



Resources for Nuclear Physics and Engineering

Posted by [JoulesBurn](#) on April 4, 2011 - 10:20am

Three weeks have elapsed since the East Japan earthquake and tsunami triggered the crisis at the Fukushima nuclear reactors. Despite many optimistic predictions for a quick resolution to a minor mishap, it is clear that it will take a long time to even determine the exact condition of the reactors and spent fuel pools, not to mention any remediation of the radiation hazard in the immediate area. Data dissemination by TEPCO and the Japanese government has not exactly been smooth since the accident, and this has largely contributed to the confusion. Nonetheless, there has been much speculation and fitting together of puzzle pieces by visitors to this website and others.

But this post is not geared toward understanding what is going on at Fukushima, but rather on improving our collective understanding of all things nuclear. The goal is a compendium of educational and utility resources to make us better prepared to discuss what is happening in Japan and what will happen with nuclear power in the future. Suggestions by readers are requested. Let's keep it civil.

There are many reasons that many feel compelled to come here and follow or contribute to the conversation while the crisis is still unfolding. While it is unlikely that we will in any way contribute to the resolution of the immediate problem in Japan, we are all responsible for the decisions that are being and will be made about the future of nuclear power elsewhere in the world. One thing that hinders a more streamlined discussion of the fate of Fukushima, as well as nuclear power in general, is that nuclear physics and engineering are not easy subjects. The science is rather unintuitive and beyond people's everyday experience. An event like this happens, and everyone is forced to confront their own lack of expertise.

But nuclear physics has been around along time, and certainly in the beginning years of the nuclear age, there was a need to explain the basic concepts in such a way that people could understand it at some level. And scientists at many universities and laboratories have also made available some excellent material. I have identified some links that I believe are very good, and I will plant the seed by listing them below. If you know of others, please submit them in the comments. The best of these will get brought up top. This list is meant to be rather dynamic, and categories might get added as time goes on. No commentary or news on current events, though; use the Fukushima open threads for this.

Note: it is not claimed that any resource is completely without bias -- if that is indeed possible. If you feel that the resources are heavily slanted one way or the other, suggest others.

Tutorials and Online Texts

- [Particle Adventure](#)

By Lawrence Berkeley Labs. From atoms to what they are made of to what holds them together and why they fall apart. Highly recommended, though it doesn't cover nuclear

- [Hyperphysics Nuclear Concepts](#)

Start with a mind map view of all things nuclear (including reactors), and then drill down to what you are interested in. From Georgia State University.

- [Nuclear Chemistry and the Community](#)

This is a rather comprehensive basic tutorial by Frank Settle, developed with support from the NSF.

- [Radiation and Radioactivity](#)

From the Health Physics Society and the University of Michigan. Rather brief introductions to several concepts.

- [A Teacher's Guide to the Nuclear Science Wall Chart](#)

From Lawrence Berkeley Laboratory

- [The Nuclear Energy Option](#)

This is an online book by Bernard L. Cohen, written in 1990.

- [Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report](#)

Start at [page 39](#) for a discussion of the oxidative degradation of Zr cladding.

Atom and Isotope References

- [The Lund/LBNL Nuclear Data Search](#)

From Chu and company at LBNL

- [Theo Gray's Periodic Table](#)

Drill into an element for full technical data, known isotopes, and decay chains.

- [Chemicool Periodic Table](#) (MIT)

Tools and Visualizations

- [National Nuclear Data Center Tools](#)

From Brookhaven NL. Nuclear structure, decay, and reaction tools plus other resources. Also, see their [main page](#).

- [Wise Project Calculators](#)

A plethora of javascript calculators for nuclear decay profiles etc.

- [Personal Radiation Dose Calculator \(NRC\)](#)

- [Java Programs for Calculating Properties of Nuclear Fuels and Wastes](#)

From the [Energy from Thorium](#) blog. [Cross Sections](#), [Decay Chains](#), [Isotope Separation](#), [Spent Nuclear Fuel](#), [Ternary Mixtures](#)

Videos

- [A is for Atom](#)

Original video produced by General Electric to get the public comfortable with nuclear power.

- [A is for Atom -- BBC Documentary](#)

Some reasons why the GE vision didn't quite go as planned.

- [Physics for Future Presidents, Lecture 7: Nukes](#)

Prof. Richard A. Muller, Cal. Berkeley. Whence Fission.

- [The Battle of Chernobyl](#)

A French documentary

- [Into Eternity](#)

A documentary about the nuclear waste repository being built in Finland

Useful Papers

- [MANUAL OF PROTECTIVE ACTION GUIDES-ANDPROTECTIVE ACTIONS FOR NUCLEAR INCIDENTS](#) (EPA, 1992)
- [Nuclear Power for Energy Generation](#) (NRC)
- [The Fission Process and Heat Production](#) (NRC)
- [Boiling Water Reactor Systems](#) (NRC)
- [Pressurized Water Reactor Systems](#) (NRC)
- [Nuclear decay heat - the energy released by fission fragments](#)
- [Specific Features of Cesium Chemistry and Physics Affecting Reactor Accident Short Term Predictions](#)
- [Recriticality Energetics of a Hypothetical Water Reflood Accident in a Damaged Light Water Reactor](#)
- [Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States](#) (Alvarez 2003)
- [NRC Rebuttal to Alvarez et. al. 2003](#)
- [The Discovery Of Radioactivity:The Dawn of the Nuclear Age](#)
- [Radioactive Waste](#)
- [Dry Cask Storage of Spent Nuclear Fuel](#)

Books

- "Nuclear Reactor Engineering", by Glasstone & Sesonske
- "Sourcebook on Atomic Energy", by Glasstone
- [Power to Save the World: The Truth about Nuclear Energy](#) by Gwyneth Cravens
- [Megawatts and Megatons: The Future of Nuclear Power and Nuclear Weapons](#) by Garwin and Charpak

- [Chernobyl: Consequences of the Catastrophe for People and the Environment](#) (pdf)



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