

## Library Research for Environmental Studies aspects of Uranium Mining and Nuclear Energy - Transcript

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This is one of my favorite topics to talk about. It might seem to some a little bizarre but I have a history of helping people with this Uranium mining and Nuclear energy. And all aspects related to it. Specifically the mineral side of uranium and also the energy side of uranium. So just to start with I'm going to be using the chat to put links in. So, these are the links for the pictures on the page. On this first slide. The first three are from U.S. GS. From one of the web pages that I will show a little more into the presentation. The resources for the U.S. This is what I received here at Princeton and also when I was at USGS. Sometimes people want to see what uranium looks like in its block form. This is an example of uranium ore. People are interested in the uranium -- Series so this is an image most people think it's an APA but if you look at the fine print on the EPA website it comes from -- And it has more information. The sources the world nuclear Association and this is an example of the current and future generation of nuclear power in the world. If you look at the top is the U.S. This is an example from the U.S. energy information vision of the New Jersey -- Generation by source and this is from May of 2020. If you look most of it is nuclear. When I help people here at Princeton they do not necessarily realize they may be using nuclear energy. It brings a bigger discussion of where is nuclear energy and where it is being used and then what it takes to supply the nuclear facilities and also the history of uranium mining and other aspects. Specifically from environmental studies. And so Winston is in the nation service of humanity. Princeton has been -- Since 1884. So when I first started working here I had already been giving many many different presentations through this program. And Princeton said to keep on presenting because as long as there is an interest, there is no trouble in presenting to the public. This style of presenting is a hybrid now. It's a high breast of you is -- Once -- Not necessarily in death or the commercial databases. Most the time I am helping people and they have tried every thing out. This is the first trick. I have given many past webinars. This is the webpage I created for the library guide. And in the library, the ED website and also the USGS patient website. Even my go to instruction, especially if it is policy or line this goes on this slide I do help scientists. I also help her people on campus with nonscientist. They are part of the environmental studies program. Also affiliated with the different loss of finance and other programs on campus. This is something, mostly -- Even though Princeton seems large it is a smaller campus. And student body than larger universities. It doesn't take long for faculty and students to know I knew how to find uranium and nuclear energy type of information rather quickly. And so I hope you can still see my slide. My screen just flickered. So the uranium family. This is something I like to talk about both as a geoscience person and a chemistry librarian. And so these are some of the basic. I will put the link in the chat and then you can kind of follow along if that is your interest. Okay. Starting with uranium 238, we have uranium 238 of course there are other elements, the parent is uranium 238 and the daughter is -- Radium, radon, polonium, -- It has the estimate half-life units and any type of rock or to clay or time sequencing, when I was working at the Denver Federal Center if there is anyone interested in the type of technology, any type of literature with specific to the decay chain and any type of metric dating just let me know. Also the uranium or information. What uranium or looks like. The different variations. Another question I receive overtime is about yellowcake. Yellowcake is used -- And this is a link to this NRC which oversees the processing of yellowcake. This photo is actually from the Grand Canyon trust. I wanted to put this in here because even when I was at USGS and then throughout my entire career, so far here at Princeton, most of the inquiries are about the Grand Canyon and the four corners that I received. Because there is so much uranium naturally occurring but also there is the

