



**AMERICAN INSTITUTE OF MINING,  
METALLURGICAL, AND PETROLEUM ENGINEERS**

**ORAL HISTORY PROGRAM**

**Barbara Arnold: Responding to the Call of Service**

## **PREFACE**

The following oral history is the result of recorded interviews with Barbara Arnold conducted by Nikhil Trivedi on May 12<sup>th</sup>, 2022. This interview is part of the AIME Oral History Program.

## **ABSTRACT**

An international trailblazer for woman engineers, Barbara Arnold has taken on multiple arms of service as SME President, Mortar Board National Foundation President, researcher, and entrepreneur. Arnold grew up as a coal miner's daughter in Western Pennsylvania and never left her coal roots behind her. Now a Professor of Practice at the Pennsylvania State University, Arnold returned to her alma mater to teach mining and mineral processing. Following the words of Wayne Gretzky, "You miss 100% of the shots you never take," Arnold began a global business venture and has traveled to six continents, consulting and fulfilling her SME presidential duties. Attending every SME meeting since 1985, Arnold has continued to annually publish papers and grow her network within the coal and mining industry. Arnold's illustrious career would not have been possible if not for her role model and mentor, Frank Aplan.

Readers are asked to bear in mind that they are reading a transcript of the spoken word, rather than written prose. The following transcript has been reviewed, edited, and approved by the narrator.

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## **00:13 Introduction**

Trivedi:

Thank you for listening today. This is a continuation of the AIME Oral History project to capture the history of important members and their industry experience. My name is Nikhil Trivedi. I am pleased to sit down today with Dr. Barbara Arnold, Professor of Practice at The Pennsylvania State University. Barbara has served as SME Foundation President in 2011 and SME President in 2018. She is an honorary member of AIME. It is indeed an honor to interview Barbara and provide our listeners with an insight into an illustrious career of a trailblazing woman engineer who traveled to faraway places but never left her beloved Penn State and the coal industry. Barbara, many thanks to you for taking the time to contribute to our oral history program.

Arnold:

It's my pleasure, Nikhil.

## **01:11 Pennsylvania Roots – Growing Up in Western Pennsylvania as a Coal Miner’s Daughter**

Trivedi:

So, Barbara, you proudly introduce yourself as a coal miner's daughter. Please tell us about your childhood, your parents, your growing up in Western Pennsylvania, and your high school years.

Arnold:

Certainly, I grew up in Western PA, as Nikhil has said, outside a little town called Ford City, Pennsylvania, in Armstrong County, Pennsylvania. Really just a rural area outside of Pittsburgh, so I'm a Pittsburgh Steeler, Penguin, and Pirates fan. And then you add the Penn State thing on top of it, but we'll get to that later, I'm sure. I had two sisters. We grew up in Bethel Township, which is rural to rural Ford City, and Mom and Dad had a small three-bedroom house. Mom and Dad still live there. Dad passed away a couple of years ago, but yeah, Dad was a coal miner. Interestingly, he didn't become a coal miner until I was in, I think, ninth grade.

Penn State had a mine mechanic electrician's program at Elder's Ridge, and so Dad technically is the first Penn State graduate because he graduated from that program – the first Penn State graduate in our family. I remember fondly sitting at the table helping him with his mine electrical circuit homework. I don't know why I sort of just picked it up. I read through the description, and I'm like, yeah, Dad, this is how you do it, and showed him how to do the circuits. Not that I ever needed to do that until I got to college, of course, with electrical class. My grandparents lived next door to us. Grandpap was the one who always said, “Use your brain, use your brain.”

## **03:32 My Penn State Carpool – Finding Chemistry in Mining & Studying Mineral Processing**

Arnold:

But I got into mining because I went to Penn State New Kensington Campus, which [was] half an hour from my house. So [I] commuted, and we had a carpool. Two guys from Ford City and they'd stop and

pick me up in Bethel Township, and we continued on to campus. Well, one of the guys decided that he was going to be a mining engineer, just like his older brother. At the campus, at the time, there was a two-year associate degree program in mining, and they also offered Mining-30, which was the introduction to mining [class]. It was in the evening, wasn't going to break up the carpool, so I took the class.

The faculty member gave essay tests, and of course, I could write, so I'm like, okay. After the class, he's like, "Barb, you need to be a mining engineer." I'm like, okay, well, I had enrolled in the College of Earth and Mineral Sciences anyway because my dad was a coal miner, and my uncle was actually a metallurgist at Allegheny Ludlum at the time. That was not a strange thing for me to think about metallurgy or mining, so I just ended up in mining.

But it was kind of interesting because when I got to University Park as a junior, I was like, okay, there's just not enough chemistry in mining, and the students that I teach now are like, "Chemistry! That's the worst class and –" Sorry, but there's not enough chemistry in mining. So I went to my faculty advisor, Harold Lovell, and I said, "You know, should I go into metallurgy?" It would have taken me an extra term, and he said, "Nope, let me trot you down the hall to the mineral processors." And he trotted me into Pete Luckie's office and is like, "She's one of yours." I'm like, okay. So there I was in the mineral processing option, still graduating in four years. You know, you make your decisions, and I've not made a bad one in that, so that's why mining.

Trivedi:

So one good, very good decision you made was not to break up that carpool. So, we are thankful for that.

Arnold:

That was a big one. Yes. Yes.

#### **06:14 Scholarships & Funded Research – My PhD Thesis with the Electric Power Research Institute**

Trivedi:

Barb, how did you fund your education?

Arnold:

Well, I had scholarships. I was very fortunate at Penn State New Kensington Campus to get one of the large scholarships there. I had been very active in other organizations as a high schooler, so I was class secretary or something like that. Chorus, drill team, all those sorts of things. This was a scholarship/ leadership/service kind of scholarship, and that funded a good portion of my first two years of school because it was for both years. I also had college work-study, and then even at University Park, work-study and scholarships. When I finished with my bachelor's degree, I had no debt.

I did stay for my master's and my PhD. My master's was actually funded by US Steel through their research center. Then my PhD was fully funded through the Electric Power Research Institute [EPRI] and their Coal Cleaning Test Facility, where I did my PhD research. So I came out – I think I had a loan for

\$1200 when I was done. So I was like, okay, this works. I paid it off very quickly.

Trivedi:

And it does work, indeed. Yes.

Arnold:

But you have to be a good student.

