GERRY STEPHENSON

Date and place of birth (if available):

Date and place of interview: September 2, 2011, 10:20 a.m. at Mr. Stephenson's residence in Canmore, Alberta

Name of interviewer: Peter McKenzie-Brown

Name of videographer: Peter Tombrowski

Full names (spelled out) of all others present: N/A

Consent form signed: Yes

Initials of Interviewer: PMB

Last name of subject: STEPHENSON

PMB: I'm talking to Gerry Stephenson who is a Mining Engineer by background. We're at his house here in Canmore, Alberta and I don't know whether the cameras can see this at all, but behind him is an amazing collection of antiques from the mining industry, old lights and the kind of bird cage that you used to take a bird into the mine to protect the miners; an amazing collection of wonderful antiques.

Gerry is going to explain to us how he became involved in in-situ oil sands production from an engineering perspective and specifically about his involvement with the Underground Test Facility. And so that is the basic story that we are going to be focusing on today. The date today is the 2nd of September and it's now about 10:20 in the morning. Okay, Gerry, thank you very much for agreeing to participate in this. Can you begin by telling us a little bit about your career, your biography…?

STEPHENSON: Sure.

PMB: …and how your career developed?

STEPHENSON: Yes, I took a degree in Mining Engineering at Nottingham University and came out in 1952 and the first thing I did was to come to Canada actually, and I worked in a gold mine in Quebec, in Val d'Or, for six months, just to see a bit of the world, you know. Then I went back to England because I had gone through University on a Coal Board Scholarship.

PMB: Sorry, what kind of scholarship?

STEPHENSON: A National Coal Board.

PMB: Oh, National Coal Board, okay.

STEPHENSON: At that time the British Coal Industry was run by the government, so I came back and worked for them for a total of seven years, and my first experience was three years on the coal face working as a collier, digging coal, largely by hand because this was 1952/1953. And I spent three years doing that and for a big part of that of that time I worked in a 20 inch thick coal field, digging nine tonnes of coal a day for the princely sum of $2.50 a day. Now it toughened me up and I needed toughening because the coal mine industry is, it's not an easy industry to be in either as a miner, a manager or an engineer. So I...

PMB: Now when you were working in the mine, you already had a university degree?

STEPHENSON: I did, but I knew nothing about mining. It was all theoretical knowledge. The point is when you go into a mine for the first time, even if you've got a degree, you're a danger to everybody yourself included, if you're not properly supervised. So I was put with two old miners, well they seemed old to me at the time, they were in their mid-50's and they taught me how to keep myself safe and how to keep from putting them at risk as well. So I learned a lot about people in those three years, you know, it wasn't just learning about coal mining, it was learning about people. So then I became an underground official, what they call a deputy, an overman. And then I got my manager's ticket and for three years I was an underground manager at the largest coal mine in Cumberland, which was where I was working. I quite enjoyed that and was moderately successful, but I did find that the management systems used by the Coal Board at that time, in my humble opinion, were very poor indeed. The Coal Board was largely dominated by having a Labour government in power and by the fact that the unions had a lot of control over management of the mines.

So I found that very exasperating and in 1960 I left the Coal Board, and my wife and I with our four year old daughter, we went to India and I worked for five years in northeast India. I went out as Chief Engineer at a coal company there, but the General Manager had a heart attack just before I arrived and I was assured it was nothing to do with my arrival. But anyway, the point was that they didn't have a General Manager, so they took a risk and they made me General Manager at 28 years old, for seven coal mines, a coke plant, a hospital, schools, housing and 4,000 employees and I wasn't frightened by this because I was too inexperienced to realize just what I was getting into at that time, you know. And I really enjoyed India, fell in love with the country and have been back many times since and I learned the language to a limited extent. And I put into practice some of my own ideas on how you manage people to their benefit and to yours, I introduced...

The people who worked there were largely migrant workers, bachelors living in middle-huts, no social life, drinking too much, very unhappy as a result and that caused me a lot of problems because I encountered a lot of strikes. So I got money from the company to introduce athletics and soccer, first-aid competitions, rescue competitions and set up my seven mines so that they competed with

each other on the sports field and that resulted in a certain amount of loyalty, from even the ordinary miner to his mine and to a limited extent, to his company. In the third year there, I didn't have a single strike.

PMB: What were the shifts? 12 hours?

STEPHENSON: Oh it was a three shift system, morning shift, which I think started at six in the morning, eight hours, and then two in the afternoon and then ten o'clock at night.

PMB: Was it an Indian owned company?

STEPHENSON: No it was a British-Indian owned...

PMB: Okay.

STEPHENSON: ...joint company, called the East Indian Coal Company.

