

# **Oral History Interview Transcript**

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Institution: University of Chicago

Student Name: Eric Fang

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My name: Eric Fang  
Interviewee Name: Yixing Sung  
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No translations required.

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Eric Fang 0:12  
Hello, thank you for the time.

Yixing Sung 0:21  
Sure.

Eric Fang 0:23  
Yeah so for context. This interview is going towards a project that I'm doing for a class I'm taking called energy in civilizations, which covers, energy use throughout history pretty much. And the purpose of this interview is to document people's experiences with energy over time. So this interview will be recorded, if you don't mind. And the transcript will be used for my project, but also it will be saved by the University of Chicago just as a record. And you can refuse to answer any question that I ask if you choose to do so. Is that okay with you?

Yixing Sung 1:13  
I understand.

Eric Fang 1:14  
Great. So do you mind if I started recording the interview now? Great. Okay. Just for the record, would you mind saying your first and last name for the record and how you spell that name?

Yixing Sung 1:30  
Okay. Yeah. My name is Yixing song. First Name Yixing. It is spelled as Y I X I N G. Last name Sung. S U N G.

Eric Fang 1:41  
Okay. Great. And just to note for the recording, we're calling at noon on Sunday, May fifth over the phone. Okay, I'm going to the questions now. Would you mind talking about your current occupation? Like, where do you currently work? What do you do? And how long have you been working at this in this role?

Speaker 1 2:01

Okay, yeah, currently, I'm an engineer working at Westinghouse electrical company in Pittsburgh. I have been in this position for more than 35 years. My job is working with energy related field, in particular, I'm working on a nuclear fuel design and application in nuclear power plants.

Eric Fang 2:27

Okay, great. And how long have you been working in this role?

Yixing Sung 2:36

I've been with Westinghouse for more than 35 years. I have been in this industry, almost for 38 and close to 40 years already.

Eric Fang 2:49

Gotcha. And have you always had the engineer position throughout your entire 35 years? Or has that position changed over time?

Yixing Sung 2:57

No, pretty much the same. I did change job once. I used to work at in Texas when I started my career. And then after that, I moved to Pittsburgh working for Westinghouse for 35 years now. I've been working in this field ever since then.

Eric Fang 3:16

Okay. And do you work on like, specific, a specific nuclear power plant? Or do you kind of like move across multiple power plants?

Yixing Sung 3:25

Yeah, our company designs nuclear fuel products for nuclear power plants. It's not necessarily associated with one particular plant. We are a reactor fuel vendor that supplies fuels to US plants, and also for overseas plants as well. And mainly in these plants are Western designed nuclear reactors, but we are also involved with reactor fuels for other reactor designs.

Eric Fang 3:54

Okay, so you've worked on the reactor designs for nuclear power plants?

Yixing Sung 3:58

Yeah. Yeah.

Eric Fang 4:03

Did you say nuclear fuel or nuclear reactors?

Yixing Sung 4:06

Yeah. Well reactor consists of nuclear fuel assemblage.

Eric Fang 4:14

Okay. Nuclear fuel assembly.

Yixing Sung 4:15

Nuclear fuel is part of the reactor. Yeah, nuclear fuel is part of reactor components.

Eric Fang 4:21

Okay. So you mentioned working in the nuclear industry for about 35 or so years. What inspired you to join or to enter that field in the first place?

Yixing Sung 4:36

When I was in school, I was interested in studying engineering. And then looking at the potential engineering fields, I realized that my interests were mainly associated with the power and energy generation. That is, at that time, what I was interested in and I chose that as my major and my field of study.

Eric Fang 5:09

Okay. And back then how popular was that career path among engineers to go into nuclear engineering?

Yixing Sung 5:22

Actually, at the time my decision to go into nuclear engineering was not at the time when nuclear engineering was very popular. When I decided to study nuclear engineering in school, it was the early 1980s That was right after a nuclear accident that happened in the U.S. at Three Mile Island. So at the time, nuclear energy, nuclear engineering was not very popular at all because of that accident in the U.S. But I decided in the 1980s to keep looking into it because I found it fascinating.

Eric Fang 6:11

Okay, and you're like referring to the Three Mile Island incident, right?

Yixing Sung 6:16

Right. It was a nuclear accident that actually happened in Pennsylvania, not too far from Pittsburgh. Fortunately, no one died in an accident. But it was an accident that was major news at the time.

Eric Fang 6:42

Okay, so this happened before you went to engineering school? Is that right?

Yixing Sung 6:47

That's right. This happened in 1979 I think. The Three Mile Island accident.

Eric Fang 6:56

Okay, and you were saying that a lot of people chose not to go into the nuclear field because of that accident, but you did anyways, do you mind talking about why you chose that?

Yixing Sung 7:12

Well I still believed at the time, and I still believe now that we need some new energy source for power generation. And I looked at that time, and I thought that nuclear energy was a new area or new technology for power generation. So I was fascinated at the time, but I didn't quite understand at the time how atomic energy from the atom converted to electrical power generation and a major component that was actually water. Nuclear energy from Atomic power generation, or electricity, does not come directly from atoms. Rather, it goes through the atoms, generating heat, and water is used as a transport medium for energy conversion to steam and then to generate electricity. So, the whole process was interesting for me. So I wondered why water plays such an important role in this energy generation through nuclear power.

Eric Fang 8:38

And back when you were in engineering school still picking out the nuclear engineering field, did you think that the use of nuclear power would look different than it currently is in the modern day? Like, do you think people would use more nuclear energy or less nuclear energy compared to today?

Yixing Sung 8:59

Yeah, at the time, I thought nuclear energy would still be a part of the energy generation because, at the time, there was almost about about 100 nuclear power plants in the US in operation or under construction. I thought, at least for the foreseeable future, nuclear power would still be a part of the energy generation technology, and I did not know, even today, it's hard to predict the future. In regards to how nuclear power generation will grow. But I did believe at that time and I still believe now that nuclear energy will always be a part of the energy generation portfolio.