history of uranium mining in that area. So this is a link if you're interested in that environmental aspect of the uranium mining history and other type of information. So then in the upper right-hand corner -- And this is the front Range of the Rocky Mountains in Colorado. Denver is not that far away. This is the link I added. It is the link to -- Legacy sites. It doesn't look like this anymore. I did not want to clue a newer picture because they are available. The houses are built up to the site and the buildings that were the site are no longer there. So if anyone is interested in the specific topic I give more information. I think I forgot to mention, back. When I help the first-year class that I am part of, sustainable futures. Whenever I am helping students with the environmental aspect of uranium -- The uranium -- Which is a documentary about the uranium processes mining and milling. The other aspect is -- This is about someone that lives in the neighborhood that was adjacent to Rocky Flats. Here is Rocky Flats in the upper right-hand corner. Another aspect, they basically made plutonium but it's and one reason why the location is where it is is because, and I will get to this in a few slides. One of the largest uranium deposits is across the street in the mountains. Along the front Range. It was a shorter transportation for putting, taking the rock and processing it into the plutonium. Another aspect of plutonium is it's a byproduct of nuclear power. I love talking about this but then it shows, I will not get to it now but this is the overview of what happens in a nuclear reaction. Nuclear facilities. This is an example of a nuclear Jennifer -- And New Jersey. When you have all the waste afterward, after you make the nuclear energy, you have to put it somewhere. At this time there is really a place to put it. Some places stored on site. This goes back to. One of the projects was early on in my career at USGS was the -- Project. The research project for the storage of nuclear waste. So that was actually, the group was in one building over from where I worked when I was in Denver. So I was there librarian for that project for many years before it went away. So I can help. I still help people find that information. So this is me. I am back in the office. I have been here since 2018. Before that I was at the U.S. geological survey for about 23 years. So I actually became a librarian because of the USGS because I was really good at -- And I had fun with it and they recommended that I obtain a Masters in information about library and information studies and then they supported me where I was a hydrologist by day and a library student at night and the weekends. And so a lot of my career is around starting around 1998. I was both, I had one foot each profession. So I was a hydrologist and I was working in library studies. One of the interesting aspects is that, especially when it comes to radio nuclei, there are a lot of projects. I was working on many of them. So this is my, Princeton information but also USGS information and publications. And then this is the one page I use the most about radionuclide life. When I was a hydrologist a lot of -- Not just looking at how much water there is but also the quality. Because I was, I could find things quickly and pull data quickly, because I was more of the information library and hydrologist, I was hired by my colleagues on different projects. A lot of them work involved with the nuclei. So I used to pull data and information sources constantly for my colleagues. They put me on the projects because I could do it quickly. But this is something that most people are not aware of. Even if there is no mining you can still have radium nuclides in your water. Because water is very friendly and water goes to rock all the time. From surface water and groundwater. So when I help people with when I was a hydrologist library at at USGS in Princeton, within the ecosystem, the biosphere in the atmosphere, of uranium and anything in the uranium family throughout these different layers. So this is the one aspect I can do very very quickly. It did not take long. I was put on projects here at Princeton most immediately. I'm helping a lot of researchers here as well on this topic putting some information together for them and helping them with the research needs. I am often referred to as the library, the uranium librarian. I will try and copy and paste this. In Rhode Island I had to learn the radioactive aspects of Rhode Island because there was an event that happened in Grand Junction. I'm sorry, that is in Colorado. You can look at the report. It's professional paper 1571. There was a spill. So I went into the groundwater. My first project in professional report was in the -- So I had to know the ins and outs of everything that was involved in the history of that land. Because it came up at every public presentation I ever did for years and years and years. So that was just something I had to

know off the top of the I was pulled in two other projects that dealt with radio nuclei's or other soil quality and other types of. It's one of those aspects, it just kept going. These are some examples. I will not go into this but there are many publications out there about me talking about uranium in the ground water, surface water, soil air and other information. This is to get you started. To save these upcoming past presentations I have done. So this is a snapshot of what I help people with here at Princeton and also when I was at USGS. My publication -- Kind of shows the basics of where to start and explains the different types of reports he will explain to the audience. Also local state and other information that is available. I will get to that in another slide. I just wanted to go over the research pass if you will. Most scientists want the raw data. So the water is real-time continuous partial record historical. If it is rock it is any type of historical information as well. If it is then that information taken in model is the calculated data so equations software labs the model results. So USGS actually has many many different software products that are, they have created. So when I was there I was an alpha beta tester. So I can figure out a lot of things pretty quickly. There is also the mat data. In some cases it is the output of the calculated data in some cases it is based on the field information. So the last thing that I help people with when they are writing, at least from the science side is the citations to make sure they have everything cited correctly and they include everything. The is the most thorough literature. I know this not because I was just on the products but I hope the scientists and I know it's better than searching or googling. You can actually take a USGS report and it is one of the best sources for that topic especially uranium. Or anything related to the environmental aspect of uranium. So from the other side what I helped the nonscientist with is I show them the publications and then the maps and how they came, how the information came to be through the different calculated data. And then if they are interested, most of the time they are, the raw data. It is kind of two different directions. Most faculty here at Princeton no I came from USGS. So they refer their students to me. Sometimes I have meetings with students on a weekly or biweekly basis. Sometimes it is once a month. And I keep them up-to-date on anything happening. Especially with uranium. Because a lot of policy students for example really keeping up to date on what is happening not just in the U.S. but worldwide when it comes to uranium and nuclear waste and other aspects. So what happens is about 99.9% of the research I received for the environmental aspects of uranium and specifically I answer them with USGS data publication. My colleagues within the library if they are helping a student with any discipline and they get to a point where they realize they need this type of information for where the uranium is located on earth and what is happening from the environmental aspects of uranium and/or nuclear waste, then they say, oh good, Emily, she will help you as she came from USGS and that is where a lot of the information is. And so, so this is the way I have been teaching the research. Because so much of it is great literature. It is so much easier to start at the local level. This is an example of one great lace to start. It is the critical analysis of uranium resources. I will put that in the chat. It has everything in the world. I helped with, when they were preparing this particular location and once it was published I helped people around the world find more information from the information that was in the publication itself. I clipped this. This is an example of the United States. For example in the U.S. the Black Hills has uranium. The front Range of Colorado, which I showed a picture before. The -- Mineral belt, which is that -- Movie the uranium driving. And then the grams district sometimes people call it the grant district Mineral belt. So I help people find mostly this local and state information. On the first slide I have been trying to find something for two weeks and we found it in five minutes. That happens to me all the time especially with uranium because they usually will try to use something like -- Science not realizing most of this type of information, especially for uranium is great literature and it is really only in the government or local NGO type website. And so, this publication, just as a quick FYI that available as a general article and also published as a chapter in a book. Many students are using this as a guide. Sometimes it is mis-cited because it was published in 2009 went online in 2008. So I usually use that as a teaching moment when I am doing -- Construction. And so the best place to go, and there is no good literature that would be

