

# Nuclear Energy - The Better Energy

*Everything you need to know about Nuclear Energy*

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## *To all our readers*

Nuclear Energy - The Better Energy started out as an individual project that has now turned into an organization involving extensive, international collaborations. Our motivation to promote awareness about the peaceful uses of Nuclear Power has led us to evaluate our position in society and what we can do as individuals to reduce our carbon footprint.

The first and foremost step is to enhance our understanding of the potential of nuclear power production and how it can positively impact our lives, helping us minimize our dependence on fossil fuels and other less reliable sources of energy. As scientists working in this field, our team considers this our moral responsibility to act and hence this initiative.

In our aim to reach as many people as possible, we have tried to provide reliable and easy to understand information through our website and social media platforms. Taking another step forward, we are proudly presenting this first issue of our magazine. Our team member Lydia Schaecher has graciously agreed to be the Editor-in-chief and has worked hard to get this first issue published.

Happy reading!

Our founder, Nirupama Sensharma, is a PhD candidate in physics at the University of Notre Dame. She is an ardent supporter of nuclear energy and is actively involved in social movements to spread awareness about the peaceful uses of nuclear energy.





# Three Mile Island: The Beginning of America's Nuclear Power "Problems"



*Image Source: (Richard Hertzler/LNP/LancasterOnline via AP)*

According to the U.S Energy Information Administration, the first commercial power plant opened near Pittsburgh in 1957. By 1979, 69 nuclear reactors were operational in the United States. The steady increase of nuclear reactors being built was not a trend that continued, though. 1979 marked the year of a pivotal moment in the American nuclear power industry. The Three Mile Island crisis (TMI) occurred in March 1979 in Dauphin County, Pennsylvania. The accident resulted in a partial nuclear meltdown. A series of both human error and mechanical failures led to the overheating of the one of the nuclear reactors found at the TMI plant, which caused the reactor to melt and release radioactive gases into the surrounding environment. Dr. George K. Tokuhata, Director of the Division of Epidemiology of the Pennsylvania Department of Health, commented on the effects of the meltdown, ““The Three Mile island accident, unlike natural disasters such as floods, hurricanes, earthquakes, or major fires, left no immediate physical alterations in the surrounding environment”” (qtd. in Houts et al. vii) In other words, the TMI left no visible evidence of a disaster. *Not a single living person or animal in Three Mile Island died as a direct result of the accident.*

Yet, TMI is universally considered to be the most significant nuclear power plant accident in the history of the United States. Why? For the first time in the history of the United States, nuclear power had an immediate, personal effect on American citizens. TMI prompted an immediate national response; within 5 hours on the accident, Governor Thornburgh of Pennsylvania and the current United States president Jimmy Carter were both notified, and the Associated Press released a national bulletin declaring a general emergency at TMI (Houts et al. 2-3). The public was assured that no radiation had been released and that they were in no danger.

However, this statement was contradicted two days later, when above-normal radiation levels were recorded, and Governor Thornburgh issued a statement advising schools within a five-mile radius to close and for pregnant women and young children to evacuate the area. This statement resulted in widespread panic, and in the days following TMI, “66% of the households within five miles of TMI had at least one person evacuate” (Houts et al. 13). This percentage is based on surveys conducted by both the Nuclear Regulatory Commission (NRC) and the Pennsylvania Department of Health, and these surveys also reported that “perceived danger was the reason most respondents gave for evacuating, but about 80% of respondents cited confusing information as a reason for leaving” (Houts et al. 13).