Eric Fang 9:52

Gotcha. But you thought nuclear energy would be a little bit more of the current mix than it is today. Back then.

Yixing Sung 9:58

Yeah. I knew that nuclear energy would still be a part of the power generation capacity in this country and also worldwide, but I did not know at the time how this involves today. How other energy technologies would emerge up to this day. And quite frankly, it's hard to even predict in the future, how nuclear energy will grow or decline, but it will always be the main part of the energy generation capacity at least in the foreseeable future.

Eric Fang 10:44

The shift in how you thought it would turn out – how much nuclear power is being used in reality in the modern day, what do you think is like the main reason that caused that?

Yixing Sung 10:57

I think one of the driving forces behind nuclear power is that it meets society's needs for electricity. Okay, and that still is a major driving force back then, now, and into the future. And you can see more and more technologies, today that can generate a very large amount of electricity. So from that perspective, nuclear energy will always be there. Because compared to conventional power generation, like oil or coal, nuclear energy offers a much more efficient energy generation. So this is what I remembered, when I study in college. So when it compare different power generators, in order to generate among the same amount of electrical power, you may need a truckload of coal to generate the same amount of energy. But with nuclear power, all you need are very small pellets. Basically it's a small cylinder of uranium metal. So when you compare the volume of the material used for a generation of the same amount of energy between nuclear and coal, it's a big difference. At the time, we did not know, at least I did not know, about green house gas emissions. So right now, there's people concerned about the greenhouse gas effect, and that is a major climate concern. At the time, that was not a major concern, and now it becomes an issue. So we generate electricity with coal or any natural gas, it produces the greenhouse gas effect. And on the other hand, nuclear energy does not cause that kind of climate change.

Eric Fang 13:53

Gotcha. Yeah. I guess like, in the past few decades, we've seen a pretty big rise in power generation sources, like natural gas, for example, and not so large of an increase for nuclear power. What do you think is driving the increases in other generation sources, as opposed to nuclear power the past few decades?

Yixing Sung 14:19

Yeah, several factors. One is the economic cost. Right now, using natural gas to generate electrical power is very cheap, cheaper than nuclear. Nuclear cost is not necessarily about the fuel. It's power plant construction that is very costly. That's one thing that affects that nuclear power generation growth. The other thing is the public's perception about nuclear power. People always worry about nuclear power having radiation issues or that it is radioactive. When you

hear the word nuclear, people often think about nuclear weapons, the atomic bomb, or about accidents that happen, like Three Mile Island. Since Three Mile Island, there was another nuclear accident that happened in Russia in 1986 with a different reactor design and led to a major disaster in Europe. Several years later, there was another nuclear accident that happened in Japan at Fukushima. So these accidents do happen, but these accidents, so far, have not really caused major issues. They do have some effects on the environment and the local environment. It also may have a major effect on the public perception about nuclear power. The other issue that nuclear power plant has is where the nuclear power plant should keep its waste. When you use nuclear materials to generate electricity and after nuclear reactions, it generates nuclear waste. It is not a big amount, but that amount is there and could last thousands of years. So how do you treat that and how do you manage that kind of nuclear waste? It's something needs to be addressed through public policy or through technology. The nuclear power growth is really affected by three things. Its cost, the public perception about its safety, and also dealing with nuclear waste.

Eric Fang 17:47

Okay, great. Thank you. And taking a deep dive into the two situations that you mentioned, Chernobyl and Fukushima. Do you remember where you were or what point of your life you were in when you heard about those accidents? What was your personal reaction to those accidents, as well as what you thought the general industry's reaction was to it?

Yixing Sung 18:09

Yeah, that's a good question. Three Mile Island happened before I went into nuclear engineering study. Chernobyl happened when I was in school, actually, when I was in graduate school at Berkeley. I remember when this accident happened, it caused major concerns, and we also discussed this a lot at school at the time. But in our perception, first of all, it happened in Europe. Back then it was the Soviet Union and by the way, it was actually located in Ukraine, but it was part of the Soviet Union at the time. And our conclusion at the time was that it was a different design. It was a Russian designed reactor and there were some issues with its design. The actual cause was from personnel errors as well. They were doing an experiment, and then the experiment went terribly wrong which caused that. So it affected people and it affected me when I was in school. I remember some students after that quit the major and transferred to something else, but I stayed with the belief that that was a different design reactor and that would not happen with reactors designed by the US in the western world. So, that's what happened in Chernobyl. Now Fukushima happened in 2012 back in Japan. The Fukushima accident actually also happened due to a reactor design, different from the one I worked on and the company I work with, which is Westinghouse. The Fukushima reactor design was based on the General Electric design, so it's a different reactor type. So far, of all the Western designed reactors, there has not been any accidents. Three Mile Island happened, yes, but that design was also a different design from back then, a BMW design. Chernobyl was a Russian design and Fukushima was a

General Electric design. So after these accidents happen, the government and the companies do a lot of investigations and evaluations.

But it's really a different design than the ones my company are working on. In fact, the Fukushima design actually put a stop hard on the nuclear renaissance. Before Fukushima, there was a major initiative going on in the US, or in the world for that matter, to build new nuclear power plants because people realized that we need the power and nuclear power source would be a good way to generate more electric power. But after Fukushima, they basically put a stop on new plant construction in the US and also in Japan. These people were not planning for that anymore. The only place that actually had more new nuclear power plants built is actually in China or now in India. In the US, we have a couple more plants being built after Fukushima, but mainly, the new plants are all built in Asia right now. So the Fukushima accident did affect the US nuclear power plant construction.

Eric Fang 23:27

And did it affect your personal work at all after the Fukushima incident?

