

STEVE FRISHMAN
Las Vegas, Nevada

An Interview by

Danielle Endres

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Nuclear Technology in the American West Oral History Project

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THE FOLLOWING IS AN INTERVIEW WITH STEVE FRISHMAN ON NOVEMBER 13, 2009, CONDUCTED IN LAS VEGAS, NEVADA. THE INTERVIEWER IS DANIELLE ENDRES.

DE: Okay this is Danielle Endres and I'm interviewing Steve Frishman and it's November 13, 2009 and we're in Las Vegas [Nevada]. It's about one o'clock. So Steve can you tell me your full name with the spelling?

SF: Steve Frishman, F-R-I-S-H-M-A-N.

DE: Okay and your current residence.

SF: 4587 Ermine Court, Las Vegas, Nevada.

DE: And how long have you lived at that residence?

SF: In that house just since March.

DE: Okay, and then your occupation.

SF: I'm a geologist and I work as a technical consultant to the law firm that's representing the State of Nevada in its contesting of the Yucca Mountain license application [to the Nuclear Regulatory Commission].

DE: Okay, thanks. Okay so we're going to start with some background information where I'll ask some information on you that's not necessarily related to nuclear waste but just kind of your life circumstances and what brought you to where you are. So your birthplace and birthday.

SF: Ah.

DE: And you don't have to give me your age actually.

[laughs]

SF: I was born in Washington, D.C., September 15, 1944.

DE: Okay and do you have siblings?

SF: I have two brothers and a sister.

DE: Great and then what brought you from Washington, D.C. to live in Nevada?

SF: Well, I went to Andover Academy and then went to college in Worcester, Massachusetts and then went to graduate school at the University of Texas at Austin. And between college and graduate school I worked for the National Science Foundation on a project in the Antarctic and New Zealand. So when I got to the University of Texas I was in the Geology Department and got a Master's degree. And then went to—I got the Master's degree at the Marine Science Institute for the University of Texas. That's on Mustang Island on the Texas coast. So I was living in a little town there called Port Aransas [Texas]. And when I—after I got my Master's degree I started a newspaper on the island. It's the first time the town ever had a newspaper. We had a very bad hurricane that wiped out about half of the town. And there were some really bad—I thought bad—political decisions being made by the city council. So I started the newspaper partly to sort of inject into that process and get people empowered to be able to take care of their own town. And so I had that newspaper and I sold it after ten years, and it's still going so it's—the newspaper is almost forty years old now.

DE: Great, what's that name of the newspaper...

SF: It's called South Jetty and it's because the city or the town is at the end of the island where the Corpus Cristi ship channel goes out into the Gulf of Mexico. And on coast lines like that you need to jetty the channels in order to keep them from filling in with sand. And we were trying to think of—we knew we were going to start a paper and we were trying to think of a name for it. So my office at the Marine Institute looked out over the jetty on the south side of the channel. So it just occurred to me, "Well let's call it

South Jetty because it's the only stable thing in town." [laugh] So that was kind of fun.

So I had that paper for ten years.

And during that same time I became involved in a lot of coastal and environmental issues. I ended up—well I was on a regional council having to do primarily with the implementation and enforcement of The Clean Water Act. A lot of issues were dredging the wetlands. Just about the time I started the newspaper in 1970, there was a proposal to build the largest inshore port in the country, right at the mouth of the channel meaning just right across the channel from the city of Port Aransas [Texas]. One of my early editorials was opposing that port project. I became involved with a group of people who had decided very early to oppose it. My newspaper was sort of the central vehicle for opposition. And I eventually was able to—well I became a vice president of the Texas Environmental Coalition so I had a very large group of people opposing it because the Texas Environmental Coalition represented a large number of groups—environmental groups and other interests such as one of the members was the Texas AFL-CIO [The American Federation of Labor and Congress of Industrial Organizations]. So we had a lot of people involved. And because of my opposition to that and my position in both the Texas Environmental Coalition and another local organization, there was a state agency called the Coastal Marine—Texas Coastal and Marine Council—and I went to every one of their meetings trying to get support and help from them. And finally it got to the point where I knew the chairman and the members very well and it got to the point where I was so active with them, that the Lieutenant Governor decided that the best way to keep me under control at all was to just appoint me to the commission. So he did. [laugh]

So with that commission [Texas Coastal and Marine Council] I made sure everybody was very well aware of the problems that that port would cause. And on top of that, aside from environmental issues, I saw it as a safety issue for the town where I lived because of—primarily because of hurricane surges where the town normally pretty much went under water during a hurricane. Because of the configuration of this port that they were planning to build and dredging the channel from forty-five feet deep to ninety feet deep, we were able to calculate that a storm surge would very likely just take out the whole town. The proponents of it tried to do models that showed something different and we picked their models apart and all the rest. So in the course of opposing that, I got into the state system by being a commissioner on the [Texas] Coastal Marine Council and that got me to where I was known in the state.

One of the other things I did with Texas Environmental Coalition was in 1976 there was a draft Environmental Impact Statement for disposition of commercial high-level nuclear waste from power plants. I did the first comments on the draft for the Texas Environmental Coalition. And—thinking—essentially just how arrogant it was of us to think we could do something that would actually last and do what it was supposed to for ten thousand years. But I wrote a lot of technical comment for the Environmental Coalition. And then once they were submitted I didn't really think a lot more about it. And but then in 1980 when—let's see I was—I sold the newspaper in 1980 and I was just working as an environmental consultant on fisheries things and again on wetlands dredging and I did some work for a large waste disposal authority around Houston that was having some real environmental problems and problems getting permits to things that they needed to do so I helped them sort of to take a better look at what they thought

they needed to do as opposed to what could be permitted and also what made environmental sense in the long run for them. So I had clients like that. And then in 1981, the Texas Energy and Natural Resources Advisory Council, referred to as TENRAC was—one of the things that they were doing was putting together a panel to advise the Texas Congressional delegation on the then-being-developed Nuclear Waste Policy Act. And because of my position on the Texas Environmental Coalition, I was invited to be on the panel that was looking at the development of the Nuclear Waste Policy Act and advising the Texas delegation. And so I was essentially in on the writing of the original Nuclear Waste Policy Act that became the Nuclear Waste Policy Act of 1982. And I was in on the internal debates. And then we knew what's going on in Washington [D.C.] with other states and other delegations. And then we picked through that and tried to pick the—what we thought were probably the best positions for Texas because even before the Nuclear Waste Policy Act, the Department of Energy was already looking at possible sites for high level waste disposal. They actually had a program going and there were—at that time there were about four sites in Texas that they were looking at, two in salt domes in East Texas and in bedded salt in the Texas panhandle. So we were trying to make sure that our delegation was aware of the protective type things that we wanted to have into the [Nuclear Waste Policy] Act. So eventually the [Nuclear Waste Policy] Act did pass.