PMB: Okay, and at some point you came to Canada.

STEPHENSON: Yeah, I came back to England and worked in London for a consulting company but I wasn't a very good employee I don't think. I was a bit too, I had my own ideas how you did things and that didn't fit in very well. So I resigned and I came to Canada as Chief Engineer of Canmore Mines here in Canmore and I was there for five years and was mainly occupied with designing and engineering mines and doing the reclamation of the past mining activities through here. And that included the construction of Quarry Lake, which some of your listeners may have heard of. But then it was taken over by a large American corporation and again, I found I wasn't a very good employee for a large American corporation. So I'd been wanting to work for myself for a long time, so at that point, my wife and I, Avice and I, we set up an independent consulting company.

PMB: How is her name spelled?

STEPHENSON: Avice. A-V-I-C-E. And she was, she did all the typing, the accounting. She prepared maps for me and I did the engineering and so on. And we worked together quite… we had a few rows you know as you do in business when a man and wife are working together, but altogether I was quite successful. Soon after I started that company, which was in 1974, I was approached by a board member, Fred Kidd, who was on the Board of AOSTRA and he said, "We need someone to do evaluations of proposals that come to AOSTRA for recovering bitumen by means other than surface mining, which is what AOSTRA was set up to do. And some of them involved mining activities, would you work for us on that as a contractor?"So I took that on.

PMB: Before you leave that, there's a question I have here. AOSTRA, did I hear you say it was set up to fund research into underground project?

STEPHENSON: No. It was set up to try and find ways of recovering bitumen from the oil sands that did not involve surface mining.

PMB: So in other words, it would not have funded projects proposed by Syncrude or Suncor?

STEPHENSON: Not the standard mining projects, no. The thinking was at that time, with only about 5 percent of the total reserve being surface minable, how on earth were they going to develop the other 95 percent and under Premier Lougheed, who in my opinion was just one of the best politicians this country has ever seen, it was at his instigation that the Alberta Oil Sands Technology and Research Authority was set up, AOSTRA. And the Chairman was Dr. Clem Bowman, who was a real character himself.

PMB: We interviewed him a few weeks ago.

STEPHENSON: Did you? Ah.

PMB: And he told us we had to talk to you.

STEPHENSON: Oh good! Good.

PMB: So did Maurice Carrigy.

STEPHENSON: And Maurice, yeah. Maurice was Deputy Chairman.

PMB: That's right.

STEPHENSON: So one of the things that they looked at was the idea of constructing tunnels underground to apply the SAGD system, Steam-Assisted Gravity Drainage that was being developed by Roger Butler at the University of Calgary.

PMB: Roger Butler went to the University of Calgary, I think in the mid-80s?

STEPHENSON: Yes, but I think even before that...

PMB: But you're talking about a period around '76.

STEPHENSON: But I think before that he had been working either with or for AOSTRA, or perhaps the Alberta Research Council.

PMB: Imperial, Imperial Oil?

STEPHENSON: Perhaps Imperial Oil, yeah.

PMB: Okay.

STEPHENSON: So I think, you know, certainly the thinking was at that time that if we were going to apply Steam-Assisted Gravity Drainage, the ideal location for it was an underground tunnel to take advantage of drainage into the tunnel. So AOSTRA asked me to go on a visit to a mine in Russia, an underground oil mine at a place called Yarega. This took place in 1976 actually. And this was pretty well on the Arctic Circle, way up north, and they had a heavy oil deposit there into fine grain sandstone and they found it uneconomic to drill from the surface, so they'd sunk shafts down and put tunnels in the reservoir itself and were drilling wells to inject steam and separate wells to recover the mobilized heavy oil.

PMB: So these were horizontal wells they were drilling from the shafts?

STEPHENSON: No, the wells were angled upwards, from the tunnels, to use gravity drainage in the well.

PMB: Oh.

STEPHENSON: And the wells that were injecting steam were drilled from an upper level of tunnel, which was above the heavy oil reservoir, so the injection wells were drilled from above, but from tunnels and the recovery wells were drilled from below, and there were, I think five oil companies had vice presidents on the same trip who were interested.

PMB: Do you remember the names of the companies?

STEPHENSON: Canadian Oxy was one. Petro-Canada was another. Sorry, its a long time ago.

PMB: Okay, but this was...okay.

STEPHENSON: That was in 1976. So I went on that trip and I found it fascinating because the system was definitely working, but the mine was very, very primitive. The tunnels were tiny, they weren't mechanized at all, the piping systems were not much better than you would find in your garden, but the thing was, what it demonstrated was, if you heat heavy oil, it will mobilize, it will be possible then to drain it, and if you put in wells for production that, where the well heads are below the reservoir, you will get production without pumping.