*Image Source: (PennLive)*

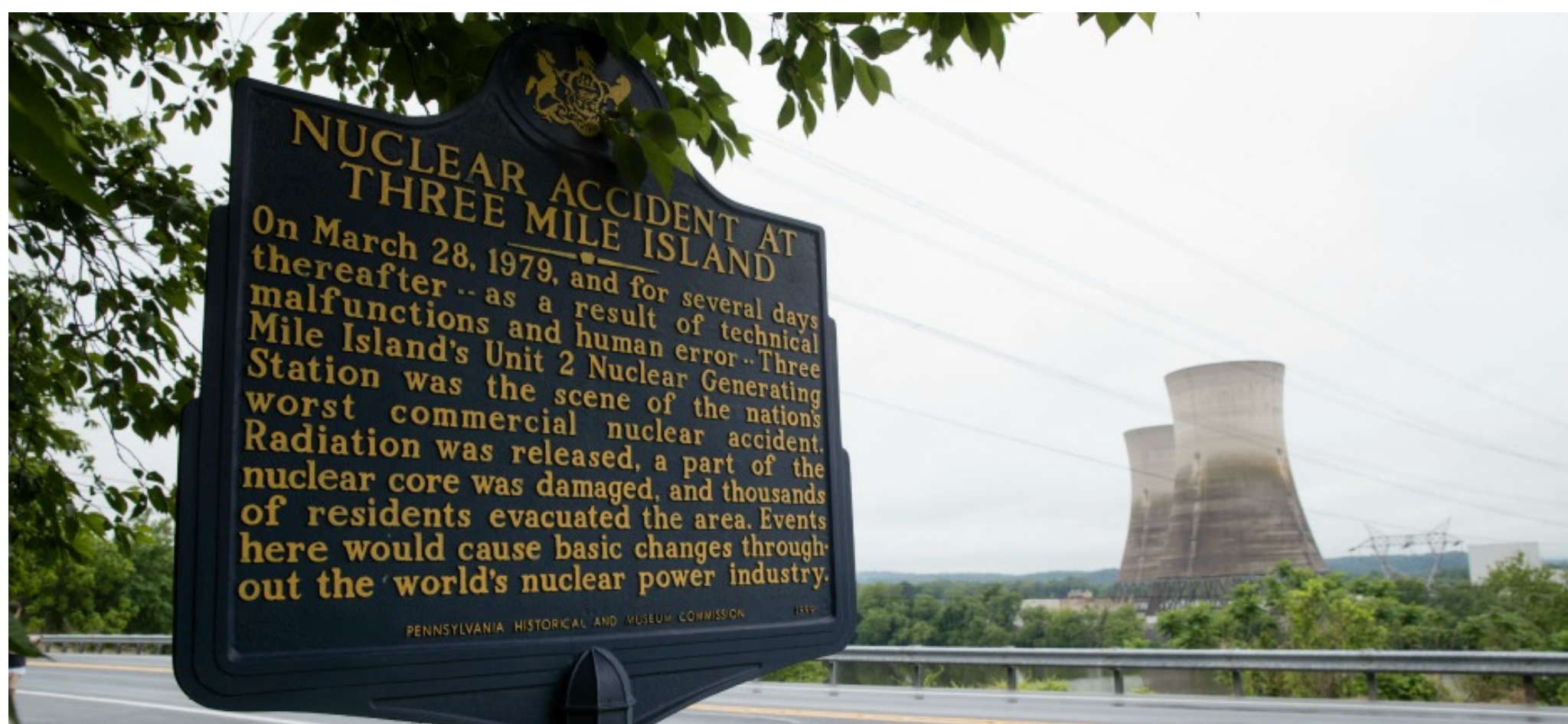
The source of fear and perceived danger was indeed marked by confusion. With the slew of contradictory statements being issued by the government, the NRC, and the media in the days following TMI, the public did not know which way was up. Initially, no one was sure how much radiation had been released or what the exact effects of this unknown amount of radiation would have on the surrounding population. Naturally, people responded to this uncertain threat of danger with fear, and many fled the area.

Since TMI the NRC, the U.S. Department of Energy, the Environmental Protection Agency, and various independent organizations have done countless studies on TMI. They came to the nearly unanimous conclusion, “the approximately 2 million people around TMI-2 during the accident are estimated to have received an average radiation dose of only about 1 millirem above the usual background dose. To put this into context, exposure from a chest X-ray is about 6 millirem” (U.S. NRC). Despite the insignificantly low amount of radiation released by the accident, TMI was not easily forgotten by the American people. Cleanup from the accident lasted nearly 14 years, and officially ended in 1993. Cleanup involved dismantling the Unit 2 reactor that had caused the accident, removing and disposing of the nuclear waste that was in the reactor, and decontaminating the immediate environment around the site of the accident, and cost the United States hundreds of millions of dollars (U.S. NRC). In 1985, the undamaged Unit 1 reactor, which had not been involved in the accident, but which had been shut down shortly after TMI, was restarted and began operating normally again (Houts et al. 85). The long-term cleanup and the controversial restarting of the Unit 1 reactor at TMI meant that the accident never really left the limelight, and “many residents in the vicinity of Three Mile Island perceived a continuing threat association with the reactor, even after the crisis was declared over” (Houts et al. 67).

