhouse gas-free energy to our customers. We are taking a proactive approach in reaching out to our internal and external stakeholders to keep them educated and informed through email communications, brown bag sessions, community meetings, industry meetings, and congressional visits.

If you receive any information requests from the media, you are encouraged to refer them to PG&E’s dedicated media line available 24 hours a day, 7 days a week, (415) 973-5930.

Interview with John Conway

Energy Supply SVP and Chief Nuclear Officer answers employee FAQ’s regarding Diablo Canyon’s Nuclear infrastructure and safety procedures.

How is spent fuel housed and protected at Diablo Canyon Power Plant?

DCPP’s spent fuel pools are located on the 140 foot elevation of the Fuel Handling Building. Each pool has a reinforced concrete structure with a seam welded stainless steel plate liner. The pools’ volume is approximately 59,100 cubic feet and is filled with borated water. Spent fuel in the pools are protected by maintaining 23 feet of borated water over the spent fuel. Heat is removed by a cooling system constantly re-circulating the spent fuel pool water.

After the spent fuel sits in the pool for a minimum of five years, it can be transitioned to and protected in dry storage within a multi-purpose Canister (MPC) that is constructed of stainless steel and closed using a welding process. The Storage Overpack that the MPC is placed into is over 20 feet tall, and is constructed out of two steel vessels, each 1 inch thick, with the space between the vessels filled with approximately 28 inches of concrete. This over-pack container (seen at the Independent Spent Fuel Storage Installation site or ISFSI site) is bolted to a 7-½ foot thick reinforced concrete pad to ensure it is seismically restrained.

The ISFSI site and the storage system have been designed to withstand a 7.5 magnitude earthquake. The ISFSI is located over 300 feet above sea level and not susceptible to tsunami waves.

Can you walk us through the steps the plant operators would go through to shut down the plant in an emergency?

In the event that a Unit needs to be immediately shut-down, a manual reactor trip signal would open the reactor trip breakers and the control rods would drop into the core. This sequence of events takes about 2 seconds, resulting in the reactor being shutdown. Control systems will function independent of operator action to stabilize important plant parameters at the no load settings. This normally occurs in 10-15 minutes. The plant would be considered stable in Mode 3 (Hot Shutdown) at this time.

To cool down the plant to Mode 5 (Cold Shutdown), which is when the reactor coolant temperature is less than 200°F, requires operator action. This sequence of events is limited by several operational constraints, and will normally not occur faster than 6 hours (absolute minimum timeframe is 4 hours). Normally, we take about 12 hours to go from Mode 3 to Mode 5 as we perform various tests during the cooldown process.