after then. Then this webpage. You can kind of copy it. So, I think I might have the duplicated one. Yet. It is duplicate it again. But that's okay. So it is integrated uranium resource environmental assessment webpage is from USGS. It is from energy. There is a USGS energy group. Which uranium is, the mineral that went from being in the minerals group to the energy group because it was a mineral that became an energy source. And so you will find information in both the mineral side and the energy side. And you have to kind of use both. But this website pretty much if you are looking for uranium or nuclear waste or nuclear energy type of information for anyone on earth, this is the one webpage that will lead you to almost anything. Susan works with everybody around the world and across the U.S. and she does lots of presentations. There is other people that were part of their group that were in the uranium section. I work with them one-on-one quite often. So that is something where officially students are writing a paper or part of their thesis. Most of the publications they need are actually my coworkers that I had when I was in Denver. So it's pretty easy for me to find it. So this is an example from the world nuclear Association of the, the, the, sorry. The mining of uranium. There is the link. Oh. I don't know if that happened. Maybe not. Yeah. I don't know if you can grab that. Sorry about that. But yeah. This is from the world uranium mining production. It has enlisted by the top is the most production of the minds. I could never say this correctly. Because I have a stutter. So I apologize. The first one. And then Canada, Australia, Namibia. So you can see the U.S. is down here. The middle kind of. So when I help people with uranium information and any type of production. The whole envelope of everything it is not just in the U.S. It is most my inquiries actually have everything in addition to the U.S. Canada, Australia, some of the other countries. And it is something I can find very quickly. But also the USGS has a lot of tools already available that are quick links. So I would definitely suggest that. And then the bibliography again is amazing. And so this is the next slide but it looks very similar. This is an example of the most mind country. The USGS mineral data. And I did another example of, in geoscience world so you could see how much information is available. One of the things I did, I don't think these things are working. You can copy and paste them in your browser I think maybe. Eight if you, when I have the students culture finding information, I show them the data. So this is an example of the first link when you go to it. It is actually, the different locations of everything. For anything mineral related to that specific country. And then in geoscience world, this is a group, it's a nonprofit database specific to geosciences. That a lot of, a lot of information, you can see the different research that is happening. Most of it, most geosciences, a lot of it is open access. Because the intent is for people to have access to information as quickly as possible because geosciences, encompasses the environmental aspects of anything better that could happen the rocks were water supply or if there is an earthquake or anything like that. It is kind of an emergency mode profession if you will. So this is another aspect, that got a little, jumbled. Excuse me. The, the geology, sorry, this is the, the image again in 2012. So these are the different uranium areas. This is a -- From Princeton. It is another, there are several overlaps with Princeton and USGS. As I felt quickly. This is an example of the geology -- Southwest quadrant of South Dakota -- For uranium deposits in the southern Black Hills. We don't have this particular PhD available online. We have an in a catalog. So people from Princeton can requested and look at it and I have a copy in my office. It is also, I went through the copy in my office and work word for word the USGS open file report is exactly the same. And so, so one aspect of what people are looking for is, you know, or other companies out there that are looking for, you know, to mine uranium? And what areas do they own? This is an example of, one quota. Where they own 100% of the uranium project and there are technical reports involved in this from the website and then there is also information from the EPA. Everything has to be approved of course because it could essentially be toxic. So one of the things I also show because this comes up quite often is, there, my colleague and I hear a Princeton we do a series of -- And this is an example of what comes up from where we share the same students or faculty that are researching something because they are looking at the financial aspects of the rock or geology information and then the financial side. So this is an example of the uranium production of members. So these are different uranium companies.