And at the same time another person who was on the [TENRAC] commission was the state geologist who had been one of my professors in graduate school at the University of Texas. And he had a—or the State Geological Survey, which in Texas is called the Bureau of Economic Geology, which he was director of. They were doing some work for the Department of Energy in starting to do the geological characterization

of these sites that the Department of Energy was looking at so that essentially the geological survey was doing the original work just sort of working out the geology of these sites. They had the contract and one of the requirements to do this work for the Department of Energy was the organization doing the work, which was that the Bureau of Economic Geology needed to have a quality assurance program. In order to make sure that all the work got sufficiently documented and looking way forward to where the kinds of information and recordkeeping and transparency that you would need if you ever got into a licensing situation such as Yucca Mountain is now in. So there's a very well defined and rigorous quality assurance program that has to go with all of the research work that needs doing and all the design work that's done. Scientists don't particularly like being bound by these rigorous quality assurance programs and the director had tried to get his people to do what they needed to do. And he had one person who was in charge of trying to get them to do that. And it's very difficult if you're working with your peers and you're for administrative reasons trying to make your peers do things that they don't want to do. So he asked me because of our association on that advisory committee, he asked me if I would come to work for the Bureau of Economic Geology. And because many of the people who work there are people that I went to graduate school with, he said "You know a lot of these people but you're not part of the internal culture and structure. Do you think you could come in and try to, one way or another, get them to adhere to a quality assurance program?" And because I didn't really have any baggage from where I wouldn't have to be in a situation and maybe showing friendship and biases this way or that. So I said, "Yeah I'll give it a try," and "I think I understand what quality assurance is." I researched what the program was supposed to be. So I went to work there

and in the space of about a year was able to get them fully compliant without having any big blowups or anything. We worked together and I showed them how it doesn't have to be a burden. It can actually help you keep your work organized. And it took time but they got used to it and we ended up with a qualified program. One of the benefits that I built into it that helped it along and helped them be happy about it was I worked with the computer programmer at the Bureau [of Economic Geology] and we worked out a way to trace every bit of work and every bit of sampling that was done in computer code to where you could see the—like if you took a sample on a certain day at a certain place you could show where, everything that was sampled, the laboratory work that was done, the reports that it went into and ultimately the publications that it went into. So you could trace everything from it's beginning ultimately through a peer-reviewed publication. And this turned out to be something that was very helpful to the scientists that were doing the work. So that was a bone that I tossed to them, in return for them towing the line on stuff that they really didn't like doing but they realized that they had to do. So that worked out pretty well.

When the Waste Policy Act passed the director of the Bureau of Economic Geology who was also a member of this Texas Energy and Natural Resource Advisory Committee said he thought it would be a good idea if I went to work for them because the Nuclear Waste Policy Act requires affected states to have an oversight program. And you get federal government funding—out of the Nuclear Waste Fund, which is a fund that the ratepayers pay into for nuclear waste disposal—The Nuclear Waste Policy Act said that the states were entitled to grants to carry out their oversight duties of the program. That oversight duty in Texas was placed in the Texas Energy and Natural Resources Advisory

Council. The director of the Bureau of Economic Geology said “Okay I think we got a quality assurance program up and running, why don’t you go take a job over there and be part of the state oversight because you know the program because you’ve been working on it based on the bureau’s contract.” I knew all of the other programs that were going on at the same time.

I went to work there and the TENRAC [Texas Energy and Natural Resources Council] was at that time very controversial because it also was involved in oil and gas policy in the state. And the railroad commission in Texas actually was the regulator. But TENRAC was helping the legislature developing oil and gas resource management policies. And there were a lot of the oil and gas guys in the state who just really hated TENRAC and partly because the director was a pretty forceful person and didn’t take direction very well from the legislature. So there was a big controversy in the legislature about what to do about TENRAC. And the director was in a position where he was probably was going to get fired. The Director of the Bureau of Economic Geology was shopping me around as the next director and the legislature finally just got so fed up that they decided that they were going to abolish the agency rather than put a new director. They didn’t want any more policy direction. [laugh] So that meant that the state’s oversight organization didn’t exist anymore. When the legislature abolished it—in fact the key person who actually led to the abolishing of it was a guy that used to walk around and say “The people who worked at TENRAC couldn’t find a can of oil at an Exxon station.” [laugh] So there were some pretty bad feelings about the whole agency. I think some of it probably deserved. But it left the state’s oversight out of a waste program [and the] federal program was down then to only two sites in Texas that were being looked

at (there were a total of nine sites in six states being looked at). It left it high and dry. So I and the director worked out with the Governor that the oversight would be done in the Governor's office through the General Council office just as a way of parking it somewhere. We were actually an office within the Governor's office. And because of my history I ended up being the Director of that office. And we got moved around from agency—you know from locations to locations but we always answered substantively to the Governor where administratively we had to deal with other agencies. But so...

DE: What was the name of that office?

SF: It was the Nuclear Waste Programs Office. We did that with a new Governor who didn't like the idea of a waste dump, and a new Attorney General that didn't like the idea of nuclear waste in Texas, an Agriculture Commissioner who didn't like the idea, a State Treasurer who didn't like the idea. The State Treasurer was Ann Richards, who later became Governor. The Agriculture Commissioner who is still—he has a populist radio show—Jim Hightower. So we had a pretty good working group with the Governor and the Attorney General, the Ag Commissioner, and the Treasurer.

