A nuclear accident is an event that can cause significant consequences to people, the environment or the facility. Currently 30 countries use the nuclear power plants (NPP) to produce electricity (in total 442 operating nuclear reactors spread over 30 countries). Countries such as the USA, France, Japan, and Russia have the most nuclear reactors, whereas many countries such as Australia and Bangladesh donot have any nuclear power plants at this moment (Figure 1). NPP can be categorised as environmentally friendly in the sense that there are little or no greenhouse gas emissions from using uranium to generate electricity (see Table 1: note: 63 percent of world’s uranium production is from Kazakhstan, Canada and Australia) and electricity produced by nuclear power tends to be much cheaper than other forms of production (e.g. coal, natural gas and oil). Therefore, in the future there may be more demand to construct NPP, for example, over 45 countries are actively considering embarking upon nuclear power programs; the front runner countries of which are Iran, United Arab Emirates (UAE), Turkey, Italy, Vietnam and Jordan. However, consequences of any nuclear accidents could be catastrophic (e.g. 1986 Chernobyl nuclear disaster).

On 11 March 2011, a major earthquake and tsunami devastated Sendai of Japan despite it has the world’s densest seismometer (instruments that measure motions of the ground, including those of seismic waves generated by earthquakes) network, the biggest tsunami barriers and the most extensive earthquake early-warning system. The 2011 Sendai tsunami caused severe damage to Fukushima Daiichi (dai-ichi means ‘number one’) nuclear power plant resulting release of radioactive materials such as Iodine-131 (half-life 8.02 days) and Caesium-137 or Cesium-137 (half-life 30.17 years) (Table 2) into the environment (note: half-life is the time required for a radioactive substance to lose 50% of its activity through decay). Abnormal levels of radiation in milk, spinach, fish from areas near Fukushima, and in tap and seawater water have been reported. The main source has been wind-borne dust which is deposited on fruit or vegetables or which falls on the soil, where it is absorbed by grass and leafy plants. Radioactive particles are then transmitted through the food chain (see Figure 2). Additionally direct release of effluents from the plant into the sea can cause significant effects on marine organisms including seafood.

There is a short-term risk to human health if radioactive Iodine-131 in food is absorbed into the human body as it can increase the risk of thyroid cancer via accumulation in human body; in particular children and young people are particularly at risk. However, the longer-term problem comes from Caesium-137, whose ‘half life’ is 30 years meaning that it may take long time before it breaks down totally. Japan itself has banned fishing within 20 km of the Fukushima plant, since it fears that seaweeds and marine organisms may have been contaminated with radioactive materials. Furthermore, Caesium-137 tends to accumulate in larger fish near the top of the food chain.

Many countries have already set food import restriction from Japan including Australia, Canada, China, France, Hong Kong, Philippines, Russia, Singapore, and United States. Australia banned produce from the Fukushima area, including seaweed and seafood, milk, dairy products, fresh fruit and vegetables (both fresh and frozen). Indian government has also announced a ban on all food imports from Japan. Many countries have expressed concern over the radiation effects.

Table 2: Major nuclear power plant accidents and their effects

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Causes</th>
<th>INES level</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-March 11</td>
<td>Fukushima Daiichi 7</td>
<td>Cooling failure in 4 reactors following an earthquake, tsunami and multiple fires and hydrogen explosions</td>
<td>7</td>
<td>strong release of radioactive iodine-131 and cesium-137; vegetables, fish, food &amp; water contamination; 2 deaths</td>
</tr>
<tr>
<td>1986-April 26</td>
<td>Chernobyl accident, 3</td>
<td>Steam explosion and fire</td>
<td>3</td>
<td>major release of radioactive materials (iodine-131, caesium-137, tellurium) with widespread health and environmental effect; 57 direct deaths; 6000 beyond cancer fatalities from contaminated milk</td>
</tr>
<tr>
<td>1979-March 28</td>
<td>Three Mile Island 5</td>
<td>Loss of coolant and partial core meltdown</td>
<td>5</td>
<td>major radioactive release including harmless noble gases (xenon-135) and iodine-131; zero deaths</td>
</tr>
</tbody>
</table>

Key references

http://en.wikipedia.org/wiki/Fukushima_Daiichi_nuclear_accidents
http://en.wikipedia.org/wiki/International_Nuclear_Event_Scale
http://en.wikipedia.org/wiki/Nuclear_accident
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http://www.bagep.com/articles/nuclear-power-geo-and-con.html
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http://www.world-nuclear.org/info/inf08.html (World nuclear association)

Japan Times, 20 March 2011.

Note: The article is based on various sources and was compiled by Golam Kibria, Ph.D in April 2011 for http://www.sydneybashi-bangla.com (23) for community benefits. Views expressed in this article are those of the author and are not to be taken to be the views of any others including third parties. The information in this article may be assistance to you but the author donot guarantee that it is without flaw of any kind and therefore disclose any liability for any error, loss or other consequences which may arise from relying on any information in this article.
### Appendix 1: Pros and cons of various power generation options

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>Low cost</td>
<td>- requires huge amount of freshwater</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- produces more carbon dioxide (CO₂) or green house gas than any other electricity generation method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- contains sulphur, arsenic, selenium, mercury and radioactive elements uranium, thorium, radium and radon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- not sustainable</td>
</tr>
<tr>
<td>Natural gas</td>
<td>Low cost</td>
<td>- produces CO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- not sustainable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- gas reserves are limited</td>
</tr>
<tr>
<td>Oil</td>
<td>Low cost</td>
<td>- produces CO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- requires substantial amount of cooling water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- oil reserves are limited</td>
</tr>
<tr>
<td>Non-fossil fuel - nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td>- doesn’t contribute to green house gas emissions (GHG) or pollutants</td>
<td>- produces radioactive waste which are harmful to living organisms (can cause cancer, genetic mutation)</td>
</tr>
<tr>
<td></td>
<td>- efficient power generation (less fuel required)</td>
<td>- requires substantial amount of cooling water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- high capital and maintenance costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- may take 10-15 years to build</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- a target for terrorist attack</td>
</tr>
<tr>
<td>Non-fossil fuel - Renewable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal (hot water)</td>
<td>- sustainable, non-polluting</td>
<td>- can be developed only in selected volcanic areas</td>
</tr>
<tr>
<td>Hydro (dams)</td>
<td>- sustainable, non-polluting, simpler and cheaper</td>
<td>- impair migration of native species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- causes cold water pollution since water released from bottom of dams is cold affecting native species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- can cause flooding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- can produce significant amounts of carbon dioxide and methane (greenhouse gases)</td>
</tr>
<tr>
<td>Wind</td>
<td>- sustainable, non-polluting, requires little or no cooling water</td>
<td>- doesn’t produce power when wind is not blowing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- need numerous turbines spread over large areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- depends on wind velocity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- can kill birds etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- can cause noise pollution</td>
</tr>
<tr>
<td>Solar (sun)</td>
<td>- sustainable, non-polluting, can be produced in any part of the world</td>
<td>- requires large space</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- may require substantial amount of cooling water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- solar electricity could be expensive</td>
</tr>
<tr>
<td>Wave</td>
<td>- sustainable, non-polluting</td>
<td>- installation would damage the local sea-bed</td>
</tr>
<tr>
<td>Biomass</td>
<td>- uses renewable fuel</td>
<td>- a large area of land is required for the production of fuel</td>
</tr>
<tr>
<td>(wood, alcohol fuels, solid waste)</td>
<td></td>
<td>- requires fertiliser for crops</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- burning of biomass may create pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- expensive (requires lot of resources)</td>
</tr>
</tbody>
</table>