Trivedi:

Right. Tell me about your dissertation, your PhD thesis.

Arnold:

My PhD thesis was the rate and residence time in conventional coal froth flotation cells. I had the opportunity to do rate tests with coal. So that's lab scale with the samples that we would collect from commercial-scale plants. I actually, at the test facility, was able to do test work on banks of 1.4 cubic foot cells, so very small ones. I did tons of residence time studies on those with clay, for example, to see what was the residence time distribution of a mineral in the froth cells. We put lignite in to see what the residence time distribution of, essentially, coal particles, that density of material would be. But I could change the air hold up. I could change the flow rate, all of those types of things.

We also had a bank of, I think they were ten cubic foot cells, and so we did tests with those. Then I went to Doverspike Brothers' preparation plant in Dora, Pennsylvania, and we actually blocked off the bank of cells and took samples along those, as well as did the residence time distribution in that. Actually, even post-dissertation, I sort of put that into a mode, I essentially. I mean, you still have to determine the residence time distribution of the cells and the rate of flotation. But once you do that, there's a way to measure or predict the yield and recovery from your lab test to conventional cells.

Trivedi:

Scaling it up.

Arnold:

Scaling it up, yes. So that was very— that was fun. That was fun.

### **10:12 Completing My PhD Dissertation – A 10-Year Stint at the EPRI Coal Cleaning Test Facility**

Trivedi:

Now, right after your PhD, you went into business for yourself.

Arnold:

No, I actually had a ten-year stint at the Electric Power Research Institute's Coal Cleaning Test Facility

first. They hired me before I finished my dissertation. I was on the road to the Dora prep plant with my thesis advisor Dr. Aplan, and I knew at the time that the test facility was going to make me a job offer. I knew that I didn't have my thesis done, so on the way there, I said, "You know, they've made me—they're going to make me an offer to come and work for them full time. What do you think?" He said, "Well, you have to finish your degree. You know, you've got to get the piece of paper. You put in this much time; you've got to get the paper." So I started at the test facility in '87; January of '87, with the promise that I was supposed to have 20% of my time to work on my thesis. Well, one of the other engineers left, and I inherited his projects. A year later, when those projects were finished, I said, I'm taking 20% of my time.

I defended on the hottest June 2<sup>nd</sup> in State College, I swear. It was 1989, a very hot day; the air conditioning that they had just put into the Hosler building decided not to work that day. There I was in my black suit. Dr. Aplan says, "Barb, you know your thesis committee is going to be very hot in that little conference room where you're doing your defense. You better find some beverages." So I'm like finding quarters to go buy pop. Yeah, I'm from Western Pennsylvania; I say pop. I should translate for you, Nikhil, since you're [from] Eastern Pennsylvania [and] say soda.

But [I] put the quarters in the machine and had enough pop for them, and then I'm like, okay, where do I get ice to keep it cold? So at least that sort of kept my mind off actually having to do the defense. But, you know, they put you through all of that. You go stand out in the hall for about a good 20 minutes, and then they come out and say congratulations. But I got the piece of paper. So that initial piece of being at the test facility, plus finishing my dissertation, was kind of an interesting time.

Then I was there for ten years. Did a project on coal handling. Had several symposiums that we put together, "coal blending" – a bunch of different coal cleaning test programs in our 20-ton-per-hour Coal Cleaning Test Facility. Learned a lot about sampling. We also did a coal cleaning simulator with the Department of Energy, so I still have all of those Fortran models somewhere. But who uses Fortran now? So, I have all of those, and it's one of those things that I keep saying, I'm going to pull those out and do something with them. But at some point, now that I'm faculty, maybe I can actually do something about it.

#### **14:15 My Global Business Venture – Inspired by the Words of Wayne Gretzky to Expand My Career**

Arnold:

But then, after ten years, I was approached by a company to start a business doing flowsheets and things for coal companies or for the actual contractors, the construction companies. So I said, okay, well, let me come down, and we'll talk about it. It was along with a former colleague from the test facility, and we went down on a Saturday and talked to them. On Monday morning, I went into my office at – well then it was CQ Inc., we'd done an employee buyout type of thing – went into my office, and I looked up at my bulletin board. I collect little sayings and things. The first thing that I saw was the Wayne Gretzky quote saying, "You miss 100% of the shots you never take." I'm like, okay, I'll do it. But I didn't call them until Wednesday to tell them. So I started my own business and did some consulting for some companies, did some flowsheet design.

A couple of years later, we were approached by Multotec Process Equipment from South Africa to be their US representatives. We went and visited them in South Africa. Signed the papers in India, of all places, at Coal Prep India in 2000. So we signed the papers then, and we were their representatives for

cyclones and spirals. And then, a filter press came along from TH in Spain and CLI Corporation's magnetic separator. We did a bunch of equipment sales. Now, of course, that's up and down and up and down as the industry goes, and some years were better than others. But in about, say, 2018 or '19 now, probably about 2018, Multotec decided that they were going to do all of their equipment sales from their office in Canada – all of their North American sales from there. We had about a year to wind things down.

So we started doing that, and I was approached by the department at Penn State. And another decision. You miss 100% of the shots you never take. So I do joke that now this is my retirement job because all of my— not all, a lot of my college friends and a lot of my high school friends are retired. So I'm like, oh, maybe I'm supposed to do that, but we'll try this.

Trivedi:

We need to thank Wayne Gretzky in many, many ways because it was Wayne Gretzky who made you do the other job and now Penn State.

### **17:39 “Secretary for Life” of the SME Coal Division – Attending Every SME Meeting Since 1985**

Trivedi:

Ever since I've known you, Barbara, I've known you as an entrepreneur, as a businesswoman, and I also know that your business career and your SME activities were kind of intertwined. Your first SME meeting was in 1983, and you have never missed a single SME meeting since 1985. So how did you manage this effective presence at SME and a successful business venture?

Arnold:

Through 1996, I was at the test facility. I was either in grad school and had the opportunity to go to conferences when I was in grad school and gave presentations. Then when I went to the test facility, they told me that as long as I had a project that was going to pay for me to go, I could go. And I made sure that I had projects that wanted papers presented at conferences so I could go. It was very important for me to go to SME. Dr. Aplan, my thesis advisor, introduced all of us to going to the SME conferences. He took Patrice Ackerman and me to the conference in Atlanta in 1983, and then I stayed home for the 1984 one when everybody else went to Los Angeles. I got to hold down the fort, as Dr. Aplan said, I think, and then in '85, we – all the grads, all of Dr. Aplan's grad students – went to New York City for that meeting.