What I did was put together at the very beginning with the new Governor just an options paper. And saying "Here are the different ways that the state can react to the new federal law. And these are the different ways that we can carry out our oversight." And it went everything from being cooperative to being totally uncooperative, to setting ourselves up as a technically competent organization. But our duty was or our job was to be critical of the program to the extent that we thought that we could show that it was bad both geologically in terms of safety and that it was bad for the society in the state—bad for economics. The two areas that they were looking at were—one of them was in the

second highest producing agricultural county in the country and primarily because both farming and feedlots. At that time, it was producing about a billion dollars a year in agricultural products. And of course the Department of Energy really liked it. And the farmers complained, "Well if you're going to mine the salt and you'll be piling the salt up on the ground"—this is irrigated farmland in the Texas panhandle using water from the Ogallala aquifer—and the farmer's are saying, "Well you're just going to spread salt around. And our biggest problem with irrigated farming is buildup of salts. It's just going to get worse." And the Department of Energy's answer was "Well just grow more salt-tolerant crops." [laugh] They haven't changed. So anyway I became the director of that agency and remained the director until just shortly before the Nuclear Waste Policy Act Amendments Act was passed in late 1987. I was director there and to the point where we knew that it was going to be over, all except for Nevada.

Because of my representing Texas when some of the other states were involved including Nevada I got to know people in all of the other involved states. And I got to know the director of the Nevada program. Within the group of states who were involved there were some of us who had better coalitions than others. I always worked well with the director of the Nevada program and a few others. So when it looked like Nevada was going to get stuck and that Texas was going to be off the hook then Nevada Governor Dick Bryan who went on to be Senator and the Director of the Nevada Agency [for Nuclear Projects] asked if I would come to work for them as a consultant and see if we could get it out of Nevada as quickly as we got out of Texas. And we knew the program inside and out. So it was 1987 when I came here. Up until just a year ago I worked as a consultant to the Nevada Agency for Nuclear Projects.

Then because of changes having to do with the fact that DOE [Department of Energy] finally put a license application in [with the Nuclear Regulatory Commission] and the law firm was going to be end up doing most of the work, because for years we've been doing technical work and building up all of our material that would ultimately would end up being used contesting a license application. We had done a lot of work, we had clearly established ourselves as no pushover and [laugh] if the emphasis was going to be on the licensing, which it was, then it seemed to make more sense that I would work directly with the attorneys rather than working through the Agency secondhand to the attorneys. It just seemed to be a more efficient way to work and a way for me to better channel the work that I was doing. So that's what I've been doing for the last year. The way the NRC [Nuclear Regulatory Commission] system works is in order to be a party to the proceeding, you have to file and have accepted at least one contention, meaning one objection that essentially contests something in the application for not being in compliance with the rules with the Nuclear Regulatory Commission rules for licensing. Well we ended up filing two hundred and twenty-nine contentions, and of those two hundred and twenty-one of them were accepted. And this is just really unusual. Usually in NRC [Nuclear Regulatory Commission] licensing cases you may get twenty-five or thirty contentions and you may get one or two accepted. In this case we just flooded the system. And so we're in the process of right now of briefing some contentions that are just legal issues rather than being substantive issues about the license application. This is a first of its kind process that we're going through. They're following licensing procedures that they'd use but this is a very complicated process and it involves way more than just what you usually would go through for licensing a nuclear reactor. It's got

many more disciplines involved and there's on top of just the safety analysis that has to be done, there's also an Environmental Impact Statement. So you get some of the things coming out under both headings. The Nuclear Regulatory Commission decided that the contentions would be single-issue contentions because it's easier to litigate them that way. So we have, well for instance, just on one area how the water, how rainfall actually converts to infiltration—meaning water that's moving through the area above the water table, how much of the rainfall actually is water that's moving down through the site. We have about a dozen contentions just in that one issue. So we ended up with two hundred and twenty-nine plus we added five since based on new information that's come out and one of them has been accepted. We're still waiting on the other four to see whether they'll be accepted and we think they probably will. So we're in the process now where briefs are being written on just the legal contentions so we can get legal issues settled before we go into the actual substance of contentions. And it seems logical to do it that way because we have a couple legal issues where if we win on those legal issues then it's over anyway. And but there're strictly issues where the regulations don't make it cut and dried how it could be decided. They're going to have to make some interpretation of regulation. This again is very unusual in a proceeding. So we're out in the area where it's—the downside is some of it is sort of make it up as you go, but the upside is you get a decision.

One of the reasons this thing has dragged on for so long—meaning from 1987 until 2008 when the license application went in—is because in that entire time there was only one other decision that was made about the site itself. And that was in 2002 when the Secretary of Energy recommended the site to the President and it went through the

Congressional approval process where the State [of Nevada] was allowed to file a notice of disapproval which both Houses had to override or else we would have had a veto. We filed it and of course we were overridden. But in that entire time, 2002 was the only time the DOE [Department of Energy] ever made a decision that was a final decision. So there was essentially nothing we could do other than just stay on top of it constantly shooting at anything that looked bad and building up our own resources of information in case it ever did go to licensing. We spent twenty years, twenty-one years doing nothing essentially but keeping up the institution of opposition [laugh] and making sure that we had very solid information if we ever had to go to licensing.

When we hired the attorneys in 2002, we asked for proposals and qualifications and had two or three law firms that were very interested. And we picked one that we thought served our needs best, and then rather than just jumping in and saying yes, what they did was came to our office and spent a week going through our files and with us explaining what we had done and why we had done it and what we had to back up positions that we had. And in the end they said, "Okay we will be your attorney." And they gave us what I thought was a real compliment. When they made that decision they said you're the best-prepared client that we've ever had. [laugh] So we thought we had been doing our work right.

There's a lot of stuff that went on along the way. And I think we'll probably get into that. But that's how I first even thought about the thing way back when I was with the Texas Environmental Coalition, where just one of the things that I did because of the position I had was reviewed this draft Environmental Impact Statement where I thought

the concept might be absurd. [laugh] And it ended up where I never really made a great choice that this is what I wanted to do. It just sort of moved along that way.