Yixing Sung 23:33

It changed some of the working focus at the time. Right before Fukushima, we had actually designed new reactors. We built new reactors in Westinghouse, with a new electrical AP 1000 best pilot plant, General Electric, 1000 electrical and megawatt electricity in nuclear power. So, we were actively involved in that and also designed other reactors. But after Fukushima, all of the new power plants everywhere had been slowed down. In the US, we planned maybe 10 more of those types of plants. But right now, only two plants were competed. The rest of the plants were canceled or put on hold.

It affected my personal business and our work focus after Fukushima. Instead of working on new plants or new reactor designs, we focused more on operating plants solution for fuel supply. There are still roughly in the US about 100 nuclear power plants in operation right now.

The number of plants compared to the number 20 years ago was less, but still around 100. But there were a lot more plants being built worldwide in Asia. So, we focused more on those plants being built and their products and services after Fukushima, but now it's changing again. In recent years, we're seeing more and more people are interested in new plant designs. Now, this just happened in the last two or three years. After Fukushima, there was about 10 years where no new plans were consumed initially in the US. But now, more and more people are interested in reactor designs.

Eric Fang 26:15



So you mentioned that there's more interest in nuclear power in Asia compared to in a lot of Western company countries? Like why do you think that there's more? Like, why do you think that that that is like, Why do you think there's more interest in nuclear power in Asian countries compared to Western countries right now?

Yixing Sung 26:31

Yeah, several reasons. One main reason is nuclear power plants use unique parts built in Asia, particularly in China or India, because these countries economies are growing, so they innovate. Their economic growths are much faster with the help of the world like the US or Europe. When they have their economy upgraded and the people's lives changed for the better, they need a lot more power. Nuclear power generation is certainly one of the options they considered. And because recently, more and more people are concerned about the greenhouse effect or climate issues. Actually, nuclear power will help these issues when you have a more power plants. So that's the nature factor, their economic growth and also environmental effects. The other thing is they have better control over construction costs than in the US. Governments there tend to have better control over the budget in the construction costs.

Eric Fang 28:05

And as Westinghouse involved in any of these, like Asian reactor construction projects, yes,

Yixing Sung 28:12

Yes we are. We actually helped China to build two power plants in the last 10 years. We don't have any plants. Well, we had two plants being built in the US at the time.

But China was building more than 10 and Westinghouse provided support. And actually technology transfer flip to the first two plants built over there. And since then, they can build their own plants using Westinghouse's technology.

Eric Fang 28:47

And like what's like your personal involvement with a lot of these, like Asian construction projects.

Yixing Sung 28:54

I was involved in the beginning when we tried to build the first two plants. I provided technical support training over there, and in fact, I went to China a couple of times for that for a few years.

I was involved early on. But now, there's not that much involvement anymore. And part of that is due to

geopolitical situation. China and the US are not in a good relationship like before.

Eric Fang 29:49

Okay, so the geopolitical situation has reduced how much Westinghouse can do business with China on nuclear power plants. Is that what you're saying?

Yixing Sung 29:57

Yeah that's a factor that we considered. We still have business in China, but it's more of a restriction.

Eric Fang 30:11

Over the years that you've worked with Westinghouse, the 35 years you mentioned, how has the nature of your work changed? How was the reactors you've designed changed? How has the technology that you use changed?

Yixing Sung 30:26

I started working as an engineer and then move on to more and more senior positions. Technology changes, as we see, other than the nuclear design concepts.

At least in Westinghouse, design did not change much in the details. Technologies are changing more and more starting from the original design in analog systems to digital innovations. They require a lot more computer modeling simulation technologies, recently more towards artificial intelligence, big data analysis, and machine learning technologies. The nuclear design, at least the power generation console, did not change much, but the technology is a new model.

Eric Fang 31:45

Gotcha. How does this technology influence your personal work? Do you have to incorporate all of these and learn all these technologies? Or did they kind of support you as you do your traditional work?

Yixing Sung 31:56

We definitely have to keep up with the technology development. The computing power chain doesn't work and so, the work we do versus the people original work fifty years ago or forty years ago are quite different. These changing technologies, we first have to understand, follow, adapt, and then apply. A lot of these computer advancements are not original to Westinghouse. You can find it anywhere from Cicinnati or to other continents. Westinghouse understands we should use technology advances such as computer languages, all the software and hardware, and then tried to find a way to tie them to nuclear power plants design. That's part of my job.

Eric Fang 32:07

Do you have any specific memories or projects that you've worked on with Westinghouse that you want to share?

Yixing Sung 33:22  
Particular projects?

Eric Fang 33:24  
Yeah, that kind of stand out to you in your memory?

Yixing Sung 33:43  
One example is we were actually involved in designing or supporting Russia's design. We're also involved in supporting a few designs to other plants designs overseas. One good example is actually we designed a fuel for the Russian reactors. So Westinghouse was involved in the Russia fuel design for the Russian market even back in the early 90s for the plants in the Czech Republic. That was the first time we're involved in that the design of a nuclear fuel power plant for Russian reactors. Russian reactor was the one of the first pump in Russia that did kind of work. That was more than 30 years ago. And then work slowed down in that area, not because of Russia or the global supply, the fuel supply in the Czech Republic after a while. But now, in the last several years, it became a major business for Westinghouse to redesign or resupply the fuel. Not only to the plants in the Czech Republic but now, to supply the fuel to Ukraine. Many other plants are actually outside Russia now, because the war situation there. Those 100 days were interesting. Use of power generation sometimes involves geopolitical factors into power generation does not only affect the general power, but it also depends. Businesses will be affected by the country's relationship.

Eric Fang 36:08  
Gotcha. That's great. Going back to when you first graduated from engineering school, and you were choosing where to work afterwards, like, why did you choose? Why did you land on like Westinghouse as your ultimate choice? And why have you stayed for so long at Westinghouse?

Yixing Sung 36:36  
When I graduated from school, my first job we actually was in Texas where I worked for Texas Utilities. Actually, at the time we were trying to finish off the nuclear power plants under construction. So my first job started working for Texas Utilities company and worked on the plant being built near completion. Then Westinghouse had job openings, and I was really interested in applying for that job.