PMB: Was Roger Butler on this trip by any chance?

STEPHENSON: No, Roger didn't go on that.

PMB: Okay.

STEPHENSON: Maurice Carrigy went and Tom, I think it was Tom... someone from Petro-Canada, Tom Smith, I think and then two people from Canadian Oxy and then there was at least one other oil company.

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PMB: Okay, doesn't matter.

STEPHENSON: And the trip was organized by Williams Brothers of Calgary, who were promoting the idea of using this Russian technology and the Russians wanted to have the technology used and charge for its use. So we came back and between the Williams Brothers and myself, we wrote a report for AOSTRA that said, basically, the system works, it's very primitive but we should study for application in the oil sands where we have similar problems, the bitumen is not mobilized, we cannot produce anything by simply drilling, we have to apply heat to mobilize it and the ideal place to apply that heat is right at that base of the reservoir, and then was to drill upwards into it. In other words, the concept should use two important principles, one is that...

[1ST RECORDING ENDS]

[2ND RECORDING RESUMES]

PMB: We had a momentary break because of a technical problem with this computer, say something again will you please?

STEPHENSON: Yeah sure.

PMB: Okay, that's perfect. And so where this tape ended, where that last recording ended, you had come back from Russia, and you said to, I think it was Maurice Carrigy, you said, "We really need to study this thing. Clearly it works." But you hadn't quite described the two principles it is based on, steam goes up, oil comes down; would you start there?

STEPHENSON: Yeah, well, when we started looking at this for introduction into the oil sands, it was clear there were two things that were important about it, one was that the wells be below the...the production wells, the well heads, be below the reservoir so that gravity is used to draw the mobilized bitumen down into the tunnels, through the well heads into a pipeline system. In other words, liquid flows downhill, so make use of that. And secondly, that we have the wells right at the base of the reservoir so that as the heat is generated by the steam injection well, heat rises always, so it would rise through the reservoir, and ideally would be largely utilized by the time the steam reached the top of the recoverable bitumen. So the next step was that a project was undertaken, jointly funded by Gulf and AOSTRA, but operated by Gulf on the Surmount Project which was a very rich reservoir, but quite deep. And the idea of the study, which lasted about I think a year and a half, was to explore the Surmount, get the data we needed and then prepare a report comparing the use of what we now call SAGD, comparing the use of SAGD with, between the use of tunnels under the reservoir, and the use of wells drilled purely from the surface. SAGD, Steam-Assisted Gravity Drainage, at that time we didn't know it by that name but it makes sense to use that now. The problem arose when Gulf staff, on the process side, insisted that they had to use 2,000 PSI, steam pressure...

PMB: PSI is Pounds per Square Inch.

STEPHENSON: To fracture the bitumen oil sands. Now I was a Mining Engineer, but what I was beginning to realize was that, sometimes you encounter people, I think in the oil industry to be quite honest, who tend to ignore common sense and apply very deep, sometimes rather academic reasoning to the oil sands and there was a case here which was very much a case of, we must do what we've always done, which was apply high pressures to fracture an oil reservoir, so that the oil would flow. What they were forgetting in this case was that we didn't have to fracture the reservoir. What we had to do was create a path for the steam, around the injection well, and then allow steam to soak up, through the reservoir, of its own accord, rising to form a steam chamber.

And I said to them, if you apply 2,000 PSI, first of all you will make the tunnels tremendously expensive, and what the calculation showed was that the tunnel liner would cost eight times as much as driving the tunnel itself, because of the pressures adjacent to the tunnel in the reservoir. And I said the second thing is, common sense tells me that if you fracture the bitumen with heavy pressures like that, the steam will simply go up the fractures and will escape into the upper levels of the reservoir, and the overburden above it, and the steam will not be used efficiently, you will create paths through the reservoir for the steam, and it will take those paths. And I based this on my own knowledge of putting out fires in surface spoil heaps at coal mines.

PMB: Now before we leave that…The year for the Surmount experiments, as I recall, was around '79 or '80?

STEPHENSON: That's right, yes, it was.

PMB: Something like that. And of course that was just about the time that Esso had come up with its discovery at Cold Lake, different reservoir, that if they did use the high pressure steam, basically hydraulic fracturing, it increased production of a well from a couple of barrels to 70 barrels a day.

STEPHENSON: Yes, that's right.

PMB: So there was an argument for the fracturing.