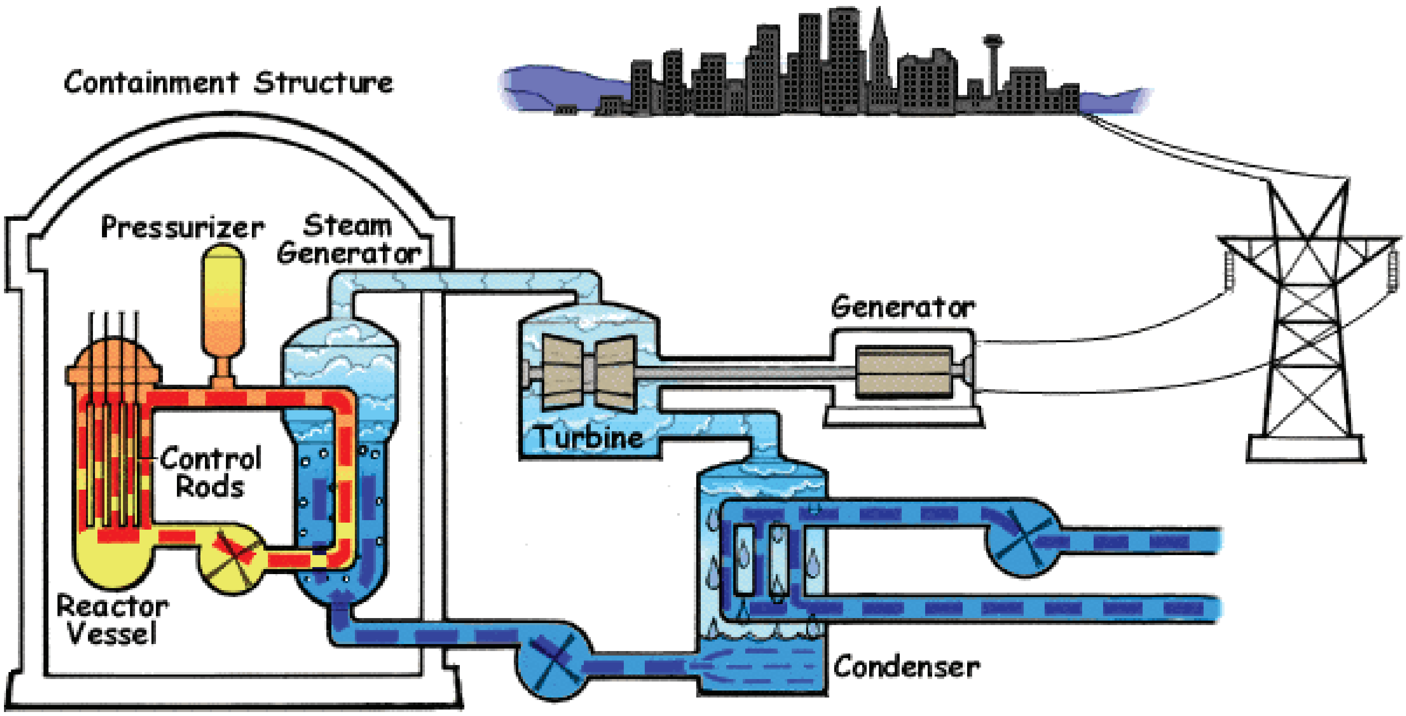
What would Diablo Canyon operators do if the plant lost power from the grid as well as emergency diesel generators like the operators at Fukushima Daiichi?

Nuclear power plant operators are trained to ensure that the plant will achieve and maintain safe shutdown during a station blackout scenario (loss of offsite power and loss of onsite emergency AC power). These operators have been trained in regular classroom work as well as plant-specific simulator exercises to take actions to respond to this scenario.

In addition, each unit has three installed diesel generators that are seismically qualified, with enough fuel onsite to produce power for one week. That time can be extended by reducing the loads on emergency diesel generators. These diesel generators are air cooled. They do not need water for cooling. They have self-contained radiators to provide engine cooling. The capacity of the backup diesel generators is 2.6 megawatts each.

A safe, efficient, and incident-free used fuel loading campaign in 2009.

Diablo Canyon sits along the California coast in Avila Beach. The plant’s power block and many of its safety features are situated on a bluff that is 85 feet above sea level.



Schematic of a Pressurized Nuclear Water Reactor

FREQUENTLY ASKED QUESTIONS

Q: How is nuclear power generated?

A: All turbine generators operate on the same basic principle - a mechanical force such as moving water, steam, gas, or wind turns a conductive wire within a magnetic field to create an electric current.

With nuclear power in a pressurized water reactor, such as in Diablo Canyon's two units, nuclear fission (the splitting of one atom into two) releases energy to heat reactor coolant which is circulated to boil water into steam. This steam moves a large turbine which spins a giant electromagnet to generate electricity. The generator is connected to electric grid and takes electricity to customers through transmission and distribution lines.

In the red loop in the schematic above, you can see that the reactor vessel is housed within a containment structure. This structure is built with layers of thick concrete and steel to protect against radiation leaking into the environment.

The reactor vessel is where the nuclear reaction takes place. U-235, a particular kind of uranium, is used as fuel for nuclear power because its atoms are easily split apart. This uranium fuel is formed into pellets with each pellet producing energy equivalent to approximately 150 gallons of oil. The pellets are stacked end to end to create fuel rods several meters in length. Several hundreds of these fuel rods are organized into bundles within the reactor core.