In conclusion, the United States’ most “devastating” nuclear power plant accident did not significantly injure or kill anyone and had almost no observable effect on the surrounding environment. Despite nuclear power’s practically spotless record of producing reliable and clean energy in our country, we have decided to reject the technology on the grounds that it is “not safe,” a sentiment rooted in the confusing aftermath of TMI. Instead, we continue to rely on fossil fuels to supply our growing energy demands, despite the overwhelming evidence that they are causing irreversible damage to our climate and that their pollution is linked to widespread human health concerns. Today, fossil fuels supply 80-85% of energy produced worldwide, and sustainable alternatives are desperately needed.



Currently, the best option for an alternative power source is nuclear power. It has a high energy density compared to other alternative energy sources, is a reliable source of energy that can be produced 24/7, and it generates relatively negligible amounts of pollutants (Brook and Bradshaw). Currently, nuclear energy meets about 20% of the U.S.'s electricity demands, though it can supply much more if we let it. Looking back on the Three Mile Island accident, our fears of nuclear meltdowns and radiation are unwarranted, especially given nuclear power's incredible safety track record in the U.S. We must give nuclear energy a second chance if we want to transition away from our fossil fuel dependency and combat climate change.



*Image Source: AP Photo/Matt Rourke)*

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This article was written by our Editor-in-chief Lydia Schaecher.

She is an undergraduate student at the University of Notre Dame and has been a member of our organization since January, 2020.



# Interview



## Prof. Don Howard

Prof. Don Howard is the former director and a Fellow of the University of Notre Dame's Reilly Center for Science, Technology, and values, where he now functions as co-director of the center's ethics of emerging technologies focus area. He has also recently been appointed as an affiliate of Notre Dame's new technology ethics center, NDTEC. He is a Professor in the Department of Philosophy.



*Have you always been a supporter of Nuclear Energy?*

**Don:** For the better part of my life, yes. I do remember being a little rattled back at the time of Three Mile Island, when I was in graduate school, or just had finished graduate school. But even back then, I think I had the sort of clear-headed detachment that it took to understand that, while it was a worrisome accident, in fact, there was only a minimal release of radiation. There was literally no harm to the environment or human well-being, or anything like that. So, yes, I've been convinced, from a long time ago, that if we build and maintain our reactors in a responsible way, that this is an environmentally-friendly way to make energy on a mass scale. And I've long been puzzled by the ever-greater public anxiety about nuclear energy, which in part, I think just reflects the failure to understand the technology. But speaking for myself, from an early age, I've been a real fan of nuclear energy.

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*The USA is the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity. However, for the last 30 years, there has been no growth in the nuclear energy sector, and coal and natural gas still take turns dominating the electricity market. Why do you think that is the case?*