Then we just kept going; I just kept going. So it was the networking. I'd say that was probably the most important thing to me with that, so that's how it ties into the business too. You develop all of these people that you know from SME, from the time that I was going at the test facility, to then, okay, I'm starting a business, I still need to go to SME. Those are the people who will give me connections for equipment sales, for consulting because we were still doing consulting as well. It just sort of intertwined. I was made secretary for life, I guess I'll call it, of the coal division after they decided that Chris Bise should continue on and through the Coal Division chairs. I think I only did that job for two years, but because they knew I was always coming to the conference – Barb will do it. She can do [it]. Okay, fine. But I'm like, okay, two years, they decide that, oh no, we're redoing the bylaws for the Coal Division at the time, and we have this new structure. Barb, you're secretary this year, you're going through the chairs. So by – what did we decide, 2003? I was the chairperson for the Coal Division.



At that time, we had this discussion about changing the name to the coal and energy division. I had to present this to the business meeting on Tuesday because we had to have a vote of the members to make such a change. So we opened it up for discussion, I opened it for discussion, and Bob Murray was in the back of the room, and he says, "Yes, that's what we need to do. We need to be the Coal and Energy Division." And I'm like, okay, I can breathe now because I thought it was going to be very, very contentious, but it was smooth sailing.

A couple of years later, we made sure that we got the Coal Division gavel. At that time, we were doing auctions for our scholarship fund at the luncheons, so that was one of the things that we raffled off. We made sure we got the Coal Division gavel and had that as part of that auction a couple of years later when we remembered we should do that. So, yeah, and I've just always been part of SME now.

### **22:27 SME Foundation Fundraiser Dinners – "The Place to be on Sunday Nights"**

Arnold:

I became SME Foundation President in 2011. That was quite interesting. I followed George Luxbacher, I followed George through the coal and energy division chairs, and he became SME President. I don't remember what year; he's like 2008 or '09 or something like that.

Trivedi:

2008.

Arnold:

2008, okay. I thought it was 2008, and at that time, he was appointing new members to the foundation. And he said to me, "Barb, I need you to be on the foundation board. Will you be the vice president—" or vice chair, whatever we call it, "for the foundation? Then that means—" we do two-year terms, "in four years you'll be the president." I said, "Of course, George. I will do that." Can't say no, so yeah, I did the foundation thing. Actually, Anne Marie was the foundation staff member at the time.

Trivedi:

You mean Anne Marie Estrada?

Arnold:

Estrada, yes. She was the staff member at the time. We had all of these discussions about, well, we need to have these fundraisers, and we need to do a campaign, and we need to do this, and we need to do that. We were talking this up, and Dave Kanagy got wind of this, and he said, "Hold on. We need to do a survey to see if there's actually money out there to really support the foundation." And so I had experience at Penn State doing fundraising.

Trivedi:

I was going to ask you that because I do believe that, you know, you took over the SME Foundation presidency at a very critical time in its history and its little life. What experience did you have

beforehand to do what I believe is a successful job over there?

Arnold:

At Penn State, they started capital campaigns or major campaigns back in the late 90s. I served on the Penn State New Kensington Advisory Board, and as part of that, I served on the campaign committees. So I did that part. Learned how the campaigns are structured, all of those types of things. How to go and make asks, just how people gauge whether people will give funds. So, after that, we've closed the first Penn State campaign and then the second one in a row there. I was the campaign co-chair, with more responsibility for fundraising.

When it came time to become the SME Foundation President, it was like the fundraising piece of it didn't scare me. It's like we needed to push that. So that was fabulous. We were able to then get someone to do the survey for us and started to delineate a plan for a campaign. We were extremely fortunate to get both Rick Whiting and Red Conger to be our campaign chairs, and the rest is history. They did it all; just got it on its way.

We also started having more and more successful foundation dinners. We had had dinners for quite some time, like throughout the 2000s. We had had some dinners, but we needed to start making it an event. I remember after one or two of them; I don't know if it was when I was chair or when I was president of the foundation, or maybe like the next year or something like that. I'm standing with Anne Marie at one of the dinners and looking out over the crowd, and we're like, oh my gosh, I think we've arrived. And then we hear one of the wives of one of the members say, "This is the place to be on Sunday nights." I'm like, I think we made it. So it has become the place to be at SME on Sunday nights. We just have a fabulous time on Sundays with that. Have a really nice program, have an event afterward. It's become very successful.

### **27:31 Penn State Mortar Board – "The Privilege of Service to Our Alma Mater."**

Trivedi:

What I'm taking away from this conversation, and we've just begun, is that thanks to Wayne Gretzky, first of all. But secondly, SME or any professional society of that type gives you a tremendous networking opportunity. We all talk about it. You are the prime example of how you did that because that was part of your business outreach as well, and the second thing that I learned from you is volunteering. Seems like you say, "Well, Barbara was there, and Barb took over." But Barb was there to volunteer, and that's just an amazing attribute that you have, Barb.

Arnold:

Well, the volunteering, I don't know where it started, but I was recognized as a Mortar Board when I was in Penn State at the Archousai chapter. I'll have to throw that in. We have odd names for the Mortar Board chapters, some of them. Stayed involved when I was in graduate school, in the alumni group, and got a phone call: do I want to be a Section Coordinator? Well, Mortar Board is scholarship, leadership, and service; and the service piece, technically, is more related to service to your university, to your profession, and whatever. That service piece of Mortar Board is one of the things that I just always go back to. One of the lines in one of our songs is "the privilege of service to our alma mater, dear." And, you know, if I'm asked to serve, I go back to that. It's like, yeah, it's service. It's what you do. I've never

cared about the recognition pieces of that, but it's like, that's what I do.

I'm fortunate that I've been able to serve Mortar Board nationally. I've had huge role models within the Mortar Board organization. When I came on, a woman named Dottie Moser was president, and then Cathy Randall, Kay MacKenzie, Dottie Phillips, and Mabel Freeman. Those were the presidents right before me. Some of them have lived exceptional lives of service, and they're part of my role models for the scholarship, leadership, and service aspects of what I try to do. I've got tons of other role models as well. I think for the leadership, for the service, scholarship sort of just comes along. But, Mortar Board has sort of buffered all of that. I mean, I've been to, I guess, every national conference of Mortar Board, except for when I had my knee done the one summer.