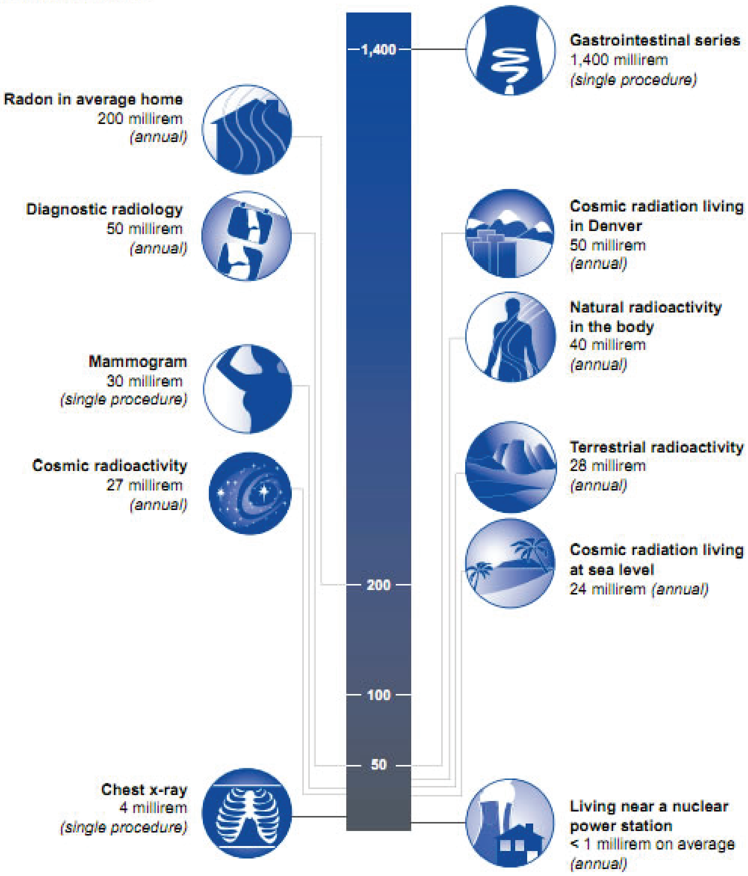
Control rods are also housed inside the vessel pressure boundry. These rods are composed of pellets made of very efficient neutron capturers that work to block the nuclear reaction created by the fuel rods. These control rods are connected to machines that can raise or lower them in the core to regulate the rate of the nuclear reaction as well as the heat generated. When they are fully lowered into the core, the fission chain reaction cannot be sustained and the power plant is shut down.

Pressurized water reactors heat the water surrounding the nuclear fuel, but prevent the fuel from boiling by regulating the amount of pressure in the vessel. A pump moves the hot water from the reactor vessel to the steam generator. As seen in the diagram, this separate supply of water to the steam generator boils to make steam that spins the turbine.

As seen in the blue loop above, the exhaust from the turbine condenses into water and is pumped back to the steam generator.

RELATIVE DOSES FROM RADIATION SOURCES

Millirem Doses



Source: http://www.epa.gov/radiation/understand/perspective.html

Radiation
The energy given off by unstable atoms. Radiation cannot get on you or on your clothes. You can not carry radiation from place to place any more than you can carry sunlight around. Radiation is energy in the form of particles or waves emanating through space. Radiation covers the electro-magnetic spectrum from heat through X and gamma rays. X-ray and gamma ray energies lie on the electro-magnetic spectrum just beyond ultraviolet light.

Radioactive Material
Any material containing un-stable (or radioactive) atoms. This material gives off radiation as it decays. Radioactive materials have a characteristic probability of decay that is described by the half-life. This is the amount of time any given radioactive isotope decreases through decay to one half of its starting value. The rate of decay versus time is known as activity. Uranium is a natural radio-active material. Other radioactive materials are man-made. Your own body has naturally occurring radioactive potassium and carbon atoms in it.

Radioactive Contamination
Unwanted small dust-like particles of radioactive material. Radioac-tive contamination is radioactive material in a place we do not want it. The fuel in the reactor is radioactive, but since we want the fuel to be radioactive we do not call it contamination. If the same fuel was dispersed on the ground it would be called contamination.