**Don:** Just a moment ago, I alluded to the effect of Three Mile Island on shaping American public opinion, and then especially the Chernobyl accident in 1986 really caused a lot of fear among Americans. It's at that point that the growth of nuclear energy really came to a halt in the United States. But, as I have written recently in an article I did for Notre Dame's brand new Journal on Emerging Technologies, I think even the reaction to Chernobyl reflects a lot of misinformation and serious misimpressions about the seriousness of the accident. So, yes, it was a horrible accident by any measure, and it's a tragedy that 54 people died as a result of the accident, that there may be additional cancers and leukemias in the population, but of course all that pales by comparison to the literally millions and millions of people who have died and who have been sickened globally by burning coal and natural gas and other heavily-polluting sources of energy. So, the real question to me is not 'Is this the right way to go or not?' The real question to me is 'How do you communicate responsibly and clearly to a public that is spooked by the prospective risks of nuclear energy?' I think the media have got a lot to learn with responsible reporting of these things. Take the example of Fukushima, where literally no one died as a result of the accident. Some people died as a result of the hasty and perhaps ill-advised evacuation that was ordered within like 48 hours of the accident. But whenever I talk with people about the Fukushima accident, they virtually all don't know that no one died. They have this impression that lots of people were sickened and killed by the accident. And how did that happen? I think the media shares a large part of the blame for that. It should be possible to report simple facts. Nobody died...actually, let me modify that. In the official record, there is one death that has been officially attributed to the Fukushima accident. This is a technician that was involved in the cleanup, but if you dig more deeply into the story there, this is a guy who did get cancer, did die, but all the competent medical opinion says that this had absolutely nothing to do with his exposure during the cleanup. And the Japanese government decided to list this as a reactor-related death, or accident-related death, only so as to make it possible for his family to get the government pensions that were available, and they didn't want to stir up public controversy by refusing to provide the pension. So, in order to be able to provide the pension, they had to list his death as being related to the accident, when it in fact was not.



*The United States does not have any concrete policy regarding disposal or reprocessing of spent fuel? Why do you think the Government is not considering investing in reprocessing nuclear waste (like France) especially after the technical know-how mastered since the Manhattan project?*

**Don:** There are a lot of issues involved here. For one thing, reprocessing might not be the most responsible way of dealing with nuclear waste. I mean, yes countries like France have invested heavily in that, but France is now drawing down its reprocessing capability and instead is building a deep underground permanent disposal site, as Sweden and Finland have done cooperatively, and as we started to do at Yucca mountain. And I think people have come to realize that deep underground permanent storage is the far more reasonable way of dealing with nuclear waste. So that's partly what's going on there. It's just that opinion has changed about how best to deal with this. Now, that might change if we are successful at bringing online a sufficient number of Gen-4 reactors like the molten salt reactors, because they can eat spent fuel from conventional pressurized heavy water reactors. So that's not quite reprocessing in the way in which it was originally envisioned, but it is the re-use of that material before what's left is eventually sent to permanent underground storage. So, I think that's the main issue. Of course, as with everything having to do with nuclear, there is the NIMBY problem, the "Not In My Back Yard" problem. If you're going to build a reprocessing facility, you've got to put it somewhere, and people are so freaked out about nuclear stuff that they don't want a reprocessing facility to be built anywhere near them. And so politically it's a challenge to find a site. But I think really it's more of the former, that is, this seemed thirty years ago to be the technology of choice, but I think that it doesn't appear to be that anymore.

***So, the real question to me is not 'Is this the right way to go or not?' The real question to me is 'How do you communicate responsibly and clearly to a public that is spooked by the prospective risks of nuclear energy?'***

*Would you also say the reprocessing raises concerns about proliferation? Is that why we aren't investing in reprocessing?*

**Don:** Well, it depends on what kind of fuel we're reprocessing. Some have greater risks of proliferation, of fissile materials getting into the wrong hands, for some kinds of reprocessed fuel. But then that's also an issue with reactor design in the first place. If you're going to build breeder reactors, then you're producing plutonium that can be stolen and fall into the hands of terrorists. So, don't build breeder reactors, right? There are other designs that are out there. But, for me, that's not really the major concern; it's just questions of economics, of the inherent safety of the process, and so on and so forth. And, again, I think what the world community has concluded, is that deep underground permanent storage is the more sensible way to go. As we do, by the way, with the WIPP [Waste Isolation Pilot Plant] facility where we bury all of our waste from our own nuclear weapons program. That's sort of a fiction, that we don't have deep underground storage in the U.S. We do. We've got this massive facility. We just don't have it for waste from civilian nuclear reactors.