Trivedi:

That's excuse enough, I think.

Arnold:

It's one of those other long-serving things for me, and now I'm actually serving as the Mortar Board National Foundation President. So that fundraising piece is still part of what I'm doing with that arm of service.

### **31:23 Role Models of Scholarship & Leadership – My High School Teachers & the Penn State Faculty**

Trivedi:

You know, you just mentioned role models, but you often mention people who have played a role in your life. Do you want to mention a few?

Arnold:

Oh, absolutely. You know, you can go back to high school and some of the high school faculty. Karl Troth was our senior honors English teacher. He taught us how to write. I thank him to this day that he made sure that we knew how to write a proper paragraph and a proper essay because I wouldn't be in mining if I hadn't known how to write that essay back in Mining-30. But I was able to place out of three credits of English at Penn State without even taking a test because of Karl Troth. So, I actually wrote him a thank you note and said, "This was fabulous. Thank you so much." Music – Kathy Valasek was our choir director. So, it was just that type of support for other activities that were so important. I mean, there's tons of different high school faculty.

But then you get to Penn State, and at the time, we had a huge presence in mining. Bob Stefanko passed away when I was a junior, as did Chuck Manula. So, I never had them for class, but their names are on plaques in the building. So, when I see those, I'm like, yeah. I know who that is. But then Dr. Ramani, still a mentor today on the mining side of things as well as the SME side of things. He actually, back in 1994, tapped me for the Strategic Plan Committee that SME was doing at the time. I joke that it was because I ticked off two of the diversity boxes.

I was young, and I was female. So, yes. "She's a good committee member. She gives us diversity." But if I hadn't had that introduction to some of the leadership within SME, I probably would not have been as in

tune. When Chris Bise knew that he was going to start moving through the chairs, Chris was at Penn State at the time. He said, "Barb, you're always here at these meetings; you can be secretary." So that's how that happened. It's those faculty in mining, but then it's all the mineral processing faculty as well. We had a huge cohort of faculty that were fabulous in mineral processing at the time. Dick Hogg, Len Austin, Pete Luckie, and then, of course, my thesis advisor, Frank Aplan.

It's kind of interesting when I look back at the time, you know, I've never really given it a thought that "Oh yeah, she's a woman in mining or she's a woman in mineral processing." It was just happening because [of] Dr. Aplan himself. I was one of three female grad students at the time. So, it's like, who cares if we're female? We're doing the research. We're doing the projects. It just didn't matter if we were male or female because, actually, some of the male graduate students didn't do any work. But that's another story for another— They would come in and put their coats on their chairs and never show up. So, we would joke about that. It was this huge team in mineral processing at the time, and they brought in Dr. Chander later. I had Osseo-Asare for hydromet. I mean, he's a hydromet Guru, I guess, would be the right name for him. And you know, it's just part of that culture then, at the time, that those were fabulous role models.

### **36:13 My Mentor in Everything – A Daughter of Aplan, A Great Granddaughter of Gaudin**

Arnold:

Dr. Aplan especially, I mean, taking everybody under his wing, introducing us to SME, and always being there for us for any support that we needed as we went forward. Though I probably should tell the story about Dr. Aplan when he contracted leukemia. I think '84 or '85. He went into the hospital, I think, over a weekend. Then he just didn't come in for a couple of days, and we're like, okay, what's going on? He calls us into the hospital and tells us what's going on, all of us around his bed. So he goes around the room and says, "Well, you're almost finished with your thesis. You'll work with Doctor Hogg to get that finished." Da da da da da. You do this; you work with so-and-so, and you're almost done. He comes to me and does this [sign of the cross with hands]. Dr. Aplan's Catholic, and I am too, so I knew what he meant. Because I was on my way to the test facility, he didn't know what to expect. I didn't know what to expect. So it's like, go with God, Barb. When he came back after all of his treatments, I was the first one he called to his house. And I'm like, okay? Is this going to be all right? How's it going to be? He just wanted to know; how did it go? Because I had been at the test facility for several months and started to do research there. It was just it was very special being his student.

The interesting piece of all of this, though, is some people have always asked, "Well, aren't you a descendant of Gaudin?" And those of you out there who are mineral processors know that Professor Gaudin was up there with Professor Richards and such in mineral processing. I said, "Oh, no, no. Dr. Aplan's advisor was not Professor Gaudin." Well, I wrote up – we had a tribute to Dr. Aplan at the SME annual meeting, two sessions in his memory. He passed away in the fall of 2020, and we had these two sessions, and I wrote a preface. We also did a special issue of Mining, Metallurgy, and Exploration. We did that special issue, and in the preface, I talked about this story.

I said, "No, we're not descendants of Gaudin," essentially. Well, Dr. Fuerstenau, D.W. Fuerstenau, sends me an email and says, "Barb, let me explain. You know that Dr. Aplan's thesis advisor –" Well, Dr. Fuerstenau went on and on about how things were done at MIT at the time because both he and Dr. Aplan were at MIT about the same time. He was already becoming an assistant professor. Dr. Fuerstenau was there when Dr. Aplan came into the graduate program for his doctorate. And he said,

"You know, Gaudin wasn't really taking new students at the time—" Dr. Fuerstenau had worked with Gaudin. But Phil DeBruyn was starting to do some research on certain things. I knew that Phil DeBruyn was Dr. Aplan's thesis advisor. I actually have a soft-bound copy of Dr. Aplan's thesis in all the books that he gave me. I swear, it smells of mercaptans. He did mercaptans in gold.

I'm like, this thing smells. But he explained, "Oh, no, no, Dr. Phil DeBruyn was one of Gaudin's students. So, yes, you are a great-granddaughter of Gaudin." So, there I am at the conference back in Salt Lake, back in February, telling everybody. I said to B.K. Parekh, "Did you know that we're descendants of Gaudin?" He said, "No, I didn't know that." So, this is all news to all of us because we never made the connection between DeBruyn and Gaudin. And so, it's like making this whole faculty thing even weirder for me because I'm like, oh my gosh, I now have to live up to being a great-granddaughter of Gaudin. It was bad enough being a daughter of Aplan but a great-granddaughter of Gaudin! That is my definite mentor in everything and all this.

Trivedi:

I never had the pleasure of working with Professor Aplan, but I do know that they just don't make men like that anymore. I have so much respect for Frank Aplan. I'm glad I'm talking to Frank Aplan's daughter here.