Acute dose
Some amount of radiation received over a short period of time. For example, some medical treatments involve large doses of radiation. Those prompt radiation doses could result in non-specific blood changes, transient sickness, and other effects. High doses of radiation received promptly and without medical intervention can cause damage to blood forming organs, to the gastro-intestinal tract, or to the central nervous system.

Chronic dose
Some amount of radiation re-ceived over a long or protracted period of time. This includes normal occupational exposure and results in no visible effects. The basis for US and international regulations assumes that even small radiation doses may slightly increase the risk of a future cancer.

A good example of the difference between Acute and Chronic doses is the difference in sunbathing for one hour a day for seven days (Chronic) or sunbathing for seven hours in one day (Acute).

Understanding Radiation

Dose & Milli-rem

Dose is the measure of the amount of radiation absorbed by the body. In the U.S., the unit of measurement of the amount of radiation energy absorbed by a person ("radiation dose") is the Rad. The effect of the absorbed energy adjusted for energy and type of radiation is called the Rem. The most useful unit in the US is the milli-rem. 1,000 milli-rem is equivalent to 1 rem.

Natural Background Radiation

On average, Americans receive about 310 milli-rem per year of radiation from naturally occurring radiation in the environment (commonly known as "natural background radiation"). This includes radiation from space (cosmic radiation), and radioactive material in the earth, the air, and food and water.

Radon in home and workplaces accounts about for two-thirds of natural background radiation dose (about 200 milli-rem per year). A round-trip flight between New York and Los Angeles will result in about 4 milli-rem due to being at a higher altitude and receiving more cosmic radiation. Flight crews receive 200-400 milli-rem per year.

Medical and Dental Radiation

Americans also receive radiation dose from medical and dental procedures in the form of x-rays, CT scans, nuclear medicine, etc. Although the average amount of radiation dose is calculated as more than 300 milli-rem per year, much larger amounts of radiation dose are received by people undergoing diagnosis or treatment of specific medical conditions.

- A typical chest x-ray is 2 milli-rem.
- An upper GI tract examination is 600 milli-rem.
- A CT scan of the chest or abdomen is 800 milli-rem.

Federal Radiation Safety Limits

Federal agencies such as the U.S. Nuclear Regulatory Commission (NRC) establish radiation dose limits to protect the health and safety of the public and nuclear workers. The limits are based on the current scientific understanding of potential risks from radiation exposure.

The NRC radiation dose limit for protecting members of the public is 100 milli-rem per year from any license holder. The NRC radiation dose limit for protecting nuclear workers is 5,000 milli-rem or 5 rem per **year.**

Radiation from a Nuclear Power Plant - Routine Operations

As a part of routine operations, small amounts of radioactive material are released from nuclear power plants into the environment in accordance with requirements that are specified in the operating licenses issued by the NRC. Radiation dose to members of the public from these releases to the air and water are routinely monitored by the plants, the states and the NRC and are documented in public reports submitted to the NRC.

The average radiation dose to a person living near a nuclear power plant is much less than 1 milli-rem per year.

Source:
http://www.nei.org/news-andevents/information-on-the-japanese-earthquake-and-reactors-in-that-region/
radiation-in-perspective

Industry Who's Who

WANO

The World Association of Nuclear Operators (WANO) unites every company and country in the world with an operating commercial nuclear power plant to achieve the highest possible standards of nuclear safety. WANO's mission is to maximize the safety and reliability of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information and emulation of best practices.

INPO

The Institute of Nuclear Power Operations (INPO) promotes the highest levels of safety and reliability to promote excellence in the operation of commercial nuclear power plants in the United States. INPO establishes performance objectives, criteria and guidelines for the nuclear power industry, conducts regular detailed evaluations of nuclear power plants, and provides assistance to help nuclear power plants continually improve their performance.