At the time, why I chose Westinghouse was because Westinghouse was a major developer and designer of the reactors worldwide. Look at it right now. Of the nuclear power plants built in the world, at least one-third or half of the nuclear power plants in the world were based on the

Westinghouse technology. I thought I wanted to work for a company like that was the best in the nuclear field and this is a company that I work for because they were original designer of the nuclear power plant, and they have the expertise or experience something I can really learn from. That's why I decided to join the Westinghouse. Every time my hiring manager told me "If you join Westinghouse, you will see more opportunities for growth as compared to just working for a company in Texas with two plants there. And he was right so I joined Westinghouse for so many different causes for plants in the US, Asia, and Europe. So because we have more opportunities to grow and I enjoy it.

Eric Fang 39:13

Okay, that's great. And just to clarify, what utility did you work at in Texas?

Yixing Sung 39:19

For the time it's called a Texas Utilities and Electric. It's headquartered in Dallas, Texas. The company name may have changed. Basically, in Texas there are two major big power companies. One is Houston Power Light. They generate electricity for the Houston area. This company, they should provide the power electrical supplies for the Dallas area.

Eric Fang 39:59

Gotcha. Do you mind saying the name of that company one more time, please. I didn't really catch that.

Yixing Sung 40:07

In the 1980's, the company's name called TU Electric also called Texas Utilities. That was their name.

Eric Fang 40:26

Gotcha. Okay. Thank you. You mentioned a few times in this call about the role of like geopolitics in energy and energy generation, like nuclear energy generation. I'm hoping to write about this in my paper. Do you mind both recapping and expanding on what you've previously said about the role of geopolitics in nuclear power? And if you can expand it all upon that, that would be great as well.

Yixing Sung 41:06

In our business, we work on two things that could affect more than either geopolitical situations, country relationships, or international relationships. One is power generation. Any power generation for any country is a major capital investment because that's part of the infrastructure design. That usually will involve government decisions on where to build a power plant, how much electricity to generate, and what type of power generation technology to use. The second thing related to our business is power generation using nuclear power technology and that's also

in a way sensitive. Part of that is because of misconception. People think about nuclear power generation and they all think that it's also related to nuclear weapon design or construction. The two really are quite different. But still, when you hear the word nuclear, a lot of people just think, "Oh, this is something related to nuclear weapons design, or nuclear weapon technology." For these reasons, a lot of nuclear related technology is subject to government export control. So these two things come into play. And now our company is more or less affected by international relationships or political situation.

Eric Fang 43:20

Do you mind recapping for me, the situation with the Czech Republic. Why did that kind of business tune down a little bit because of geopolitics?

Yixing Sung 43:34

First of all, we started business to design the fuel part for the Russian nuclear reactors. That was our mission in the early 90s because the Soviet Union was breaking up. A lot of Eastern countries, which used to be under the Soviet block, became more independent. At the time, there was the Czech Republic and they had two nuclear power plants ruled by the Russians, also the Soviet Union back then. But they had become more independent and they were looking for some suppliers outside the Soviet Union. They were looking at Westinghouse as a potential fuel supplier as basically as a divestment. Basically, we want to build a more independent fuel supply other than Russia. But that was how Westinghouse got involved, in the Czech Republic, helping them to finish off the fuel plant. We also would provide a fuel supply for those plants. But after several years, the Russians came back because they were not happy. This is a time that was more geopolitical situation and was more business. They were not happy to lose the business, have a few things in the checkbook, part of it was Westinghouse, just a company. We designed and offered an advanced fuel power that reaches our new demand from Czech Republic. It was competitive. And we offered that, not necessarily a better technology power, but they offer a power with a much cheaper price. As a result, the Czech customers at the time decided to switch fuel back to the Russian design. They actually instead of buying fuel from Westinghouse, they went back to the Russian to get it. They also had a cheaper price, so that was a business decision and it was mainly because of the costs, the price. But then, the war in Ukraine broke out and now the Czech stopped using and buying fuel from Russia. Then, they looked back to Westinghouse. We were the only one who could supply the fuel to them. They asked Westinghouse to basically come back and provide the fuel to them.

Westinghouse not only had to provide fuel to the Czech Republic, but also provide fuel to other Russian-designed reactors we used in Europe. So we supplied fuel to the plants and that was their main operation in Ukraine. They had a war there, but they also had the nuclear power plants in operation to generate electricity. And those plants, although they were designed by the Russians, Ukraine was buying fuel from Westinghouse. We also supply the fuel with Bulgaria to

Slovenia. So basically, many countries outside Russia right now use Russian reactors, but get fuel from Westinghouse.

Eric Fang 48:17

Great. Thank you. You mentioned the fear that a lot of countries have of nuclear power, like proliferating nuclear weapons. How valid do you think that concern is that nuclear energy is a generation source might lead to or help in the development of nuclear weapons in the future?

Yixing Sung 48:45

That's actually is a misconception. The technology used for nuclear power generation is quite different from the technology used to produce nuclear weapons. The materials are different and also the hardware design are quite different. If you want to differentiate nuclear fuel for power plants versus nuclear materials or weapons, the big difference is the enrichment of uranium. The nuclear weapon we know uses high enrichment uranium as a material for explosions. The uranium that causes fission or explosions is isotope 235. In nature, there is a very low concentration of uranium material. It also needs the enrichment process. Anytime you build a nuclear weapon, you basically need enrichment or make man-made plutonium material. In a nuclear power plant, we don't require that kind of higher enrichment. In particular, nuclear power plants use nuclear fuel with limited enrichment of uranium-235 to less than 5%. For weapons, you will need at least 95%. So, the material is quite different and whatever is in nuclear fuel for nuclear power plants cannot be used for nuclear weapons.

Eric Fang 51:09

To respond to that, I was reading about the situation with India and their development of nuclear weapons several decades ago. It seems like the general consensus is that they used research nuclear reactors for energy to develop their nuclear weapons. Do you have any thoughts about that and how to prevent that possibility in the future?