At the early times of it, I was also doing stuff for another federal advisory committee that was the National Advisory Committee on Oceans and Atmosphere. They were doing a large report called Oceans 2000. And I was actually working as a consultant for them on fisheries policy. [laugh] And because I had been involved with National Marine Fishery stuff because I lived on an island where the main income was sport fishing and the newspaper covered all the sport fishing. As I did more things about nuclear waste, I was doing less things about fisheries. I was on one of the Gulf of Mexico Marine Fishery Council Advisory Committees. I was chairman of one of those advisory committees. But finally when I got full time in nuclear waste, I resigned from the fisheries part of my life. [laugh] And then when the other place where I had to make a decision was when I knew that Texas was going to be off the list. I could go back to the fisheries management business because the fisheries were then, U.S. fisheries were then in even worse shape than they were when I was working on them before and mostly because a lot of good advice was not taken. [laugh]

But when they offered me the Nevada job, I decided I'm far enough into this thing where I know where some skeletons are. I know why the [Nuclear Waste Policy] Act is written the way it's written. I knew who the players were. I knew how the Department of Energy acted and how to react to them. I said "Well, if I know this much I might as well stay with it and use what I know." And I didn't ever expect in 1987 that we'd still be fooling with it in 2009. [laugh] But because we had the support of state-wide elected officials, which is pretty unusual. In 1989 the [Nevada State] Legislature passed a bill

making it illegal to store high-level waste in the state. So that gave the State [Nuclear Waste] Agency the policy direction that we are to use all lawful means to oppose this thing. And we have. [laugh] And we've been lucky in the sense that part of the reason Nevada was singled out in 1987 is that we had essentially no power on Capitol Hill. We had two Senators and two members of the House of Representatives. The other two states that were DOE's selected contenders were Texas, and at that time, Texas had two Senators and twenty-seven House members, and Washington—the state of Washington had two Senators and I think at that time either sixteen or eighteen House members. Plus, the Speaker of the House was from Texas, his deputy was from the state of Washington and so we knew things were pretty well set once it was decided that they were going to look at just one site. A couple of the things that drove me was, one, that this country is not very good at policy decisions that involve complex technologies. And if you look at—well just look at the history of the nuclear power industry. It could not have happened without enormous federal subsidies. And you don't get enormous federal subsidies unless it's political decisions, not necessarily good technical decisions. And that's exactly what's happening right now with the drive for a supposed [nuclear power] renaissance. They absolutely can't do it unless the federal government essentially underpins them financially for everything they want to do. And they get greedier and greedier all the time. And also we've discovered through history that nuclear power and democracy don't work very well together. The waste program is a really good example of that with forced siting. And with nuclear power plants, it was essentially impossible to keep a power plant from getting licensed even though people tried very hard. And the institutions were set up to where the public just really has no power in the system. And bad decisions get made

that way. So that's one of the things that sort of incensed me and kept me going all these years.

And the other is that the Department of Energy has been underhanded throughout this whole process. The Act required that there be a selection of a second repository site, and the reason for that was to bring some equity into a system where nobody wanted the site. If we have to do something, then at least don't make the West the dumping ground for the nation when most of the reactors are in the East. So there was a siting process that was going on a little bit behind the first repository siting process but it was aimed at looking at states in the northern Midwest and all the way down to about North Carolina. Because those are the states where there are deep buried granite bodies and granite is one rock type that is pretty attractive for the possibility of isolating nuclear waste. But these are also the populous states. In 1986 there was an election and there were members of Congress who were screaming at the White House that we can't get reelected as long as you're looking at our state for nuclear waste. So in 1986 the Department of Energy on its own stopped the siting process for the second repository just because the political heat was way too high. They couldn't take it. In the 1987 Amendment to the [Nuclear] Waste Policy Act—they got it all together when they selected Nevada as the only site even though the siting process said there were supposed to be three sites characterized. They changed the Act to say only Nevada. And that was done because of Nevada's political weakness. But they also changed the law where it would be too obvious if they named the states that couldn't be looked at. So what they did was in their infinite technical wisdom said that you can't look at any site that would be granite. And it turns out that if you look at what's going on all around the world, granite is the rock type in Sweden, granite is the

rock type in Finland. The science is pretty good. And you can have pretty high confidence that it will actually work in the rock types and the designs that they're looking at. From a technical standpoint it looks like it has a high probably of working well. And it's because of some of the characteristics of the large granite bodies. They settled that we're only going to have one site for the time being, it's going to be in the politically weakest place. It's not going to be because they have a particularly good site. Then as work went on it turns out that the site was about as bad as we thought it was. Our investigations showed some things that DOE refused to believe. And when DOE finally had to believe it because their own data started showing it and they couldn't refute it anymore. Then because the site was looking worse and worse all the time, instead of dropping the site what they did was they changed the rules to the extent that they fit Yucca Mountain. The original siting guidelines because the Act required it, had to have factors by which you either qualify or disqualify a site. Yucca Mountain has a major disqualifier. And we got the Nevada Governor first in 1989 and then again in 1999 to write letters to the Secretary of Energy including a report that explained why the site should be disqualified under their own rules.

DE: What is the disqualifying factor?

SF: The fact that ground water moves very rapidly through the site. And DOE [Department of Energy] until about 1995 just insisted that wasn't the case. And our information all said that yes that is the case. But finally DOE got some data where that could be the only explanation. [laugh] So what they did was they changed their whole model and then in order to—their hydrologic model—and then in order to not have to disqualify the site, when it finally was obvious this that ground water did move faster

than the rule allowed, they changed the rule. And [they] completely wrote out all of the factors that qualify and disqualify a site. So these are the kinds of things that keep you angry enough to work. [laugh]

DE: I can see why.

SF: DOE [Department of Energy] was always sort of dismissive of anybody who objected to anything that they were doing. They knew they were right all the time. Everybody else was wrong all the time and they pretty much ignored the public. They'd hold update meetings and they'd tell people what's going on, but they didn't want to hear from anybody. And we had very difficult times in the meetings between the States and the DOE [Department of Energy] in developing those siting guidelines and in other types of decisions we had to be involved in because we were representing the State [of Nevada] and the State's oversight of the program. They couldn't ignore us completely because we were getting invited to testify to Congress too. [laugh] And we discovered that you just had to play hardball with DOE [Department of Energy] all the time. But they lied in both by things they said and things they didn't say. And we had some really heated Congressional hearings. Other times in meetings it just got really nasty where DOE was insisting that they were going to do something and they didn't particularly care whether the states liked it or not. So most of us representing the states developed a mode of operation that the DOE used to make us appear to be mad dogs all of the time. [laugh] And when DOE was expanding out who to they talk to because of the transportation issue, which is the real sleeper in the whole thing, they started talking to some other states, like Kansas because a majority of cross-country traffic would go through Kansas. I was at a meeting one time where the Secretary of Energy for the State of Kansas was

there and was upset at the level of hardball that I was playing with DOE over some issues. She came and told me about it. And I said, "Well we've got enough experience to know that if we do anything else, they listen to nothing. This way they at least listen to something where we get them in a corner and they know they can't move and we have enough power where we can make them spin their wheels and we can get them distracted to the point where they're wasting all their time dealing with us rather than doing the work that they supposedly are doing in order to get appropriations so they can do more work." She represented Kansas for a couple years and was having sort of the same problems. Finally she came up to me one day and she said, "You know when I first talked to you and I asked you why you acted the way you do, I really didn't like your answer and I didn't understand it. Now I do and that's what I do too [laugh] because it's the only way." But I think one of the things that has been proven here and has been learned earlier in almost every other country that's trying to do anything about permanent isolation of their waste is you absolutely cannot force a site on anybody. It just doesn't work.