STEPHENSON: Yeah, I wasn't against fracturing, I was against fracturing at these ridiculously high levels of 2,000 PSI because even now, people have to create a path between the injection and the production well in a standard SAGD operation as it's done now. They have to create that path before the steam chamber can start to form. In other words, they have to have a path for the bitumen that it mobilized to go from the circumference area of the injection well, down to the production well. So I wasn't against fracturing, I was against intensive fracturing at very high pressures. Gulf refused to listen. The result was and the study showed that the very little economic difference the surface well system and the underground well system, and the main reason for that was that the underground tunnels were so hugely expensive that it basically altered the economics of the underground approach. So the project resulted in nothing. Nothing was done after that for three years.

PMB: Surmount was drilled into the Cold Lake reservoir, wasn't it?

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STEPHENSON: No, Surmount is in the McMurray.

PMB: Oh, okay sorry, Surmount was drilled in the Cold Lake oil sands area, is that correct?

STEPHENSON: No.

PMB: Is it near Athabasca?

STEPHENSON: It was south of Fort McMurray.

PMB: Okay, it was in the Athabasca.

STEPHENSON: And there's a big project going on there now with SAGD.

PMB: Okay. Can you describe to me the project; you said that Surmount actually did use tunnels.

STEPHENSON: No. The Surmount Project I'm referring to is at the same area as the active Surmount Project now, but at that time we were simply preparing a report based on the geology and the reservoir characteristics that were identified by exploration, as part of this Project. We were comparing, if we use SAGD, is it better to use it from tunnels below the reservoir, access through shafts or it is better to apply the wells from the surface, the way it's being done now...

[INTERRUPTION]

[RESUMES]

PMB: Okay, so you were describing to me what the purpose of your original Surmount Project was.

STEPHENSON: Yeah, so the result of the project, of the study, was that AOSTRA lost interest and Gulf lost interest, because the results did not appear to show that there was any advantage to being in tunnels under the reservoir. And the reason that the study showed there was no advantage to that, was the huge cost of the tunnels, which was due entirely to the fact that Gulf were insisting on using these huge fracture pressures. A tunnel that is only 15 metres, or 20 metres from a reservoir that is under a pressure of 2,000 PSI, is very, very unsafe unless you put a very thick complex lining in the tunnel. So that's what we had to cost and I told them at the time, this is ridiculous, you're not using any common sense, you're just simply going with what you've always done, but Gulf were the operator of the project. So for three years AOSTRA lost interest, and then, I'd been very busy, I'd set up a new company called Norwest Resource Consultants, with two partners.

PMB: N-O-R-W-E-S-T.

STEPHENSON: Right. So Norwest, I set it up with two partners, in Calgary and Salt Lake City. So I was very, very busy and while it really exasperated me that an idea that I knew to be a good one, was now sitting dormant, I didn't have time to do anything about it. Then one day, I think it was in

1981 probably, I'd been mulling over this and getting more and more, you could almost say angry that this thing had gone into limbo, I rang Clem Bowman, the Chairman of AOSTRA, and I said, "Clem, did you ever wonder why we got that unexpected result? Because you and Maurice and the Board, you were all very enthusiastic about this and then suddenly you lost interest because of the negative results we got from the Surmount study." He said, "Yeah." He said, "Why, what happened?" So I explained what had happened, and he said, "Well, that's very interesting." He said, "Are you saying that that study, the results we should ignore them?" And I said, "That's exactly what I'm saying to you. I think the underground approach is a good approach, to apply SAGD and I'd like to discuss it with you."

So I went up to meet Clem, Maurice Carrigy, his Deputy Chairman, and we had a discussion and I explained in more detail what had happened, and I think what happened then was that they asked me, could I prepare a short study on a short report that said why I thought that SAGD should be applied and could be successful and why it should be applied from underground tunnels, access through shafts. So that was a few weeks' work. I did that, and presented it. And then we looked at a number of studies of hypothetical McMurray situations to go into more detail and that probably was done in about early '82. And then one day I was meeting with Clem Bowman and Maurice, I think, and then they said "Well, Gerry, what do we do next? I said, "Well, I think you should stop spending money on paper studies, the paper studies are showing positive results for underground SAGD. I think you should build a pilot project." And they said, "Oh that's..."

PMB: What year was this now?

STEPHENSON: I think it was '81 or '82. And they said, "Well that's very interesting, what do you see it consisting of?" I said, "Well you would need two shafts and about one kilometre of tunnel and that would provide you the access for the drilling of well pairs, and your team and your other contractors could design a SAGD system for that pilot." And we called it the Underground Test Facility. At that time, it was an idea and it was something on paper, so they were really intrigued. Now, I'm not entirely sure I'm being quite accurate here. I'm just giving you the best memory I can from, what, from 30 years ago. And at my age, my memory isn't that good anyway, so don't hold me to exact dates or exactly what happened but the gist of this was that they asked for a report of what kind of a facility was required, how it could be built, were the shafts feasible; because shafts had been attempted in the sands and the strata above it, the Grand Rapids and the Clearwater, and one shaft that was being constructed by Minalta, a large engineering and coal mining company, had collapsed at a depth of 80 feet. Fortunately, nobody was killed, but it had showed the risk of these shafts.