Yixing Sung 51:39

Yeah, that's a good question. Producing weapon-grade material is not from nuclear power plants, but is from the research lab. Research reactors are quite different. Research reactors have two different designs and their designs are quite different from nuclear power plant designs. So from research reactors, you could produce another atom called plutonium and plutonium can also be used for bombs. But, you know, the research reactors are still quite different compared to the power reactors that generate electricity.

Eric Fang 52:29

So, you see a difference between energy nuclear reactors and research reactors.

Yixing Sung 52:36

Yes, quite different designs. The other thing is nuclear power reactors are subject to heavy regulation. In the US, there is a federal agency specially designed to monitor and supervise power plant construction called the Nuclear Regulatory Commission (NRC). Apparently designs, concepts, technology, and materials are also subject to government regulation.

Eric Fang 53:17

Okay, so you don't see a risk of proliferation with energy nuclear reactors.

Yixing Sung 53:26

Nuclear reactor technology is used quite differently from weapons. Those things have no direct relationship, but someone they could in theory could make fuel for power plants. Like I said before, easily request enrichment slightly at higher hydrogen bonds are five asset. But if someone keeps running those enrichment plants, they can see higher concentrations of uranium. And then you could make nuclear weapons. So the facility isn't there, but if you make changes to the original facility, you could attain weapons. But you have to make nuclear design changes.

Eric Fang 54:29

My last few questions are "Do you mind giving me a timeline of your personal life? What year did you come to the US? What years did you go to school, for example, undergraduate and graduate school with specific years if possible?"

Yixing Sung 54:48

Okay. I was born in China and came to the US in 1980. Then, I went to school with both my undergraduate and graduate schools in the US. I got my B.S. degree in nuclear engineering in 1984 from University of Missouri. Then I got my Masters degree in nuclear engineering at University of California, Berkeley in 1986 and I started working in 1987.

Eric Fang 55:35

Gotcha. Okay.

Yixing Sung 55:38

I was in the Ph.D. program at UC Berkeley, but I did not finish off my PhD. This is part of that job. This study was affected by the Chernobyl accident and the Three Mile Island accident which used nuclear fuel. Research funding got less and less. I was in the PhD program and my professor wanted me to find research funding to support that. And that was the time I chose to go to industry to gain some experiences, get some knowledge, and then come back to finish my degree. I never returned to school after that.

Eric Fang 56:47

Is there a reason why you did not return to the Ph. D. program?

Yixing Sung 56:51

Once you start work, it becomes challenging and you get more involved. Also once I had a family, I didn't have the energy or desire to go back to school anymore.

Eric Fang 57:20

My last question is, if you remember your time in China before coming to the US, what did the energy usage of China back then look like? How is it compared to modern day China?

Yixing Sung 57:41

Most power generation in China at the time was generated by coal power plants or hydro power. When I left China in 1980, there was only one nuclear power plant reactor in China. That was actually for experimental purposes. Okay, they built that first reactor to study how to generate electricity. So that was in the 1980s. And then right now if we looked at China, China is the country that has the most new reactors under construction right now. So the total nuclear power generation capacity may not be matched up with the U.S. yet, but in the next few years, they will catch up.

Eric Fang 58:59

Gotcha. Great. That was all the questions that I had. Thank you so much for your time and for the answers. This was really helpful.

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Eric Fang 0:00

I am calling Yixing Sung for a follow-up interview at 12 pm Central Time on Sunday, May 19. I wanted to follow up our previous conversation by taking a deeper dive into how nuclear accidents such as Three Mile Island, Chernobyl, and Fukushima affected you as well as those around you. So going in order, would you mind speaking about where you were when you first heard about the Three Mile Island accident and what your reaction was and what the people around you's reaction was?

Yixing Sung 0:21

When Three Mile Island happened, I was just beginning my undergraduate school, so I was not working in industry yet. It happened before I chose my undergraduate major at the time. So, of the students I knew and that I talked to, they were concerned about nuclear accidents and using nuclear power in the future. This is a time that affected some people in choosing nuclear engineering as a major. I did notice that the schools and a lot of universities at the time offered nuclear engineering as a major. And since then, some schools have shut down their



nuclear engineering program or they merged their nuclear engineering with some other departments at the time and that was in the early 1980s.

Eric Fang 1:19

Okay, so you chose the major three years after the accident happened?

Yixing Sung 1:36

Right.

Eric Fang 1:37

But you mentioned that some of your friends were also considering nuclear engineering for a major but chose not to. Is that right?

Yixing Sung 1:42

Right. Yeah. Some of them, I remember, actually went into petroleum engineering. Because, at the time, at least in my school, nuclear engineering and petroleum engineering both offer similar credit transfers at the time.

Eric Fang 2:12

Okay. And I guess that means your friends were more hopeful about petroleum as a future compared to nuclear energy?

Yixing Sung 2:20

Yeah, petroleum is one of the highest paying engineering field and mainly is the pay, the job prospects, and mainly for us, it was the course credits. If we transfer to other engineering majors like electrical engineering, it may take us another year to graduate because they need to take more classes. So for both nuclear and petroleum engineering at the time they offered for most of our credit classes to be transferred. So it takes us less time to graduate.

Eric Fang 3:10

Gotcha. And I guess like of your friends that you had, what proportion stayed in nuclear energy versus went to a different field?

Yixing Sung 3:22

Yeah, what's interesting is that when I graduated from the University of Missouri, in 1984, in our graduation ceremony, something was interesting to me. When I had my graduation, and they announced the people graduating from the mechanical engineering department, about 200 to 300 hundred people graduated from that field. For electrical engineering, about 500 or something graduate. And it was similar for civil and chemical engineering. These are pretty big programs, and a lot of students graduate. But when they announced nuclear, there were only about seven of

us. For petroleum engineering at the time, I think it was more, like about 30 or 40. So just based on the sizes of the graduating classes, you can see that nuclear was one of the smallest.