#### **41:54 International Conferences & Committees – Forming the Coal Preparation Society of America**

Trivedi:

You were also roped into something called the Coal Preparation Society of America. Tell me what you do there.

Arnold:

Well, I am the secretary for life at the moment. The Coal Prep Society was formed in the early 2000s because the Department of Energy used to be the group that would send a representative to the International Organizing Committee of the International Coal Preparation Congress [ICPC]. Well, the Department of Energy decided that they no longer were going to do that. Al Deurbrouck had been the representative forever. DOE said, no, we're not going to do that anymore. So, we formed the Coal Preparation Society of America so that at some point, we could do and host an International Coal Preparation Congress. We did that in 2010. I don't remember when I became secretary for life, but it was right before that because I was also the Secretariat of the Congress.

We do, at this point; we're doing every other year, a conference called CoalProTec. We also have a journal, CoalProTec, and really just try to support the coal preparation industry, so the companies, the workers. I also have been doing; I'll call it "Introduction to Coal Prep" at that conference for several times now. But I'm also, at this point, on the International Organizing Committee for the ICPC. The last one was in India, which was in 2019. We're trying to get back to Australia. That's where the next one is scheduled. But, of course, COVID messed up everything, so that's delayed till 2023. Supposedly we're having an organizing committee meeting there this fall, but I have heard nothing yet. I don't know if we'll get there and when we'll get there.

So, I will do my six years. We do six-year terms. I've already said you guys need to be thinking about

somebody else unless you really want me to continue in this role. Well, it's hard enough to find a new president or vice president sometimes because everybody is so busy. Just so, so busy. But I do keep the minutes. I keep the roster of who's on the board and when the board terms are up and all those sorts of things, as well as doing the ICPC organizing committee. It's that volunteer thing again. What the heck is wrong with me? We just had Coal Prep, or not Coal Prep, CoalProTec in Lexington, KY, at the end of April after not being able to have it in 2020. It was like old home week. It's like all these people that I know. I am like, this is fabulous. You know, go back to my coal roots, if you will.

#### **45:37 Ceremonies & Charming Remarks – Emcee for the National Mining Hall of Fame**

Trivedi:

Well, let me take you away from coal. There is another group that you have been supporting with your services, and that is the National Mining Hall of Fame. You have served as emcee for years.

Arnold:

No, just the last two. The last two. Well, of course, we took the year off for COVID, and what would that have been '21? I guess '20 as well. Yeah, [in] '20 and '21, there was no ceremony. We had— no, what am I thinking — '20, there was no ceremony. We did have one last fall in 2021. I guess this all happened as a result of my emceeing the SME annual banquet in 2019 when I was president. Of course, that's what the president does; you emcee the banquet. But afterward, they came over to me and said, "Barb, would you emcee that?" I'm like, what? Well, I think it was because I had a theme in my remarks. I started out with some things about ships. I have one of my charms that says, "You can't direct the wind, but you can adjust your sails." So, I started out with that because SME is kind of like that. You can't direct the wind coming at SME, but you can say, okay, we're going to do this a little bit different. We can do that a little bit different. You can't change the rudder very much on this ship that is SME. I went into some things like that.

Then by the end, I'm a Star Trek fan, so, at the very end, I start quoting Captain Kirk from The Wrath of Khan. Saying something about this is my final voyage or my final meeting of SME for my term, or something like that. I paraphrased what Kirk says at the end of that. Hugh Miller was the incoming president. Well, at the very end, you pass the gavel. So, at the very end of that is the quote from Peter Pan. So, I'm like, "Hugh, second star to the right and on towards morning," And I'm handing him the gavel, and everybody is just up and like— [Throws hands into the air]

I'm like, oh my gosh! So, I guess they must have liked what I said. But, you know, I had that, I guess, because I put together the remarks well and that sort of thing. It's like, "Barb, would you come and be the emcee for the National Mining Hall of Fame that fall?" I just loved it. It was just too much fun. I put together the little blurbs that I was saying about everybody. When we got back to it this fall, I found out who the recipients were or the inductees — that's the word I'm looking for. And it's Liz Arnold is getting the Prazen Award. I'm like, oh, my gosh, I have to go. Raj Ramani is being inducted. I have to go, and so I'm immediately on email, emailing. "Did you want me back?" And they're like, "Absolutely, Barb." So, I'm thinking that that might be all-day emceeing now, but we'll see how that goes. But this fall, another Penn Stater, Tom O'Neil, is being inducted, so I think I have to go. Somebody has to represent Penn State at those things, too.

Trivedi:

Absolutely, and I remember the first one I attended was when Dr. Aplan was inducted a few years back.

Arnold:

Yes. Yes.

Trivedi:

Penn State has sent quite a few of them as inductees.

Arnold:

Yeah. Yeah.

#### **49:54 My First Trip Abroad – Working in an Underground Lignite Mine in the Czech Republic**

Trivedi:

Barb, you have traveled all over the world. I know we talked about it. You traveled to Europe as early as 1991. Tell me about all those keynote speeches and all those trips you made and the contacts you made, and the contributions you made.

Arnold:

Absolutely. My first trip was while I was still at the Coal Cleaning Test Facility in 1991. We were contracted to send someone to, at the time, Czechoslovakia, now the Czech Republic, to do some washability on some lignite. Well, I think that means I have to go. So that was my first trip abroad. I flew into Prague, was there for a month. Worked at a lab outside...During the week, I would stay in a little town called Most, which was part of— the mining company actually owned it. We drove out to, essentially, the mine site lab during the day. I had a technician working with me, and so by the time we got used to each other – he spoke not a word of English. I spoke essentially no words in Czech, except that because of my heritage, I could count to ten in Slovak. But somehow, we were able to communicate, which was just completely amazing to the person from Czechoslovakia that we were dealing with, with the company.

I was able to go to their underground mine, which was a lignite longwall mine, which was quite the experience. Very humid. As you can imagine, lignite is very high in moisture content, so it needs to be ventilated quite well. So, in the areas where there were workings, it was ventilated. You could breathe very easily. We got up to one of the faces where they were working on—I think it must have been a continuous miner to develop the section. Very hot and humid. Not enough air. The guys that were working had their hardhat, their steel toes, safety glasses, and loincloths.

Trivedi:

Loincloths?