Through the years we've sort of joked about how our persistence is well-driven and we're a pretty competitive bunch in terms of being able to figure out how to control a contest. But also sort of hidden under that is Nevada's a small state. Until Senator Reid rose to his prominence, we had no political power. We used to joke about how we'd actually get treated better if we were a colony rather than a state. And look at what Puerto Rico finally pulled off in getting the Navy out of Vieques. And at the same time you know what we sort of jokingly tell people is the one thing that we proved is that if the federal government can't beat Nevada they can't beat anybody. [laugh] We don't get strongly emotional about it, it's just very, very tough business. If we let it wear on us, we

would all have burned out a long time ago. So it's just we play a very dangerous game.

And other state agencies don't like the way we play because we don't follow the rules. If we followed the rules, we'd have a dump ten years ago. But we follow the administrative rules that we have to, but we don't act like nice guy state agency people—because if we did they would have killed us. So that's sort of the nasties of the world.

DE: So in this whole process that you've described, are there particular people or any sort of role models or even values or kind of ethical considerations that guided you in this path that you've been going through at this time?

SF: I think just because of coming from an environmentalist approach, which was much of it. In my newspaper and also being on those regional committees, I got into the system of instead of being an organization environmental activist. I've figured out for myself anyway that after the twelve years it took me to and all of us to defeat that harbor project, I started feeling that I can probably get more useful stuff done being on the inside than on the outside and just pushing my way through. When I ran the [nuclear waste] program in Texas, I was part of the Governor's top staff and we'd meet and talk about other problems the state had. We were at a time when Texas environmental regulations had worked fairly well, but things were changing like the chemical industry and the oil industry so regulations were becoming more of a problem, partly because they were not updated well and partly because industries were changing and their needs were changing. So in one of our cabinet meetings, the Governor used to get us what we called the midnight memos. He'd wake up in the middle of the night write something down and then just tell somebody "Get this done." And one of the things was "We got to take a hard look at regulation of chemical industry." And so in a cabinet meeting I had an idea

about how the whole approach to the regulations could change and probably be more protective but less of a hassle for everybody. So I just laid it out on eight feet of blackboard and the Governor's Chief of Staff said, "Well put us together a white paper on that." Which I did. And it eventually ended up where after about two years and a forty-member advisory committee, Texas regulation of the chemical industry changed drastically. The industry paid about eighty million dollars a year that they hadn't been paying before, and we were back up to date and the industry wasn't griping and trying to do bad things all the time. But it has and you know, I felt sort of good that I was in a situation where if I had an idea that I thought worked and talked it through with people that maybe there's a chance that we can make things better. And I know if I pushed the same things from the outside, it would have been dead. I would have never gotten near it.

I guess the person who got me into all of this is the guy who was the state geologist, the Director of the Bureau of Economic Geology. And I had always, gotten along with him very well when I was in graduate school. He and a group of other professors in the department had worked out a whole new approach to analyzing geology for oil exploration. They were just running it up the flag pole when I came to graduate school at the University of Texas. And the approach to me was extremely logical and I could understand why we'd been doing things wrong for so long in analyzing sedimentary rock. As a student project I took on mapping a portion of the formation outside of Austin using these new principals. And it convinced me and them, "Yeah this does work at small scale and large scale." We got close because we had some intellectual agreement and it was groundbreaking stuff. It changed the way oil exploration is done. He first got me into working for him at the Bureau of Economic Geology on something

that a month before he called I would have never even thought anything about it. I would have just kept doing what I was doing. And then once we had worked together for a little while on the advisory committee on the [Nuclear] Waste Policy Act, he sort of moved me into it a little at a time and at the same time, had enough political power to where if I was willing he could get me the positions like the Director of the Texas Nuclear Waste Programs Office, or the office within the Governor's office. By the time it came to doing that, he was just convinced that it was obvious that I was the only one who could do the job. And he had enough political clout to—where the job was just never even competed. I was just told the job's yours. [laugh]

DE: And what was his name?

SF: Bill Fisher.

DE: Bill Fisher, thanks.

SF: And he's been at one time or another president I think of all of the major national geologist organizations. He's very prominent. He, under [President Gerald] Ford, was the Director of the Bureau of Mines and so a very well-known geologist in the country. And it was mostly through his prodding and plowing at the same time [laugh] it just sort of worked out and finally I got to the point where I just felt that I knew so much I couldn't afford to throw it away.

DE: And there's still that geology link that is your original area of study.

SF: In the case of Yucca Mountain aside from all the political issues involved, economic issues involved, geologically the site is just wrong. It does not work.

DE: Yeah that's actually one of my questions. So can you talk a little bit more about what some of the, you don't have to tell me everything but, some of the major geological problems.