Eric Fang 4:25

Do you think do you think a Three Mile Island did not happen? That graduating class would be bigger?

Yixing Sung 4:32

Oh, yeah, at the time in the 1970s, nuclear power plants went through a pretty rapid expansion. In the US there's not only a lot of plants that had been built but many many more plants had been ordered, so are under construction or are being planned for constructions. So after Three Mile Island, most of those plants that were planned, or were under construction, were cancelled. So that was a big impact on the nuclear power industry in the US. I remember a lot of the plants were being cancelled, some of them were almost near completion, but they decided not to pursue that.

Eric Fang 5:29

And would you happen to know how big the nuclear engineering graduating class was before the accident happened?

Yixing Sung 5:39

The graduating class in the 70s, probably I would say in the U.S., I looked at the statistics at the time, maybe about over 1,000 and then in the early 80s, it went down to maybe 400 in the whole country.

Eric Fang 5:58

And would you say that the biggest reason for that is the Three Mile Island accident?

Yixing Sung 6:03

That's a major impact. Yeah, at the time. Yeah. The other thing of course was that a lot of plants were closing down because of the accident, which affects future job prospects.

Eric Fang 6:19

So a lot of your friends chose not to pursue nuclear engineering, but you still did. Can you talk more about why you chose that?

Yixing Sung 6:29

I just believe at the time that not only the U.S. but the whole world needs power generation and nuclear power generation, in my mind at the time, I thought would be a viable option. ways. So, I believed nuclear power could have played a role in the country's energy structure.

Eric Fang 7:11

And how did your friends or family like react to you choosing nuclear engineering as a field?

Yixing Sung 7:16

They had concerns but they also respected my decision. Some people had concerns and others were still interested in this pretty high tech industry that they still associated with atomic physics.

Eric Fang 7:50

And just to clarify the timeline, so what What years were you in undergraduate school again?

Yixing Sung 7:57

I started school in the US in 1980 and then graduated in 1984.

Eric Fang 8:06

That was at the University of Missouri, right?

Yixing Sung 8:08

Yeah well, when I first came to the U.S., my first two years was spent at Arkansas, at Harding University, and then I transferred to University of Missouri for engineering.

Eric Fang 9:12

What were people saying about nuclear energy after the accident happened? Were they more distrustful of nuclear energy as a whole?

Yixing Sung 9:21

That's the general public perception because they think nuclear engineering or nuclear power at the time is too dangerous.

Eric Fang 9:36

Gotcha. Did you'd like to hear that sentiment from like any of your friends or family?

Yixing Sung 9:43

Some some.

Eric Fang 9:48

Okay. Great. And I guess like moving on to Chernobyl now, which happened in 1986. So can you talk about what phase of your life you were in when that accident happened and what your reaction was, as well as what the people around you's reaction was?

Yixing Sung 10:13

Yeah that was a time when the Chernobyl accident happened was time when I was in graduate school. So when the accident happened, the whole department was concerned about it. So we looked at it but the general consensus was that this is a an accident that happened in the Soviet Union. And that was a different reactor design. It's completely different from the plants built in the U.S. So it's a really different type of plant design and different accident scenario. So we did look into the accident, the consequences, and also the cause of the accident. That was something that we talked about on my campus, but it generally did not have a huge affect on the students nor on the department. People were concerned about nuclear accidents but they also realized this is a different type of reactor design and a different type of accident.

Eric Fang 11:34

So did you see any of your graduate school friends, dropping out of school or changing what they were studying because of Chernobyl did you?

Yixing Sung 11:41

No, but it did influence whether or not people chose to continue to go on to the PhD program. I do remember some of my friends, including myself actually, say "no we're not really going to pursue further study in research or a PhD." Part of that is not necessarily because of the Chernobly accident, but indirectly because of a lack of funding. The research funding was not sufficient at the time in the 1980s. That may be more of a carry over impact from the Three Mile Island accident, but the added impact of the Chernobyl accident certainly did not help. But that is an indirect effect.

Eric Fang 12:34

Yeah. So was funding actually like reduced after Chernobyl or was there just not enough funding to begin with?

Yixing Sung 12:43

Not enough funding to begin with already. And then after Chernobly there was even less funding for pursuing any new nuclear reactor designs or anything in the U.S. in the late 1980s.

Eric Fang 13:10

So you mentioned that you don't think the people around you and yourself were afraid of an accident like Chernobyl happening in the U.S. because the reactor design was different, right?

Yixing Sung 13:22

Right. We studied in detail about what happened at Chernobyl and we looked at the cause of the accident. And the conclusion was that that was a different design and that wouldn't happen in the U.S.

Eric Fang 13:40

Okay, so that's like you and other graduate school students and the people in the department right? How do you think people in the public reacted? Do you think they were less confident about that not happening in the U.S.?

Yixing Sung 13:59

In general, the public, if I remember correctly, the public had some concerns about the Chernobyl accident, but the concern was more about the situation in Europe. People were monitoring the situation in Europe. They were looking at the radiation level, not only in the surrounding areas of Chernobyl, but there was also some radiation level increase in Sweden, Norway, and other neighboring countries. And that caused a concern in Europe more than in the U.S.

Eric Fang 14:49

So people weren't that concerned about an accident happening in the U.S. with nuclear reactors?

Yixing Sung 14:54

I think at that time, the nuclear industry quickly declared that this is an accident unique to the designs of the Soviet Union or Russia.

Eric Fang 15:16

Okay, and you don't like see, like any scenario or something similar could happen in the U.S. at that time.

No, not like in the Chernobyl accident. That was a different design.

Yixing Sung 15:36

What's interesting to point out is, and this is what I learned after I started work, the nuclear industry has always had a pretty good quality assurance program. So anytime accidents like Three Mile Island or Chernobyl happens, the whole industry takes lessons and learns by looking at the root cause and then trying to understand what improvements need to be made. For example, after Three Mile Island, there was actually a big change in the infrastructure of the nuclear industry. So after Three Mile Island, there was a government agency change, new regulations, and after Chernobyl, also the same thing happens. New regulatory changes. That happened even though that is not an accident that could happen in the U.S., but it does drive the industry to look into some areas for improvement.