Arnold:

Yeah. Very interesting experience because it was just— Yeah, it was very hot and humid. First experience in an underground lignite mine outside the country. That was kind of an experience. Did all the lab work for the float sink for the lignite. Got all that analysis back and presented it to the folks there.

#### **53:40 Traveling Around the Globe – Conferences Abroad & International Debacle**

That year I also went to Poland. They had a project that they wanted someone to go to Poland as well, just to talk about--I think it was one of the power plants that we visited.

The next year I went back to the Czech Republic for a conference, and it was on low-rank coal. So I gave a paper on the experience that we had there. Plus, at the test facility, we had also done some low-rank coal analysis as well as ran some through our cleaning plant. So I talked about that as well as their analysis. There was a reception, I believe, in conjunction with that. So, I actually met Shirley Temple at that conference because she was the US Ambassador to Czechoslovakia at the time. So that's one of the famous people that I got to meet. I haven't met very many other ones, except for you, Nikhil.

Trivedi:

Thank you.

Arnold:

You're famous, but that was my first big experience. Now, on the first trip. no issues while I'm there. War breaks out in Bosnia, Herzegovina, Hungary, etc., in 1991. I was supposed to fly back through there. I'm like, okay, I guess that's not going to happen. So, I ended up rerouting back through Germany, I think, and then home. But, you know, your first international travel, to have it disrupted like that, it's like it's a good thing that I am very calm because I probably would have freaked out if I wasn't. You know, I try to keep sort of a calm demeanor. But that was one of those things, like, okay, how are we getting me home?

#### **55:46 Annual Trips to South Africa & The Centennial of Froth Flotation in Australia**

Arnold:

So we did that. But the next time I traveled abroad wasn't until we started doing the work with Multotec. I had the opportunity to take customers to Multotec in South Africa for what they called "inward buying trade missions." They wanted people from abroad to come to South Africa to see that this isn't third world. This is real stuff. It's real equipment. We know how to manufacture it. It's okay to buy it here.

Every year I would either take someone to the big mining show that's in South Africa or to the South African Coal Preparation Society's meeting. They would have theirs every other year. So every year, I was taking people to South Africa. I started to hate the trip. Once I got there, it was fine. But that's a long haul. Long haul. I started to know that I really liked flying through Dulles first. Yeah, no, didn't like flying through there. Dulles was okay. I also started doing some travel to some other conferences internationally. I went to the 100<sup>th</sup>, yes, the Centennial of Froth Flotation in Australia. That was back in, I want to say, like, 2004 or '05 or something like that. So that was a great trip. Held a koala bear on one of



my excursions. So that was fun. Got to pet a kangaroo and also visited some preparation plants.

So, the videos that I took of those preparation plants from that conference, I'm showing in my mineral processing class now. It's like, oh, yeah, look, here's this great big clean coal thickener, and here's the froth flotation cells operating and that kind of stuff. So, I still have those videos back on my hard drive, I guess. Then [I] started going to the International Coal Preparation Congresses about that time. I had gone to the one in South Africa in, I think, that was probably 2002.

### **58:36 Exploring the Wonders of the World – My Travels to China, South America & India**

Arnold:

I went to China for the first time in 2006. That was an experience.; They were gearing up for the Olympics. So they had not yet dealt with the pollution problem because, unbeknownst to me, looking out my hotel room across the freeway--the six-lane freeway, if you will, they were actually building that; what did they call it? The nest, the big stadium. They were actually building it right there. It wasn't until the very last day after it had rained when I looked out my window from my hotel room that I saw it being built. I'm like, that's what they're doing over there. I got to walk the Great Wall while I was there, and so that was very cool. So now I have on my bucket list seeing more of the great wonders of the world.

Trivedi:

Right.

Arnold:

So, with Penn State New Kensington, I had gone to South America twice, a trip to Peru. So up to Machu Picchu. There was one of my other wonders of the world. I went to Coal Prep India in 2002. Went to Delhi for the conference, but then also went up to Agra. I have the picture, which I will show at some point here, of me holding the tip of the Taj Mahal. I think there's another one with it on my palm. So, I have the tourist pictures from that. But you have to do those tourist things. Who knew if you were ever going to get back to China? Who knew if you are ever going to get back to India? I mean, I kind of knew that I was going to go back to South Africa once I started doing the Multotec thing.

I've been back to China. I've been back to India for some consulting projects and things. In 2011, when I became the SME Foundation President, John Murphy became the SME President. He could not go to the Phosphate Conference in Kunming that year. Kunming, China. So, it came to me to go and represent SME because we were co-sponsors. I got there, no problem, except that I think I had a cold or something on the way over but got there no problem. It was a great conference.

### **1:01:36 Fukushima Earthquake – Shaky Legs & My Layover in Japan**

Arnold:

On the way back, I'm sitting in the airport. Call my mom because I usually do that before I get on big trips to come back. Then I'm realizing, and I'm telling her, "Oh, yeah, Mom. This flight's going through Tokyo. Geez, I'll get to be in Japan." But I don't count that I've actually been in a country if I've just flown

through an airport. But now I count Japan because we land, start out of the airplane, and I'm like, oh, I wasn't sitting that long, but my legs felt shaky. Get in a little bit further, another little shake. Start going up the escalator, and you would swear that the escalator was falling apart. It was the big nine-point whatever Fukushima earthquake that was happening.

We got to where the area was going to be for us to just sit for a little while inside the terminal. Then they evacuated the terminal because they weren't sure of the structure. I think this was probably – we landed probably like noonish, early afternoon. So we're all sitting out on the tarmac. They start bringing chairs out. They start bringing blankets out, and then they start buses. They brought some buses, so they put some of us back into the one area of the terminal, which was fine. This area they cleared, we could go back in there, or they were taking people on buses.

Then a little bit later, they came around and said, well, where are you flying to? They sort of knew where everyone was flying. Well, at about 9:00 at night, it's like we were just still sitting there. They'd been passing out little granola bars and things and stuff. So the bathroom, fortunately, was right there where I was.

Arnold:

About 9:00, it's like, oh well, I guess I'm going to hunker down here on my carry-on and just maybe try to fall asleep.

Trivedi:

Get some sleep.

Arnold:

Next thing I know, someone's tapping on my shoulder, "I think you said you were going to Dulles, weren't you?" I'm like, yeah. They're having us leave now. Somehow, they had apparently cleared the tarmac, that there weren't cracks in the runways. There were two United flights, the last two that left that day, and I was on one of them. I was flying business class.