SF: Well the major problem is that if waste is going to escape and get to the environment – it's going to be water that carries it. In Yucca Mountain the rock is fractured, the waste would be above the water table. And even though it's advertised as a dry site, water runs down through the fractures very rapidly and will contact the waste, then get to the water table, and then get out to where farmers use it for irrigation. It eventually comes to the surface either through pumping or farther down gradient in a playa (lake bed). The idea of geologic disposal is that the waste stays where you put it. You put it in the rock because the rock's been there for a long time and isn't going to be eroded away or is in a situation where erosion will be very slow and the idea is that you don't want moving water contacting that waste. In the case of Yucca Mountain because it is above the water table and it's a desert and because they didn't really look at it the right way, they were saying it's dry and that water won't contact the waste and get it moving. But that's just not the case. It wasn't till 1995 that they (DOE) finally believed their own data that says that that's what happens. And that's when they changed their hydrologic model, showing their understanding of it. That's when they decided that in order to not have to walk away from Yucca Mountain, what they need to do is to figure out how to keep the water away from the waste. So they went looking for a metal that they can use for a container that's highly corrosion resistant. And then when it turns out that nothing is entirely corrosion resistant, they decide they have to put drip shields over the top to keep "non-existent" water from dripping on the metal and corroding it. And without those, what they call

engineered barriers, meaning metal container and the drip shield, if you just put the waste in Yucca Mountain without any of that you're going to see it in the environment in certainly less than one thousand years. And in fact we can show calculations that it could possibly be as soon as one hundred years. The geology simply doesn't contain the waste. So what they've done is invented engineered things that will only delay the release of the waste. They don't stop it. They stop it only as long as they function exactly as they're supposed to which means that as soon as they start corroding, the whole system goes back to where it would've been if you didn't have the engineered barriers. And what we have discovered since is that the metal container isn't even the crucial piece. The crucial piece turns out to be the drip shield. We have taken DOE's data and calculations and done a calculation that they didn't do. What happens to the performance, meaning what is the dose if you don't have a drip shield? Using all of their information, we redid the calculation for what the doses are to people if, in the code, we turned off the switch for the drip shield. It turns out if you do that then the EPA [Environmental Protection Agency] standard which sets the maximum dose that can be received by an individual, is exceeded in about two hundred and fifty years. And you get a peak dose in less than a thousand years, meaning that geology does nothing to keep the waste where it is. And the waste is long enough lived to where within the million year regulatory period those barriers are all going to go away regardless of whether you think they're gonna corrode in ten thousand, a hundred thousand or five hundred thousand years. When they go away you are going to have a dose that exceeds the standard. And so it is just a bad site and you can't fix it. You can only delay.

DE: Yeah I read some things about the seismology too like the volcanism and earthquakes does that play into it? I mean it sounds like water is the biggest one.

SF: They would be more along the catastrophic line than just the chronic inability of the site to work. You can stand on the top of Yucca Mountain and you can see volcanic cones around it. The issue then is from the Department of Energy's point of view is not that "Gee it's not really a good idea to have a site like this where there's young volcanism."

And it's young. The most recent eruptions that we can find on a nearby cone is about seventy-five thousand years which is a blink in geologic time. Major cones right next to the mountain in Crater Flat, a million to two million years old and which is still in the range. So instead of saying that "Geez this is not really a good thing to be doing, because of the potential for volcanism." What they say instead is, "Well let's look at what the probability is of volcanic activity actually intersecting a repository and causing a release of waste." So rather than saying "We shouldn't be anywhere near this. In order to preserve the site, let's look at what's the probability that something bad will happen."

And they impaneled a bunch of volcanologists who had from their own experience worked out probabilities of the worst thing happening and it's anything from about one in a million to one in a hundred million. And there's a lot of uncertainty. You have experts on both ends. And the Nuclear Regulatory Commission and it's licensing rules says that if the probability is less than about one in ten million, then you don't even have to analyze the consequence. So they're so close to that with the average of the experts, that they are having to look at the consequence. But their approach is actually saying, "Well we're not looking really at the consequence, we want to know what the risk is from the consequence." Mathematically what you do in order to get risk, is multiply the

consequence times the probability that it will happen. So the consequence is very high but the probability is very low. So they can say it's an acceptable risk. But the consequence itself is enormous. So it is low probability, but if you can avoid a low probability high consequence accident then why don't you avoid it? If you don't have to take the risk, why take the risk? And in this case you don't have to take the risk.

The NRC [Nuclear Regulatory Commission] has rules about where you can site a nuclear power plant having to do with seismicity. And they lie, cheat and steal just like everybody else on it and they make mistakes. But their rule is such that because of the known seismicity in the Yucca Mountain area, you couldn't build a nuclear power plant under their rules. But because a repository is under a different rule, then it's okay. As long as you've defined the seismicity. And there isn't a cut off. You just define it. And then you still have the probability rules where it cuts off. If it's below this probability and you don't have to do anything about it. And they also say with some level of correctness that the ground shaking below the ground due to an earthquake is attenuated. And it is. But that doesn't mean that you could not have a fault that developed—a new fault develop that actually intersects the repository and intersects waste. It also doesn't mean that even though ground shaking is less than it would be on the surface, it doesn't mean that the way they have the waste placed in the tunnels isn't going to be disturbed. And you're going to have waste canisters doing things that they weren't designed to do—falling, rolling around and getting damaged in ways they can corrode more easily. So again you have a situation where if you don't have to take the risk, why do it?

Defining the risk is only as good as your mathematical tools. You can't try it and see what happens because you only get one chance. So it's one of these things where we

know of at least one condition that is going to result in the repository releasing radionuclides to the environment and it's not a matter of if, it's a matter of when. And we know of at least two disturbing factors that if they did happen, the consequences are pretty high and so those are sort of three things that if you knew all of this when you looked at the site, you wouldn't even look twice. [laugh] The only reason that Yucca Mountain is the site at all is that in 1977, the General Accounting Office suggested to the department that they—because they knew siting was going to be difficult—look at sites or at least some sites on atomic energy defense facilities. So they got a site at Hanford to look at, and they got NTS [Nevada Test Site]. When they got to NTS, they started looking around. And they actually had at a half a dozen potential locations they wanted to look at. One of them in granite. And so as soon as the weapons side got wind of what they were looking at, the weapons people said, “We've already used that site and it's contaminated, or we have plans to use that site.” And they literally chased them around the [Nevada] Test Site until they found Yucca Mountain which is not on the Test Site. It's just off the edge of the Test Site, but the access to it is easy from the Test Site. It's not a site they would have found if they were looking at geology around the country to see if they could find a site. They found it only because institutionally, they thought it might be easier to look at locations where people had accepted nuclear stuff and weapons testing. So the whole process is sort of slimy all the time. [laugh]

And at the very beginning with the potentially acceptable sites, which is the first step of site screening, they had more than just the salt sites that ended up being looked at. They had a couple more and the very first phone call when they started after the [Nuclear Waste Policy] Act passed—when they started saying, “Well what are going to be the

potentially acceptable sites?" I got a phone call from one of the top managers at DOE, where he was wanting to know if I would object if they didn't include all of the existing salt sites. And the ones that they were going to drop, one of them or two of them were in Louisiana. But we had in our hand a copy of a telegram from [Ronald] Reagan when he was running for president promising Louisiana that the site would not be there if he got elected. And so I didn't flash that, they already knew I had that. And so I said, "Well if you're going to do that and you're just starting out on this program that's supposed to have some scientific integrity and it's supposed to be free of politics, what are you going to tell the people of the country about why you suddenly have two less sites? And do you have a technical basis for it?" "No." "What basis do you have?" "Well we really can't say." And I said, "Well put all the sites in. If you don't I'll blow the whistle." [laugh] And so they did. But you know from day one they're sleazing around. And...