If you go to the uranium information, I, so that is the, information for the, uranium producers of America but there is also a lot of, you don't, it doesn't, it doesn't mean that, there are other companies out there. That is another aspect so they can be a different, from a different country and be -- From the U.S. and the U.S. can mine and other countries. So that is a topic from papers and students. I tend to go through from the beginning to the end with a lot of students. So I show them the point of where something is on earth and where they might be processing it. And the more that is going. And then at that point I usually send the students or a faculty member to Mike Coley Bobby and she is the finance library and and she helps with the finance side of things. They also is coming to me I want to know the environmental aspects. One aspect people don't always know if that, even though the information is coming from the APA, if there is a site or if there is a mediation or any of that type of information, most of the time it's a USGS project. So when I was working as a hydrologist I often worked directly or indirectly for the EPA. They had me on speed dial when I was in Rhode Island. So I often had to put together information for them. Likewise when I was in Denver. So this is another aspect that comes up. It has been coming up my entire career. The Navajo nation, there is a history of mining. And so I am going to try to copy and paste this. Okay. I don't think that went well but we will see. I can send a link to anybody directly later. So this is, this is the four corners area here. The -- Mineral belt but Colorado and Utah border. And then this is here in Arizona. And then there is the grant. And then this whole area in blue is actually the Colorado Plateau basin. So this is the hydrology. I don't know about that copy. There is a groundwater -- The -- Reports and hydraulic atlases. This is the Colorado Plateau. So when you're looking at the rock in the mining aspects, and then looking at the groundwater, that's what makes it more complicated. This is the most common question I've received my career. Do you have the Navajo nation in the uranium mines and there is a long legacy of the uranium mining in this area. There are some projects going on. There are different quality information with water and then there is -- Thank you, Ashley. So this is, there is so much you can talk about at this point. Please let me know if you need help or if you know anyone that needs help. 90 in some cases something the Navajo nation during the compliance bill, this is something that everybody needed immediately. That is something that comes out. This area, if you look at the house.gov website for the U.S. Congress, there is always some type of hearing happening with uranium and/or the Navajo nation. In any given year. It is just something that is very much part of the policy world. In other aspects. So this is another effective, information I help people with. This you can find quickly. -- Time today. This is, the image on the left is actually, uranium -- So people don't always realize uranium is in a rock, air, soil. I can provide that information. And then the reports documenting that. And then the raw data. -- This is the chemical database. I have a lot of information about this as well. It was okay so I took the information with me. He scanned a lot of these - - Report so I still have them. If they're looking for this type of report there are hundreds of them. But I have PDFs of them. I think they will be available. I know the USGS provides them whenever anyone inquires as well. Partially informal information. And then there is the historical aspect. So the atomic energy commission works closely with the USGS on these programs which the national uranium research evaluation and then after the settlement but the trace element investigation and the trace element's -- Every time they had a request I did the same thing here. Maybe this will work better. Sorry. There is more information in here than people realize. If you are kind of report in the town or -- And then you drill down and find that information, there is much more available. This system you can search with the amount of data and publications as you can it -- This is the other thing are trying teach other librarians about in the -- Especially if it is related to health because that is one of the things that any former hydrologist concerned about is the health aspect of water and rock. In the year. Speaking of which this is what I was helping with and thankfully professionally trained in how to say it, -- They helped me practice it again and again before I did any public presentations when I was at USGS. The atomic energy company people don't realize it still in the news. These are other updates and information. Most of this is from the website. I said this was something they are still investigating and