So in our report, we said we believed that shafts can be constructed safely, to the depths required. And we talked about things like, what kind of an area would be most suitable for this, because they wanted to use Crown land obviously. The next step was AOSTRA asked me for an estimated cost of preparing the surface access side of the UTF, in other words, the investment costs, the capital costs of building two shafts, and a tunnel, a kilometre long and then, I did not include the drilling and the steam production and the processing, my task was to look at the underground access side.

PMB: How deep were these shafts?

STEPHENSON: I think they were 270 metres, I think.

PMB: And they were concrete, they were basically concrete reinforced?

STEPHENSON: No, no. They were to be steel cased, but we didn't know that at the time, that came later.

PMB: And the tunnel was how long?

STEPHENSON: There was a total of over a kilometre of tunnel.

PMB: Was it high enough that you could walk through it?

STEPHENSON: Oh yeah. It was four metres high, five metres wide.

PMB: And was it encased in steel?

STEPHENSON: No, it was supported by rock bolts.

PMB: It was supported by?

STEPHENSON: By rock bolts.

PMB: Okay.

STEPHENSON: But maybe I could come back to that later, could I, Peter?

PMB: Please.

STEPHENSON: Because what happened then was that, yes, I think we were asked to prepare a report that gave them an estimate of the budget they would require to build the access stage of the UTF, the shafts in the tunnel. So we did that, and we came up with a cost, I think it was $35 million dollars. And within six months, AOSTRA had those funds to do that. Now this is where AOSTRA, Clem Bowman, Maurice Carrigy, and the Board showed tremendous guts, because the initial reaction from industry was, this is ridiculous you don't need to go into underground tunnels to do this. AOSTRA insisted that they were going to do this and they took a big part of their existing budget and put it into this one project. Fortunately, both Clem and Maurice were very determined individuals, and they said, "No, we believe in this and we're going to do it." They showed a vision that quite frankly had been lacking amongst the majors in progressing this particular idea.

[INTERRUPTION]

[RESUMES]

PMB: Okay, so you were talking about Clem Bowman and Maurice Carrigy and the AOSTRA Board really stood behind this idea.

STEPHENSON: Absolutely, yeah. And so, having done all the work up to that point, we, that is Norwest, were fortunate enough to be assigned the contract to...we'd done a conceptual design, what was needed now was detailed design, engineering and then construction. So we were tasked with finding a company that could do all the detail work of the shaft sinking, could do the tunnel driveage, but initially could do the detailed engineering of those parts of the job and we had a 37 kilometre road to build across the muskeg, which was a bit of a difficult proposition as you can imagine. So we engaged, we went out for bids, we described the project of course, and the request for proposals. We got, I think, three or four bids, but the winning bid was a company owned by S & C Engineering combined with a Californian company who specialized in shaft sinking, and a drilling company in Calgary, Simmons Drilling, who specialized in providing large drill rigs for shaft sinking. And then there was a company called Harrison Western who was going to do the tunnelling. And Norwest was to manage all of this, supervise it, and make the payments and so on.

PMB: Norwest being your company.

STEPHENSON: Yeah. At that time it was called Norwest Resource Consultants. It's now called Norwest Corporation. So we set out on this and I was the director of the project, and I had a project manager and a senior project engineer, based in Fort McMurray. We had quite a lot of staff in Calgary working on this as well, on various aspects of it. For us it was a very big job, it was the biggest job we'd undertaken up to that point. And I guess, Maurice and Clem took a bit of a risk engaging us. We were a relatively new company, we'd only been in business for two years, but I think what they saw was that we were enthusiastic and I think they saw that we were western based. We had some great engineers and so on. Anyway, whatever reason, we got the job. So we began the process of building the road, followed by construction of the shafts. The road was a difficult proposition, it was across muskeg and the road had to be basically floated on the muskeg and we began the construction of the road.