DE: And making it political it sounds like.

SF: Uh huh, just right away. And he was smart enough to call around. If he hadn't I would have just blown the whistle. And then the program maybe even would have ended sooner. [laugh] But I... You know, looking back in the work that I did in helping to write the [Nuclear Waste Policy] Act if I had known or not been so naive about what DOE [Department of Energy] was capable of, the Act would've probably never passed because it would have been too onerous for DOE to try to do it. Because we would have had to write the protections in. I think I covered somewhere around what you were asking for.

DE: Yeah you did, yeah. I just have a few more questions. We're getting good stuff on this. So in terms of the scientific information that you've collected or that your team has collected, did you have scientific experts that you were drawing from outside of the DOE

[Department of Energy]? Or how did you at the Nevada office gain your technical information. Or were you doing some of it?

SF: I was not doing very much of it. We did hire consultants and good people. And hydrologists who help us come to the conclusions that we did long before DOE [Department of Energy] did. We had people who were able to tell us to the extent that we needed information about seismicity, about volcanism. We had one of the top volcanologists in the country who is right here at UNLV [University of Nevada, Las Vegas]. And he's been working with us for twenty years. He's published papers and advanced the science of volcanology through the work that he's done here. And so yeah, in the places where we wanted our own independent work, we got really good people and are able to use that independent work. We also ourselves and with our consultants were constantly reviewing DOE's work and finding what was wrong with it. And because at least, ostensibly DOE is supposed to make its licensing case; we don't have to defeat them. In reality we have to, but DOE is supposed to make its case. And through the years when we saw they were not making their case or that they were just dead wrong, we let them know about it. We also had another forum to work with, the Nuclear Waste Technical Review Board, which is a federal advisory committee that's supposed to be advising DOE and the government on the scientific validity of DOE's work. They hold regular meetings and we used that as a forum a lot of the time to show what we think DOE's doing wrong. And then sometimes they take up our issue and sometimes they don't but at least we get on a record and it's a transcript that we use. There was an NRC [Nuclear Regulatory Commission] Advisory Committee on Nuclear Waste that we used that as a forum as well. We were able to present a fair amount of our own work there.

Some of it, for strategic reasons, we didn't present but we'll be using it in contentions. And so yeah we ran—what I considered to be a highly competent technical program in areas where we thought we needed independent work.

DE: Right. Did you find that there was ever tension between the DOE [Department of Energy] scientists and the people that you were working with?

SF: Yeah there's always tension. It depends a lot on personalities. But the DOE [Department of Energy] scientists, mostly because so much of why they think Yucca Mountain is a good site is based on probabilistic risk assessment. The DOE guys can't think in that direction. And the epitome is when something is—if you come up with a feature where you can't really understand the uncertainty of it, their reaction is to say “Well it really doesn't matter because it's so small, and why would you want to lose an otherwise good site.” So they're very defensive of their work. And our guys argue with them, and they try to keep it at a peer level. It doesn't often get out of hand. But yeah differences are recognized and people try to make sure that the other side understands what it is they're talking about. We have done independent work on the corrosion of this supposedly highly corrosion-resistant metal and DOE started out just laughing at us. And we had good metallurgists in universities around the country working on it. We decided to do our research in a way very different from what DOE did. By the way theirs has since been discredited by them because of a lot of stupid stuff they did in designing the experiments and the way they carried them out. DOE's approach was to decide what they think are the environmental conditions that the metal materials are going to have to withstand and then run long-term experiments in what we considered to be mild conditions. We started thinking about “Well, we know what the mild conditions might be,

but what could some of the extreme conditions be that we can justify? And what does it take to make this stuff fail rather than just try to get a corrosion rate for ten years that you extrapolate to a million?" We started out with our experiments under very harsh conditions to try to see where the failure points were and what the failure mechanisms were. And then worked back from that to things that we think are probably more likely but harsh conditions. So what they tried to do was totally discredit our work because they say the conditions that we used originally would never happen in Yucca Mountain and therefore we're just being alarmists. And they literally just said, "Your work is trash," and refused to understand why we were doing what we were doing but it was just the first step of what we were doing. We completed the three steps and we now know what the vulnerability of that metal is. And DOE still says it doesn't have any. And their experiments have been discredited. We know that the corrosion of the metal is probably going to be somewhere between what DOE says it will be and what we say it will be. But if you take just what DOE says, we know that that's wrong. So yeah we've run a technical program that I think has given us just about everything that we needed. We didn't run a Cadillac program, we didn't do work that we didn't think had some important dose consequence. We were looking for alternatives primarily because performance is the whole thing. It's "What's the dose going to be to somebody?" And you have to deal with uncertainly, but still we felt we had to have reputable science and have it out there because DOE stuff doesn't get peer-reviewed. They just review it themselves and say "That's it." In their performance code is a very very complicated computer programs that deal with about ten thousand variables. They're on about the eighth rendition of that code. Each time they put it out, it was "perfect," until the next

time they put it out. [laugh] And it's always going to be that way because you learn more about code. One of the problems with DOE's performance assessment is that their code works a lot better if you don't put data into it. Data seems to mess up the results. [laugh] And I'm, just for one of our contentions right now, working through a thing where DOE wrote the code and conceptually it's probably okay, but if you take the site data and plug it in, it doesn't work because it doesn't give you the hydrologic results that we see at the site. So what DOE did was made up this statistical deal for what part of the data to use to make it sort of match up to what you observe. And there's no technical basis for the statistics other than it's essentially curve fitting. [laugh] And you know we catch that all the time. So this is why we have to keep doing what we do.

DE: So I guess my final question is based on the technical and scientific background that you have and also kind of the understanding of the political factors, what is the best or what are alternate potential solutions to the Yucca Mountain? And kind of along those lines, you know with Obama's kind of recent opposition to Yucca Mountain, do you see any movement to something else other than Yucca?