***I have firmly believed for a long time that green nuclear is the quickest and most reliable route to a carbon-free energy economy.***



*Regarding your recent paper that was published in the first edition of the Notre Dame Journal of Technology Ethics, the title of the paper starts with 'The Moral Imperative ..', did you want to imply that the resistance to adopt nuclear energy arises mostly due to one's standard of behavior or belief instead of being a technical challenge?*

**Don:** Well, it certainly is a technical challenge but the question of how we save a dying planet is a moral question. So I was quite serious in putting those words in the title of the paper. I do think that it is a moral imperative and I think we have an obligation to ourselves, to our children, to future generations, to people all around the world, to non-human organisms. We have different degrees of moral obligations to all these different constituencies. We have moral obligations to the entire planet and everything that lives on the planet and to do our best to make this a habitable and happy abode for human and other life. So no, I'm really very serious about this that it is not just a policy issue and that it is a deeper kind of moral obligation .

***We have moral obligations to the entire planet and everything that lives on the planet and to do our best to make this a habitable and happy abode for human and other life.***

*Within the United States what do you think is the biggest challenge to nuclear power support?*

**Don:** First, it's changing public opinion. We need a concerted campaign of education about what are the real risks and what are the real benefits, what are the causes and so forth. Secondly, we face a huge political challenge. In fact, I think the political challenge is the bigger of the two problems here right now and this is demonstrated in a new way more clearly by the way in which the Yucca mountains deep storage facility has become a political flip flop. We were moving ahead at a rapid pace to bring that facility online in the mid-2000s and what happened was that we elected Obama -- and I'm a huge Obama fan -- but I was shocked and appalled when literally his first executive order after taking office was to cancel the Yucca Mountain project leaving us with no safe secure long-term storage option for nuclear waste. For all that I'm not a Trump fan, I was cheered that he seemed to indicate more than a year ago that he was going to back the reopening of the Yucca Mountain facility, and you may have seen the news just a week or so ago that he has changed course. He has now come out in opposition to it. Why? Because he knows that he faces a difficult election in Nevada and he thinks that by saying no to Yucca Mountain that's going to improve his chances of winning the battle. I think it is tragic that we make science and technology policy in such a politicized way in the United States. But anyway, these are the two biggest problems - public education and getting the politics out of nuclear energy.

*Does increased support for nuclear power start with politicians, scientists or the public?*

**Don:** It could come from all three sources. I think what we really need is a scientific and technical leadership for this. I wish that there were more clearly heard voices in the science and engineering community who were not so much agitating but just advocating in a responsible and professional way for this as the one reliable way to a carbon-free energy economy by 2060, which is our deadline if we are going to stay below that 2 degree threshold so yes I would like to see the technical community step up to the plate and help to move along the public discussion of this.

*This interview was done on February 26, 2020 by Nirupama Sensharma, Lydia Schaecher and Max Nguyen.*



## Find out more about us as an organization

**Nuclear Energy - The Better Energy** is committed to providing accurate information about nuclear energy to the general public. General discussions about nuclear energy are typically rife with misinformation and unfounded prejudices. The public lacks a trustworthy, objective, and clear source of information about nuclear energy. Nuclear Energy – The Better Energy aims to be this source, and to bridge the information gap between scientists and the general public. The world is in dire need of an alternative to polluting fossil fuels that contribute to climate change, and nuclear power is the best available energy source. Nuclear Energy – The Better Energy wants to help people make well-informed and educated decisions about nuclear power that could eventually help save the world. The members of our organization represent an international team with a diverse set of backgrounds and education who support nuclear energy.

## Meet our team

**Nirupama Sensharma** is our Founder and Content Writer. She is a Physics PhD candidate at the University of Notre Dame and works in the Experimental Nuclear Physics division.

**Lydia Schaecher** is the Editor-in-chief of our magazine and is a senior undergraduate Environmental Sciences student at the University of Notre Dame.

**Max Nguyen** is our Editor and Head of Marketing and is a Masters student in Global Affairs at the University of Notre Dame.

**Hrafn Traustason** is one of our Content Writers and is a PhD candidate in Actinide Chemistry at the University of Notre Dame.

**Sara Gilson** is one of our Content Writers and is a PhD candidate in Actinide Chemistry at the University of Notre Dame.

**Prince Rautiyal** is one of our international collaborators. He is a PhD student in the field of radioactive waste management at Sheffield Hallam University with a background in Physics and Nuclear Engineering.

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