Not much could be done on-site for the shafts until the road had been constructed and so the road was built, and then in the meantime, the detailed engineering of the shafts, of the shaft equipment, the hoists, the guides, the cages, the skips, all the stuff that goes in the shafts was going on. And the shafts were, I think from memory, there were two shafts, they were 270 metres deep. We had expressed a preference for constructing the shafts by sinking, using a very large drill bit, and a large drill rig, and it was a bit like drilling an oil well, except the oil well was going to be a finished diameter of ten feet. So the idea was to drill this with a huge bit that weighed 230 tonnes, and was 12 feet in diameter, and anybody who came up to look at this from the oil industry, their jaw dropped when they saw this bit, because it was huge and it was very heavy. The reason for the weight was that… was to keep the shaft straight, as we drilled the shaft with this huge bit, the fact that there was so much suspended weight on the casing that was used to handle the bit, meant that the shaft would hopefully be absolutely vertical because it's not like an oil well where a small diversion from the vertical is not important. In our case, even a one inch diversion over that 270 metre depth would

have been really difficult, because we were going to operate cages at high speeds, in this shaft. So the technical method adopted was to drill the shafts, open hole, with mud engineered to support two sides. The thing that had defeated previous shafts was the presence of loose, weak, rock in the clear water of aquifers in the lower clear water on Grand Rapids, in the Wabiskaw and then worst thing of all, from the body of a shaft construction, was the McMurray formation itself. Because what happens there, even when you drill a well into, if you take a core, you find the core is squeezing out of the ends of the core tube.

What happens is, it contains a solution that is under pressure, which when it's exposed to atmospheric pressure, the solution becomes gas and destroys the fabric of the oil sands. The strength of the oil sands depends on two things, the friction between the grains, which are very coarse sandstone, and the effect of the bitumen which glues the particles together. So oil sands have no, it's not a rock; it has no cementing factor there, so it's dependent entirely on the friction between the grains and the bitumen. So when you drill into it, whether it's just a ten inch oil well, or a, as we were going to do, a 12 foot shaft, you have got to have some means of holding the sides of the excavation open, as you're drilling and we believe that a heavy mud would do that, so we drilled it open hole with a heavy mud and I must admit, it was a worrying time. We were pretty sure this would work but not exactly 100 percent. It worked beautifully.

We sunk, I think the first shaft, we had a budgeted time of 55 days and we sank it in 53. And what happened then was, after the shaft had been sunk, we now have an excavation 270 metres deep. I'm sorry to mix my measurements here, but it was 12 feet in diameter, and it was full of mud. Now we had to line it with a steel casing, so the first, the steel casing, each section weighed 18 tonnes, it was three metres in diameter, the bottom sections which would have the larger pressure on them, were over an inch in thickness. I mean it had to be made very accurately so that the various sections could be welded together, and the welds had to withstand the same hydrostatic pressure as the one inch of steel. So it was a bit tricky. Because we constructed the staff, so that at the worst case, with a factor of safety of I think, 2.5, the shaft liner could withstand the pressure if the whole shaft on the outside of the liner was full of liquid. So, the liner was installed by installing segments. I forget the length of them now, but they had reinforcing bows around them and the first liner piece to be put in had a bell bottom. In other words it was solid at the bottom.

We lowered that into the shaft using this enormous drill rig that had been modified by Simmons Drilling, and then we filled it with water, so that it would sink into the mud. So the first liner section went down until the top rim was just above the edge of the shaft and then we welded the second section to it, and once we tested the weld, made sure it was okay, and then we lowered the two sections down, by filling again, with water. So that we carried on this process until we had a continuous liner which was basically floating in the mud, and the whole thing weighed, I don't know probably 500 or 600 tonnes, but one person, when it was floating in the mud, one person could take that liner and rotate it slowly, because it was floating in mud, you know.

PMB: Before you installed the steel frame basically, how were you keeping the mud within the well?

STEPHENSON: Well the mud was engineered so that the mud would be so thick, that it would not move into the aquifers or any fractures in the wall sides, and it was so thick for the reason that it was required to hold back any aquifer flow that would otherwise have flown into the shaft, the water flow. It was also required to be heavy enough that it would prevent slabs of broken material falling off from the clear water from these loose formations, in the clear water in the Wabiskaw, which are very weak rocks indeed.

PMB: I'm sorry, my question is did you have another steel liner in there that prevented it from just falling into the hole?

STEPHENSON: No, that one steel liner did everything.

PMB: Okay.

STEPHENSON: So what we had was a shaft that was 12 feet in diameter, a liner that was 10 feet in diameter and a space on the outside that was full of mud and the liner itself now is full of water.

PMB: Okay, I'm with you now.

STEPHENSON: So as the liner goes down full of water, it displaces the mud, but there is still mud left in the aperture between the side of excavation and the steel liner itself. So now we've got the liner, and the liner's all welded together, we know it will withstand the pressure, but now we've got to grout the liner in place. Down the sides of the steel liner, we had tubes for injecting grout, so we injected the grout that would cure very rapidly, to fill the space between the broken side of the excavation and the steel liner and at the same time would displace the mud. So that was done, that took about 50 days I think, so again, we were on time. And we were within budget still. So now, we have a steel liner, it's grouted to the side of the shaft, now we can pump the water out of the liner, so we pump the water out.