SF: Well first, I guess for years I've—always had to question: is geologic isolation achievable? And I still think in the right setting it is, at pretty high confidence levels. What we can do right now is what we are doing, and that's to store the waste at the reactors. It's licensed, it's maintainable, it's there to see everyday. If you have a problem you can figure out how to fix it. But I don't think that we're politically mature enough to go looking for another site right away because of the atrocities that have gone on. I know you'll use that word later. [laugh] But I think what we can do is start an almost an academic program—or maybe an academic program, maybe a National Science

Foundation thing or something to start trying to figure out what we have learned in terms of what would constitute a site with very high probability of isolating waste. We know some basic features and I think we need to spend some time getting much better about saying not only what we don't want, but trying to refine what it is we do want. And then because we have such amazingly diverse geology in this country, I think at some point, if politics doesn't totally destroy it, that we could have—we could walk around looking at geologic settings with both eyes opened rather than with the geology eye looking at the ground and the politics eye looking at the sky. [laugh] And so I think it is possible, and there's a—one of the things that's sort of come clear in this whole couple decades that is Americans are so sort of built with this idea that you have to keep making progress. But, in this particular case, standing still is the best progress you get because you're doing what you know how to do which is storing the waste. Progress towards the wrong result is not progress. And it's driven for things—Well for instance, in the first line of your proposal that you sent, you say that there's a nuclear waste crisis. There isn't. [laugh]

DE: Is that because it's already being stored on-site?

SF: It's because it can be stored safely on-site. And the nuclear industry hasn't since twenty-five years ago claimed that they'll have to shut down reactors if they don't have someplace to get rid of the waste. That was the scare that they threw in to get the Nuclear Waste Policy Act originally. But just shortly after the Nuclear Waste Policy Act passed, then they suddenly woke up to the fact that the German's had already developed casks for storage. And a couple companies in the U.S. in the early eighties bought a couple of them and used them. And then a commercial cask vendor program got started with half a dozen

companies in this country. And you know, they're now instead of licensing casks for twenty years, they're licensing them for forty years.

DE: Pretty good, yeah.

SF: So we have a technology. The industry is no longer claiming that they're at risk and that people are going to have their lights shut out because we don't have Yucca Mountain. They haven't claimed that for a long time. They're even farther from it now. They say...we can have a renaissance without Yucca Mountain. And they're just saying it because it's true and they forget that they lied about it before. They think it's way more important to build more reactors than it is to figure out what to do with the waste because they know one way or another the waste is going to get taken care of. As long as it's not their responsibility they don't care. They keep saying that people around the reactors don't want that waste piling up there. They don't care. What they care about is if somebody's trying to move it through their community. [laugh] It isn't bad waste until you try to move it. And at the reactors—people in reactor communities know that as long as reactor's running, there's waste there. As long [as the] reactor's running, the biggest risk is the reactor itself. So the industry puts out these myths. And the people around the reactors have no reason to say anything because they don't—the industry doesn't tell the myth where the reactor is, they tell it to where they want to put the waste. There are few cases where people right at reactors want it done. What they really want is to not have the reactor. And many of these places where you have people who are just—trying to pressure the system to get the waste out of here and shut the reactor. There are a few places that want that but in the alternative they say just get the waste out of here because

they know the reactor's not going to get shut down because they want it shut down. And as long as it's operating it's making waste.

DE: And I guess it does have to stay there for a while even before they could move it...

SF: Yeah, the way the regulations are set up, and I think it's probably reasonable, is that you have to keep it in the pool for at least five years. Most of that is so you don't have to go to riskier and less certain design features and casks to take care of the, not so much high radiation, but the high temperature. And it can be done. It just costs more and the risk is higher. And so you got pool space, use it. We're also hearing another push, and I don't think it's going anywhere, but more and more people are saying "Well we've got to have reprocessing." And the arguments against reprocessing are the same as they've been since Gerald Ford first said—they say Jimmy Carter stopped reprocessing. Well, Gerald Ford did it first, and Carter reiterated it. Well it's because they don't like Carter. [laugh] Well, here we are back to the same thing again. Twist it just enough to where you can get negative reaction and make it sound as if it's something bad. [laugh] But it's still the same thing. Reprocessing is a dirty process, results in fuel that is two to four times more expensive than new uranium and the reprocessing technology allows plutonium to be separated. It's a non-proliferation issue. We're telling people all over the world, "You can't have plutonium." And here we—if we're reprocessing, what we're doing is having access to more plutonium than we could possibly know what to do with. But we know what it's for and that's making weapons. [laugh] And again, in all the discussions that's been going on for the last couple years, this year the latest big scheme is a scheme that involves a whole bunch of other stuff in addition to reprocessing, it was unfunded by this Congress. But people are still talking reprocessing even though it makes absolutely no

sense. And the only way it's going to get done is if the federal government pays for it because the industry isn't going to pay for it. [President Ronald] Reagan actually ended the ban on reprocessing but put the condition on it that the private sector has to do it if it's going to be done. Well nobody in the private sector's going to spend the money because it's a dead end. You got to pay for the plant, which is a minimum right now of over four billion dollars for the plant, and then to get fuel that's so expensive it doesn't compete on the market. What's the point?

DE: Yeah, doesn't sound...

SF: But because of the green talk, people are touting it as recycling and it's not. You still end up with waste. And you end up with a fuel that nobody's going to buy because it's too expensive. And it's not like we don't have any uranium. There's plenty of uranium. And the price of uranium would have to go up more than two times and maybe more than four times before reprocessing is even worth thinking about. And people say well you're throwing away all this energy. Well if it's cheaper to throw it away do it the American way. Throw it away. Shouldn't be doing it in the first place. [laugh] I have never liked the idea of nuclear power just because it's high risk in the sense that it's one of these low probability-high consequence things. And if you can avoid high consequence and there are alternatives, use the alternatives. Aside from that it's what I was saying earlier that nuclear power and democracy just can't mix because one them isn't going to work. And I prefer it was nuclear power.

DE: And let democracy decide. Well I think that's a good note to end on. This is really wonderful information. Thank you. I think I could probably interview for more hours, but...

SF: I've had too many years of thinking about it.

DE: Yeah you've been involved for a long time. So anyway thank you very much.

SF: Okay, very good.