NEI

The Nuclear Energy Institute (NEI) is the policy organization of the nuclear energy and technologies industry and participates in both the national and global policy-making process. NEI's objective is to ensure the formation of policies that promote the beneficial uses of nuclear energy and technologies in the United States and around the world.

Resources

World Association of Nuclear Operators
http://www.wano.info

Nuclear Energy Institute
http://www.nei.org

Institute of Nuclear Power Operator
http://www.inpo.info

U.S. Nuclear Regulatory Commission
http://www.nrc.gov

U.S. Department of Energy
http://www.energy.gov

Environmental Protection Agency
http://www.epa.gov

San Luis Obispo County Office of Emergency Services
http://www.slocounty.ca.gov/OES.htm

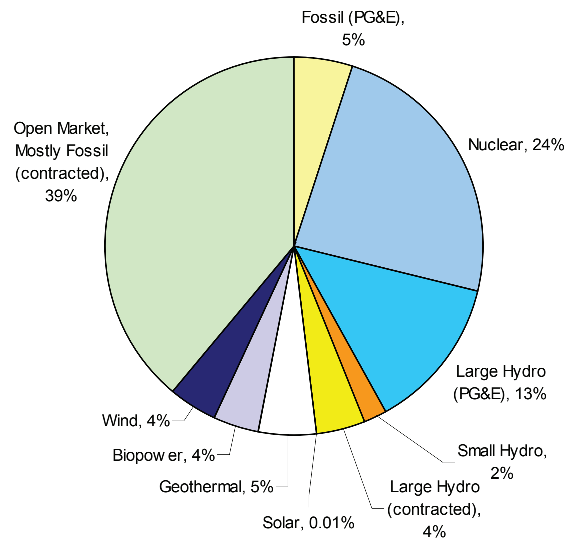
Energy Supply Fast Facts: Nuclear Power

As of March 1, 2011, there were 443 operating nuclear power reactors spread across the planet in 47 different countries. There are 104 commercial nuclear reactors with operating licenses at 64 sites in 31 states supplying 20 percent of total electricity in the United States.

Approximately 56 percent of PG&E's Electric mix comes from greenhouse gas free resources. This includes Nuclear, Hydro, Solar, Geothermal, Biopower, and Wind.

DCPP's annual generation of safe, reliable, greenhouse gas free energy is equivalent to about 7 Million Metric Tons of CO2 of GHG avoided (assuming we were running a combine cycle plant instead).

2010 Preliminary* ES Electric Mix



*Final figures available late spring 2011

Upcoming Activities

Diablo Canyon Relicensing Application

PG&E is seeking 20-year license renewals for each of DCPP's units to ensure the long-term availability of a valuable source of affordable, reliable, and greenhouse gas free electricity for more than three million Californians. If the unit licenses were to expire in 2024 and 2025 without renewal, replacing the 18,000 plus gigawatt-hours of electricity DCPP generates annually would require California residents and businesses to invest in additional energy infrastructure.

In addition to providing safe, reliable, clean, cost-effective electricity, Diablo Canyon is a vital economic engine for San Luis Obispo, if not all of California. As a major employer and purchaser of goods and services, Diablo Canyon has a total economic impact of nearly $750 million annually for San Luis Obispo County and another $100 million for the state. The more than $25 million in property taxes paid by Diablo Canyon last year, helped support municipalities, schools and other crucial public services. Moreover, Diablo Canyon employees have volunteered thousands of hours of their personal time to after-school athletic programs, environmental groups, churches and other neighborhood organizations.

Many of you may be wondering how the current nuclear events in Japan may affect Diablo Canyon's Licensing Renewal. PG&E expects that this topic will come up in hearings and could potentially extend the process. License renewal is a long and rigorous process with many opportunities for public involvement. Our current process continues as planned and we will work closely with the nuclear industry to monitor the ongoing events in Japan to determine if changes to our approach are warranted. The length of the process will allow us time to incorporate safety information gleaned from ongoing earthquake studies and the disaster in Japan. DCPP's relicensing hearings are currently scheduled to begin in the spring of 2012 and to be complete in the summer 2012.

DCPP's award winning steam generator replacement project in 2009.

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