Eric Fang 16:54

Yeah. And after Three Mile Island, you mentioned that a lot of energy companies had plans to build nuclear power plants that were cancelled. Did you see like a similar thing happening after Chernobyl?

Yixing Sung 17:13

No, Chernobyl did not have a direct impact, a huge impact, on the nuclear industry in the U.S.

Eric Fang 17:22

Okay and after Three Mile Island, did you see a recovery of those projects cancelled? Were there more being announced later on?

No. In terms of new plants orders, those things would never recover from the Three Mile Island accident. What is happening in industry is that there is more regulatory changes or more improvements with operating plants safely.

Okay great, so that was Chernobyl and that happened when you were in graduate school. The last one is Fukushima, which happened in 2011 and that was when you were working at Westinghouse already. Right? So can you talk about your reaction to that and the people around you's reaction to that?

Yixing Sung 18:45

Yeah, that one was interesting. It is more recent, and it also has a pretty significant impact on the industry again. Right before Fukushima, which happened in 2011, the power industry was actually going through a so-called renaissance period. Starting in the early 2000s, the country realized that we needed more power generation. Okay, so the nuclear power seemed like a pretty attractive option. So most companies are interested in putting nuclear power into their power generation portfolios. So operating the plants went through so-called power upgrades. So this is the latest improvements and new analysis to increase the power output of those operating plants. And there was also new plants being considered under construction in the U.S. Okay, so that's a period of time actually before 2011, which started maybe after the year 2000. This period was called a nuclear nuclear renaissance. So then came Fukushima. And that's an accident that happened in Japan. The accident happened in Japan. The reactor design is actually designed different from the one that Westinghouse, the company that I'm working for, uses. These are two types of designs. The one designed in Japan was actually by General Electric. Okay, it's another different design. That accident happened, but that does have a big impact for everyone in the industry, including for plants in the US. Okay, and then afterwards, there's a slowing down again in nuclear power plant ordering and planning.

Eric Fang 21:03

And during the nuclear renaissance that you mentioned, what drove the demand for nuclear power as opposed to other generation sources? Was that stigma from Three Mile Island disappearing?

Yixing Sung 21:19

When I was in college, at the time, nuclear power, as compared to other power generation options, the others, whether it be with coal, oil, natural gas, solar, wind, hydro, all of power generation technologies have some advantages and disadvantages. Nuclear power, being one of them, it requires less fuel supply because the energy generated from nuclear fuel is much more efficient than using power generated from coal or oil or natural gas. So people are looking into nuclear power again, mainly because of economic considerations. And in terms of safety, after Three Mile Island, the public general perception is that the industry has maybe done something, improvements, and they haven't heard about anything happening in the last 30 or 40 years. So safety was not a significant concern or major concern as it was before. People focused more on the power generation needs and nuclear power seemed to be a viable option.

Eric Fang 23:26

Okay, and what was the people in Westinghouse's reaction like? Your coworkers' reaction to the accident happening?

Yixing Sung 23:34

Yeah, this happened and the first thing is we want to know what's going on. And so we had some Westinghouse people involved in looking into the accident. Its mitigations as well as its consequences. So we actually had to send people to Japan to monitor the situation and help the Japanese utilities to understand what happened and for us to investigate what's going on. So that's the first immediate actions is to just look at what happened in the accident and how do we deal with it and how do we get the situation stabilized? And then the second part is, which Westinghouse also looked into, is is there something that we can learn from that accident? And which will help us improve our design. Okay, so that's a lot of things that we were looking at even though it was a different design, but there are lessons to be learned.

Eric Fang 24:47

And like what was like your personal reaction when you heard the news?

Yixing Sung 24:50

In general, especially in my workplace, people were concerned about it. My first reaction is "Oh, no, not this again. So what's going on?" Okay, and then we're looked at it and we understand the sequence of events and that it actually happened Japan. First, there's the earthquake, and the tsunami, and basically flooding from the tsunami overran the plant and caused some critical equipment failures. So that made us really look at Westinghouse Plans. So, if we have a natural

disaster happen, like earthquakes or flooding, what would be the impact? This does have an impact on our new reactor design at the time. We had to make some design modifications to try to accommodate that kind of a natural disaster scenario.

Eric Fang 26:08

Okay, and were changes made. from what you saw, to improve safety and natural disaster safety?

Yixing Sung 26:16

Yeah. There were a lot of changes.

Eric Fang 26:20

Okay and at the time, did you see similar scenario as Fukushima playing out in the U.S.?

Yixing Sung 26:30

Yeah, so in the U.S., there are plants with a similar design to the Fukushima plant because it was designed by General Electric. So those plants were taking extra precautions, but even the plants with a different design, like Westinghouse plants also looked at possible scenarios, like what happens if a plant experienced a natural disaster. So we looked several plants sitting near the Mississippi River. There were some concerns about what happens if there is flooding, so we looked at what measures need to be taken, like levies, to make sure flooding does not affect the plant.

Eric Fang 27:47

Okay great. And you describe a similar public reaction to Fukushima and Three Mile Island where people stop supporting or have more stigma for nuclear power after these accidents happen, right?

Yixing Sung 28:01

Right. Yeah. What happened after Three Mile Island, I don't know because I wasn't working in industry. But generally I can see the aftermath of these accidents and that some things have been done, improvements are being made. So they're similar in terms of the actions taken. Mainly just the industry wants to learn lessons from those accidents and wants to make improvements.

Eric Fang 28:39

And do you think the nuclear industry has recovered post Fukushima?