The flight crew, not the pilots, the flight crew all waived their flying time because they're allowed to do that. The pilots are not. They plotted a course back to Dulles direct for 13 hours. We were cruising because, you know, I was watching the screens. Where are we? I swear, I've never flown across the United States that fast.

Trivedi:

That fast.

Arnold:

But we were one of the last two flights out that day, and then you hear all the stuff. So I'm texting my sisters, telling them to make sure mom knows that I'm okay. Because she's going to wake up. Barb was there. Barb's in Tokyo.

Trivedi:

Actually, I heard about it too, actually, because SME was talking about something in Tokyo, and Barb is there. So, yeah, I think I was on the board then.

Arnold:

I forget who I actually had emailed. Because I had a smartphone by then, too, so I was still able to get my emails in some time. And I think, I don't remember who I responded to, but I am in blah, blah, blah. But yeah. So that was quite interesting.

Got to Dulles, get to the gate, explain what happened. Yes. Next flight to Pittsburgh. I was home maybe 5 hours later than what I was supposed to be. I was –

Trivedi:

Not bad.

Arnold:

Totally shocked. Totally shocked.

Trivedi:

Glad to be home.

Arnold:

Very glad to be home. That was one of the ones; very glad to be home.

### **1:06:33 Six Continents – How My SME Presidential Duties & Consulting Took Me Around the World**

Arnold:

But then, you know, with my SME duties as president, I was in Canada like three times, and my trip was to Russia. We went to Moscow to make a bid on the International Mineral Processing Congress. So Dave, myself, and John Marsden went to represent SME to make the bid on that. They gave the next one to Australia, but we have the one after that. I haven't heard much more about it because I'm sure COVID has messed up their schedule too, but [I] made sure that we got to see Red Square and the Kremlin and all that sort of stuff while we were there. Took an afternoon, the only nice afternoon that we had the entire trip, but that was a quick trip.

But one of the interesting trips to India, because I've been to India several times for consulting as well. On one of the interesting trips to India, I was in airports or in the air longer than I was on the ground in India.

Trivedi:

Of course.

Arnold:

Not fun.

Trivedi:

Not fun.

Arnold:

Not fun.

Trivedi:

Was this because of the fog in Delhi?

Arnold:

I don't think it was that trip. No, that was just how it was scheduled. I flew in for a meeting. Flew back out.

Trivedi:

Flew back out.

Arnold:

So, I've been to Australia a couple of times, been to India probably almost as many times as I've been to South Africa even, and then China. Inner Mongolia was one of the trips that was kind of interesting. Visited several preparation plants for the Elgin Group because I was doing some consulting for Roberts & Schaefer. At the time, they were part of the Elgin Group. They had me go and try to figure out why their centrifuges weren't working the way they were supposed to. Turns out they weren't being fed what they were supposed to be being fed. So, I actually have some really cool pictures of some centrifuge baskets that are all blown out, holes in them, and everything.

So that's one of the things I'm like; I can show those pictures in class, too! And then I can tell them about my trip to Inner Mongolia. I actually had one student come to office hours and ask and said, you know, after I went through the homework or whatever with him, I said, "You have any other questions?" And he said, "How did you get to go to all of these places?" So I guess they actually listen sometimes in class, so they listen to some things. It's been very interesting. Sometimes people will ask, what's a tidbit about you or whatever, some fact, and I say, I've been to six continents. So that's kind of cool. I need to get to Antarctica yet one of these days.

Trivedi:

Well, you have to volunteer for it, and then you will go.

Arnold:

Well, that's probably the way to go. No, I think I can probably fund my trip to Antarctica, but yeah.

### **1:10:06 "Just Be Kind" Mantra – Teaching at My Alma Mater**

Trivedi:

So now you are a professor at your alma mater. What's in store for your students?

Arnold:

Well, the last two years I've been there, starting under COVID, masked. I had my classes either hybrid, which means some people in the classroom, some on Zoom, or all in person. I kind of insisted on that because I'm like, we were allowed at the time to do that. But I wanted to get to know the students because they didn't know me. I was brand new. So, my whole mantra over the last two years was just be kind, Barb. Just be kind. Because, you know, I was already 60 years old. I've already got all of these strange experiences behind me, that I know things are going to be fine at some point. It's not a thing to be stressed about, but my first-year seminar students are 18 years old. They don't know that. Even the seniors they're maybe 22. They don't know that yet. They don't know that their life will be fine as they go forward, that it's just a matter of making decisions. Making sure that you are as safe as you possibly can be in whatever situation you're in. I've been in some places where the taxi driver did not know a bit of English, and in China, it's like, okay, oh, that's where I want to be, right there in that shop, and he's driving past, and I'm like, No, no, no, no, no. You have to be a little more forceful sometimes, but just be kind. That's sort of the whole thought process at the moment for me.

I'm teaching faculty, so I was hired as teaching faculty. I teach five classes a year. I'm helping with the senior design project, mostly to make sure that they actually use commas and semicolons when it's proper. But also making sure that they take care of the mineral processing parts of their design projects, as well. I do the Elements of Mineral Processing. Just finished up that this semester. In the fall semester, I teach Mineral Processing Engineering, which is a little more intense. I do our first-year seminar, which I call Energy and Minerals in a Sustainable Society, and that's also a writing class. So, I've got to make sure that they put their commas in the right place and their semicolons in the right place. That's also a class where they can get to learn all about Penn State, the library system, and all of the services that are available as freshmen. So that has been very, very interesting and very rewarding. I like that class. Some of them have reached out to me afterward, my first class saying, "Will you write me a letter of recommendation for such and such?" It's like, absolutely, because some of them are very good students.

### **1:13:52 Research Alongside Teaching – Rare Earth Elements Projects & Graduate Students**

Arnold:

So that's been fun. But in addition to that, I am also doing research. Probably more than I actually technically need to. But before I started, we wrote three proposals on rare earth element design projects through three companies, and we got all three of them. They were three-month projects; just about killed me. We started them on October 1<sup>st</sup>, my first semester, while I was still in the process of putting my classes together from scratch for that semester. They ended on December 31<sup>st</sup>. I had no Christmas break except for Christmas Eve and Christmas Day because we were also in the process of

putting together another big proposal to assess the Northern Appalachian Basin for rare earth elements, critical minerals, and carbon ore. You know carbon ore is coal, but we are calling it carbon ore now. So that is one of the projects that I'm also working on. That started last October. That proposal was due the 5<sup>th</sup> of January that year. I'm still trying to remember how I got all these things done. Then that first semester, I also taught a class on the surface chemistry of respirable dust.