sharing everything. When this was published I was part of the information group. So I had a list of information points and then walk people through the raw data. So this is a sample of , this is from -- That happened the dot represents the -- Amounts -- Across see this is where -- We were a little concerned from all aspect. Is the information that the poor people -- What happens with the nuclear energy aspect and what would happen during follow-up. -- The next -- Agency so that may be of interest to someone out there. I think I did a good job this time. I'm pretty excited about it. This is my list of things you might want to read. Just to become more familiar with the information. And so -- Susan's report from 2012. And then I was on the -- Uranium mine further it's an appendix at the end so if you're looking for additional information that's a good report to go to. And knowing the Mineral belt in New Mexico, the northeastern Washington groundwater this is a new publication that just came out. Also this is an example of the things people did by Denver and a characterization of the -- And sediment and Stanley. Jefferson County, Colorado. The top image on the right this is the first button from Rocky Flats 1983. -- There is a whole button archive. I can provide more information if anyone is looking for that. If you're interested in Rocky Flats I highly recommend the full-body burden book. I will give you the Amazon version of it. There is also the link in the library. This cannot 2013 and the reason why I recommended within a week after this was published I received hundreds of questions looking for the references. It's another one that has the good references about the uranium drive and also when I was working in Denver, -- Here is this link. That is what they historically have been doing. It goes into the environmental aspects of both sides. This is definitely a place to start. There was more information on the button's. I also did not included because, I can provide more information. One of the reasons why about Rocky Flats, there was a spill. If you Google Rocky Flats usually you will see the fallout from the event that happened.. It's a history on itself. Ultimately even though nuclear is technically clean, there is another side of it. Things can kind of go bad when they go there here is the environmental aspect. I am happy to help. I have been looking for information. There are summative reports that have been published that it could be a team of librarians across the world. Helping people because there is just so much out there. Anyway. Thank you for attending. I look forward to any questions. We have 10 minutes I believe.? Thank you. Great webinar. If you could put the satisfaction survey in the chat along with the archives we will have most of Emily's past revenue. Please fill out the survey. Any questions for Emily? This was a great webinar. Luckily it's not radioactive.? Yeah. It is plutonium.

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Okay.? Yeah.

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Any questions? I had just a few to throw off. I apologize if you have covered this I remembered archaeologist might be digging in areas where they are also mining uranium. Are there any conflict of health concerns?

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Yeah. I hope people that, it isn't just archaeologist. A lot of people don't realize. That's why I do a lot of these types people might hike with it ambient air may not be healthy. There is a history one of the Rocky Flats is probably the most common one I was helping people with because they made it into a park. A lot of parents did not want the children to go there on school trips. I help people with that all the time.

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I was going to visit a friend in Denver and I was going to take the back way to their house. I realize the road was closed. I was going to drive by Rocky Flats. Someone said they are burning and didn't want someone to get near it is of the radioactivity. I was like oh, that is scary. There was five or six years ago. So to something --

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I don't know there is just natural in the rocks were in the soil. Everyone I worked with at USGS is very aware. But students here, they have been doing fieldwork in the four corners. They always bring the handheld, the -- Cameras with them. There always is when it is off. Something to be aware of because it is not, uranium is actually natural. So it is in the rock and it can be in the water without any mining.. The grants area, if you need more information let me know. I can send that to you. There are a lot of photos. There is a comment in the chat. There are a lot of photos of the different mining companies and historical photo archives with the different regional libraries and also USGS and the Library of Congress. If that is of interest. It's interesting to see the process. One thing I did not include if you googled uranium in the stock market right now, the stock market has gone crazy for uranium. There is another wave of questions I received in the last week for some of those companies. It's definitely

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Any more questions for Emily? I have a recommendation. I see it has been on the -- Campus. The -- About people living in the aftermath of that. If anyone gets a chance to take a look at that, I see was a fenced in and they presented it there.

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Yes.

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That is great. 35 minute documentary.

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Yes.

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You may have mentioned this. Sorry if you didn't. Who has the most, what country has the most uranium in the world? Did you mention that at all?

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As far as naturally?

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Yeah.

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There are two different things. One is, it is in the rock. And then they mine in. So step one is, where the world is it? And step two is, where can you actually mine it?

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I see.

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So that is where I go back to the analysis of students reporting the critical analysis of -- Resources. And also the data, it is mineral resources data. Most recently asked question I received when I was at -- How come there was no -- Data. And it just stands from the mineral resources. There is a whole bunch of information.

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We talked about this I know Bill Gates has been pushing the small reactors -- What is happening as there are different types of nuclear energy that is being developed and available. There are new pellets. There is a new pellet reactor. It is something new that happens. I think it is at Elk Ridge. They're doing the data. I will put it in the chat. One of the stories. The system thing. And then there is also the -- I don't know if you heard China is experimenting with nuclear reactors made out of thorium.

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Made a what?

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Thorium. This is just from five hours ago. Sure is interesting engineering. I'm just googling this. It has been within the science community. It has been big news. This is the news about, China is testing a

thorium reactors. There are different types of, so I, I know the number. They give me a number of how much it will cost -- Uranium research go through the roof. Is when they start to hit that, that timeframe. For that cost. If they can make money on it they will want to minute more.

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It is a mystery. I hate to cut things off. I'm sure we can all talk about this. Thank you for the fantastic webinar. Really terrific. We have formal webinars coming up. If you are interested in cataloging, -- Emily will be doing this -- Thank you. Thank you audience. Come on back to the Academy for more great work. Have a great rest of your day.

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Thank you. [ Event concluded ] [Event Concluded]