And the next task was to install the guides in the shaft, so that we could actually go down the shaft and look at the liner down below. So this was quite an adventure, because nobody had ever been down in the oil sands before and we installed the guides, we installed the shaft, we installed the hoist and three of us got in the cage and we went down in the cage and we opened a porthole in the steel liner and that was quite a big moment and I have a good photo of that, and we're all smiling. So I guess from the smiles, you could say, we didn't get a gush of water coming in and drowning us. We didn't have a collapse, the grout was clearly, very hard, well cured and was preventing any seepage into the liner, so we all came back up to the surface very happy indeed. So that was the first shaft and then we sank another shaft in exactly the same way, and I'll have to look at my notes to find out exactly what the figure was, but I think the deviation of these two shafts, from the vertical, over a distance of 270 metres, 800-900 feet, was only about one inch, so it was quite remarkable. The people who actually did it, Simmons, S & C, Harrison Western people and Sante Fe from California, they did a tremendous job on this.

PMB: So now you had to drill a tunnel, construct a tunnel between the two shafts.

STEPHENSON: That's right. So now we had to, first of all, we installed fans on the surface to ventilate the shaft and then we cut out a piece of the liner, and it wasn't at the bottom. The bottom of the shaft was actually down in the Devonian limestone below the oil sands, below the McMurray, because we needed room for a sub for drainage water, and we needed room to suspend weight, I'm sorry, we needed room to put in structure underneath the McMurray and underneath the tunnel that would hold in place the steel guides, on which the cage and the skips would run. We installed what you call a raise climber in second shaft.

PMB: What is it called?

STEPHENSON: A Raise Climber.

PMB: R-A-I-S-E.

STEPHENSON: Right.

PMB: Climber. Okay.

STEPHENSON: And that's a simple device used widely in the hard rock mining industry, by means of which you can lower people into a shaft, a limited number, usually two or three people, at fairly slow speeds, to get them...and that was put in second shaft. The first shaft was to be used for winding rock from the tunnels and for people to go down in larger numbers. And we had a ladder in that shaft too. So the first thing to do was to cut out to the liner at both shafts so we could start tunnelling. We cut out the liner, we transported the tunnelling equipment underground, we used a drill and blast system, which wasn't the best method for constructing a tunnel, nor was it the cheapest for a lot of tunnel, but we were only driving a kilometre, so we couldn't afford to put in heavy tunnelling equipment.

PMB: So you were blasting through the limestone?

STEPHENSON: Blasting through the limestone, and the roof of the limestone, the roof of the tunnel, was selected at a level where we had a very massive slab, about five metres thick of limestone. And we put the tunnel immediately below that, so that that massive slab and we drilled to find out, was it consistent through the area - it was, that massive slab would form the roof of the tunnels. And we started constructing the tunnels that went very well again, it was done on time by Harrison Western. And we'd laid out a design that would allow us enough room for the two tunnels, because there was one tunnel for intake air ventilation and one tunnel for return air. Having two tunnels was vital because we were going into unknown territory here, we didn't know what we were going to, we weren't sure what we were going to encounter. We'd done a lot of drilling and geotechnical investigation, but still there are always unknown factors. So we decided it was vital that we have two means of getting into the faces and two means of getting out. So in other words, two parallel tunnels. So we drilled the two parallel tunnels and we laid out a design that would allow the drilling and process people to have two areas for SAGD experiments. So the whole thing, as I said before, was done on budget and on time, and in the meantime, we'd been assisting with the design

and construction of the drilling rig to drill these horizontal wells for distances of 600 metres and to keep the wells accurate, that is they had to be very close to the floor of the pay zone, and the two wells themselves had to be...

PMB: Are you talking wells or tunnels here?

STEPHENSON: Wells. And the wells would be drilled at an angle out of the tunnel, of 17 degrees, up into the McMurray formation, and then kicked off into a horizontal plane immediately above the floor of the McMurray. The drilling machine had to be capable of doing that. It had to be capable of drilling these wells, surveying and drilling the wells accurately enough that one well could be very close to the floor of the McMurray and that would be the production well, and the other well would be almost vertically above it, and I think 2.5 metres above it, and they had to be kept parallel or very close to parallel, so that the process would work properly. So the pilot started with, what we call, Phase A, and that was three pairs of wells, I think they were drilled for 70 metres, I'll have to check my notes later, and each well pair was drilled for 70 metres which gives, I think about 40 or 50 metres in the pay zone.