I was able to go through and get a lot of literature gathered and things. So when it came time to do a proposal to NIOSH, I was able to pull from all of that to put together a proposal to their BAA program, and that was due on January 15<sup>th</sup> of that year. But it was just like a concept paper they have you do first. Then we could do the proposal. We got that contract. It started last September. So I actually have a PhD student working on that. I said to him, sometime last fall when he started, I said, "You don't mind being a free-range grad student, do you?" He's perfectly capable, very capable of doing all of the things that he needs to do. That's working out very well.

This fall, I'm going to have— We have a program, we call it Integrated Undergraduate Graduate, which is a five-year master's degree. I have one of our environmental systems engineering students coming on board with me for her master's. She's going to be looking at beneficial use of mine tailings. So she's got a summer internship with Nevada Gold. I told her the only thing that you have to do is bring back some tailings. Bring me some tailings for your project, for her project. So we're going to do some things with tailings. And then, fall of '23, I already have a student committed to coming back for a master's degree. We're going to look at, again, tailings, but focusing more on aggregate tailings, sand, gravel tailings.

### **1:17:30 Sand Wars & Tailings Research – Finding Secondary Sources for Critical Minerals**

Arnold:

Just digging into all of that over the last couple of years. There are sand wars in the world. Very surprising to think about, but we mined probably, what is the number, 30 to 50 billion tons of sand and gravel. We have construction sand shortages in different places in the world. So let's see if we can pull out the quartz from coal tailings. Can we pull it from the aggregate tailings, the stuff, or can we make it in a different way? You know, people do manufactured sand by crushing and such, but can we find another source, a secondary source for it? Like we're talking about secondary sources for all of the critical minerals and rare earth elements from coal tailings and such.

So, I came to Penn State wanting to do tailings research. I'm finally going to get into that some and also dewatering research, which we might have a project on that starting in the fall. So the critical minerals stuff, it's like, okay, you want me to beat up some rocks and liberate the stuff and use gravity, magnetic separation, froth flotation. Yeah, that's mineral processing. But sometimes that doesn't work because they're not in there that way. There's just not enough of them in certain locations, either. So that's been interesting. We're looking at lithium as well and some of the clays that are just in the county next door to State College. So we're doing that as well.

But, you know, the transition's been interesting. I joke that some of the faculty of my era, anyway, that have been at some of the universities forever, that are now thinking about or have already retired. I think they always thought of me as more of an academic than somebody selling equipment, anyway. I still always gave papers. It was more from the standpoint of, yes, here's this new technology, and why does the technology work rather than trying to do a sales pitch on something. Dave Osborn, from Australia; I met him in South Africa eons ago, but he asked me to write a chapter in his coal book on coal

formation and macerals and that sort of stuff. And I'm like, oh yeah, Dave, I can do that. This is the second volume of it, but it's coal. It's my thing. It's, you know, it's my coal. My US Steel experience was coal flotation. That was my master's degree, macerals in coal. I do have my picture here. I'll show you my— I've actually framed my macerals in coal.

But it's actually pyrite inside fusinite. These are some of my favorite pictures. So I framed them because I had this empty frame, and it says "Penn State John and Willie Leone Family, Department of Energy and Mineral Engineering." So, it sits on my bookshelf.

Trivedi:

Absolutely.

Arnold:

But then I also get to hang out with the students. So, we went to the Komatsu reception. If you're not a student or a faculty member, you do not get to go to the Komatsu reception at SME. Now I get to go. They had a Roaring Twenties theme. So, I got the guys all suspenders, and we all had gangster hats on. There were some boas. Some of them really got dressed up. So, we got our picture taken as our group; that sits up on my wall too. So, it's just kind of—

Trivedi:

That's actually reason enough to become a faculty.

Arnold:

It is. It absolutely is. You get to hang out with the students. I've learned too much about some of them, though, when you sit at the booth because the universities always have booths.

Trivedi:

Yes.

Arnold:

You sit at the booth with the students, and you just learn things that you're like, I don't need to know that. You don't need to tell me that. But it's also fun, even in office hours over the past year. I'm like, I don't need to know that. People tell me things. I don't need to know that. But it's fun. It's fun.

Trivedi:

I think they do that because they feel comfortable.

Arnold:

Oh, I'm sure it is.

## 1:22:36 Concluding Remarks & Oral History Addendums

Trivedi:

And I feel so comfortable talking to you, Barbara, you know. Here is the deal. I hope to sit down with you again and find out what you have done after becoming faculty. So, do I have a promise from you?

Arnold:

Absolutely. Absolutely. We'll do that. We'll have our appendage to this somehow or addendum to the oral history. Because I've told you, I don't think I'm old enough to do an oral history. But, you know, I've said that all along. The Pittsburgh section, for their distinguished member of the Pittsburgh section, you have to have been a 25-year member. Well, I never gave it a thought that I was a 25-year member, and they're making me a distinguished member, and I'm like, I'm not old enough for this.

Trivedi:

But you are, truly.

Arnold:

Well, I do things. I do things, and I hope that I always do things well. But I do go back to the whole Mortar Board thing of scholarship, leadership, and service. I wouldn't be a Mortar Board if I didn't follow through on all of those things. You get asked at the department to chair a search committee for a new faculty member. And I'm like, I've never done this before.

Trivedi:

But I will.

Arnold:

Okay, I'll do that. It's just; it's whatever. It's alma mater's call. Responding to alma mater's call. So that's one of the things that I just sort of taken to heart over the years, and you just got to do it, and it's been fun. You know, the National Mining Hall of Fame emcee thing, some people will tell me, oh, aren't you nervous? I'm like, this is fun! Giving awards to these people who are so fabulous and so distinguished in our field. That's fun.

Trivedi:

I have had a lot of fun talking to you today, Barbara.

Arnold:

Well, thank you, Nikhil.

Trivedi:



Thank you so much for taking the time. I appreciate that. And on behalf of all the listeners, thanks to Wayne Gretzky.

Arnold:

Yeah. Yeah. He did have a lot to do with it.

Trivedi:

He did. He did. Thank you again.

Arnold:

Thank you so much.