Yixing Sung 28:49

Not fully recovered. The challenge today is nuclear power is again on the rise. New plants are being built, particularly in Asia, in China and also in the U.S. Westinghouse just finished two unit construction in Georgia. Okay, this new plants being built to start to operate. And these are



new plants that are new plants that are being built and operated after Three Mile Island. After 40 years these are the first new plants being ordered, constructed, and completed and now in operation. Even though in the U.S. we have these two new plants being built, but there are many more new plants being built in Asia or the Middle East or other countries. So nuclear power is on the rise again, and the challenge is not unnecessary right now related to safety. Because safety, we have pretty good regulations, and programs to address that. The challenge here is the cost. Nuclear power plant generation construction costs, right now is a pretty high. So it requires a lot of capital investment to build a new plant. Part of the reason is it can deal with what caused previous accidents. Because after each accident happened, we have lessons learned, and we make improvements, and those improvements add a cost to the plan construction and operation. So these regulations always have some impact on the new plants being constructed or being ordered because they add a cost

Eric Fang 31:09

One quick clarification from way earlier in the call, you mentioned people switching from nuclear engineering to petroleum engineering after Three Mile Island. Was that switch specific to your school? Or was that a common thing across the entire industry that you saw?

Yixing Sung 31:31

A change your from a nuclear engineer to petroleum engineering maybe that's something unique to the engineering school that I went to because not many schools in the U.S. offer petroleum engineering as a major. But in general, for other people that previously considered nuclear engineering, they may move to mechanical engineering, electrical engineering. Those are natural choices.

Eric Fang 32:04

Okay, last thing on a high level, with all these accidents in mind and the reactions to them...

Yixing Sung 32:11

I just remembered something that I want to mention. When I said nuclear renaissance, in the early 2000s before Fukushima, at the time, nuclear engineering educational programs were also expanding in the universities. So at the time we saw more and more students wenrolled in nuclear engineering during that period. And then enrollment dropped after Fukushima accident. Okay, and now it's on the rise again, although it's maybe slower.

Eric Fang 33:02

Okay. Yeah. So I guess like going back to my previous question, after all three of these accidents, it seems like you never like lost faith in nuclear power as a whole but some of your colleagues and friends might have throughout undergraduate or graduate school, what kept you so steadfast in your support for nuclear power as opposed to other people that were around you?

Yixing Sung 33:28

It's just a high level belief that the country and the world needs power. Particularly these days, you can see that we're going to need more and more electrical power to support information technology or IT or these things. So that's a general trend. I mean, that's something that will be there in the near future or in the foreseeable future. Okay, so this is something I believe but it is also believed by others. And you can look at future power generation needs. Nuclear power definitely is one of the options. I'm not saying all the future plants are going to be done by nuclear, but nuclear power definitely is an option. And that's a belief shared by many others. If you look at all the high tech company executives, like Microsoft and Bill Gates, or Amazon and Jeff Besos, or the Chat GPT chairman, they all invest in nuclear power company. Some of them have actually started their own companies looking at nuclear power generation. So that gives an indication that those guys that work in the high tech industry, information technology, they know that power generation is something definitely needed in the future. And nuclear power is definitely one of the options. So having said that, what nuclear power generation or construction company or operating company do you want to work with? That's another thing to look at. Because right now there are so many options and different nuclear power generation technologies that are being developed in different companies. So that's a bit of a challenge for people to select which company to work for, or which nuclear technology would represent the future.

Eric Fang 36:30

And I think last question, after all three of these accidents, you see a lot of very strong reactions from both the public and governments, like regulatory agencies, would you describe those reactions as over-reactions at all? Or did they result in good changes in the industry in your mind?

Yixing Sung 36:51

It's a mix. Some of those actions are needed and necessary. Some maybe over legislation. That's possible.

Eric Fang 37:01

Okay, I guess like what do you see as an example of an overreaction or overregulation as opposed to good changes that have come from these accidents.

Yixing Sung 37:12

Well, the negative impacts of over regulation is the cost. You drive up the for nuclear power construction or operating. And the concern is that if the costs are so high that would make that nuclear power generation option to be not considered feasible anymore. That's the challenge facing the industry. In the meantime, everyone understands in the industry that safety is always

the first concern we have to address because you can see that in the past histories, if any nuclear accident happened, that will affect industry in general. So there's a saying here in our industry: "If any nuclear accident happen anywhere, it basically is a nuclear accident that affects everyone." It doesn't matter if I work for Westinghouse's reactors and Westinghouse reactor design's are pretty safe to operate. Anytime accident happens, Three Mile Island which is not Westinghouse designed, Chernobly, which was Russian, or Fukushima in Japan, which was General Electric designed all these accidents happening will affect Westinghouse business. So that's one thing that everyone understands in the nuclear industry. Safety is the number one concern. And actually what is interesting is that in the nuclear industry, even though we're competitors on different technologies, everyone collaborates and cooperates on the safety measures and the safety improvements.

Eric Fang 39:13

And do you think this safety emphasis was supported or increased because of these accidents happening?

Yixing Sung 39:22

Yeah. We want to make sure we minimize the chance of these accidents happening. And no one can say for sure that you won't have any accidents happening in the future. But there's a way you can minimize that. In many ways the nuclear industry is always compared with the airline industry. They have similar models and probability studies. You know so when you fly, there's always accident chances in the flight and the plane may be involved in an accident but that does not deter most people from flying. Similarly, nuclear power generation could have some hazards, but it is about how safe it is and how likely for accidents to happen. So the first thing is to look at the frequency the accidents. The second thing is in the design. You want to make sure that if any accidents happen, you will not cause any hazard or damage to the public. You basically need to contain anything that happens to avoid any radiation release into the environment. Okay, so these things need to be put done. That's what the safety concern is about. The second thing is nuclear power is always about cost. You can design a reactor to be safe, but at what costs? That's something that the industry has to work on.

Eric Fang 41:28

Okay, great. Well, that's all the questions I had. Thank you again for the time. I think this should be like everything I need. I really appreciate you taking the time to call again.