In the meantime, steam raising facilities had been installed on the surface, pipelines had been installed in the tunnels to carry the steam to the well heads, and a pipeline to carry out the produced fluids, which would be a mixture of bitumen and condensed steam, water condensed from the steam. So those two pipelines were installed in the roof of the tunnel and then of course, the drilling started. And once the three pairs had been drilled for Phase A, steam was injected and the whole, the first experiment with SAGD wells began. And that was quite successful after, I think a year or two; it was obvious the system was working. Now things were slow, the drilling was slow because nobody had ever done this before, the drilling machine proved to be successful, the surveying equipment proved to be successful.

PMB: The "what" equipment?

STEPHENSON: Surveying equipment, because we had to survey the wells as they were drilled, progressively. Now, I wasn't involved in the detail side o this so I can't tell you too much about it, but I do know that it was a difficult process and it took quite a long time. So then the steaming began, the steaming was successful, I think this was in about 19...probably '84-'85, and I think that steaming of Phase A went on for maybe two or three years.

PMB: That project began testing that early? '84-'85? I just had the idea somehow; it was '87-'88.

STEPHENSON: Probably a bit later than that, yeah, I think you're right actually because I think it took us two or three years, starting in '82 to actually build the access stage. So you're right, it would be in the late 80s.

PMB: Okay.

STEPHENSON: I forget just how long it operated before the decision was taken to plan Phase B. Phase B was to be three well pairs, I think they were 70 metres apart, and they were to be drilled such that the effective length in the reservoir was 500 or 550 metres. In other words, they resembled a commercial well, but with only three well pairs. The production was going to be a pilot level of production of about, I think, 1800 barrels a day in theory.

PMB: Before you got into Phase B, what production levels were coming out in Phase A? How many barrels per day?

STEPHENSON: Not very high, I don't remember actually, but really the point of Phase B was to find out if you could make contact, if you could mobilize the bitumen whenever you could produce it. But the figures as to how much we would produce were not too important. Bear in mind there was only, I think 50 metres of well in the reservoir, you know, Peter. So Phase B then was constructed in terms of drilling the wells and that went well. And then obtaining and injecting steam, obtaining communication between the injection well, and the production well and then Phase B went into operation. Now that would probably be in the very early 90s, I think. Suffice to say that from that point on, Phase B became the focus of a lot of attention. I should have mentioned that very early on in the process, in the early mid-80s, AOSTRA asked, most if not all of the major oil companies, and some mid-level companies, to join in the project. And they gave a presentation in Gulf Canada Square. I'm guessing this would be maybe '82-'83. I can correct all of these when I look at my notes.

And the big disappointment there was that AOSTRA's presentation that I took part in, and Roger Butler played a big role in that, quite a few people came, but the major oil companies didn't send anybody to really influence them as to whether this is a good idea or a bad idea. In fact, from the point of view of having vice presidents there and people in a decision-making situation, the response was very disappointing. And in fact, people in the industry were very negative about what AOSTRA was doing.

I remember meeting a very senior guy from Shell on the airbus when I was going up. We were constructing the UTF at that time, and I sat beside him, we introduced each other, and he said, "What are you doing?" I said, "Well, I'm directing this construction of the Underground Test Facility." His response was, "Oh you're one of the buggers that are wasting the taxpayers' money on this silly underground idea?" I said, "Well, I'm not wasting your money, and it's not a silly idea." And he said, well you know, the gist of the conversation was why on earth would the oil industry go into a dirty, old, dangerous, underground mine to do this? And I said, "Well hey, it's not going to be dangerous, it's not going to be dirty, and it's not a mine. You're wrong on all three counts." Oh, he says. I said it's not mine because we're not extracting bitumen; we're breaking it up and taking it out of the strata, and taking it out. The simple idea is to recover that 10 percent of the McMurray that is bitumen and that draw that out from the McMurray by mobilizing it with heat and taking it to the surface. And it doesn't disturb the ground at all. Oh. I said, "We're having opening day, and I'm sure you'll be invited by AOSTRA and the government. So I'll see you there." So I was one of the people that took parties around on opening day. This was I think...

PMB: Was that fellow there?

STEPHENSON: Yes, he was.

PMB: Do you remember what his name was?

STEPHENSON: Yeah, but I'd rather not say.

PMB: Okay. Was he a senior guy?

STEPHENSON: He was very senior in Shell. And on opening day, everybody was toured around the mine, and I'd obtained an extra budget from AOSTRA because when it was obvious that the oil companies weren't showing an interest, it was also obvious that the main objection was this dirty, old, dangerous, old mine idea. So I got quite a bit of extra money from AOSTRA, I called it the "Psychological Budget" with which we would whitewash all the surfaces of the tunnels. We would install lighting at very close intervals, we would paint all the machinery in nice colours, the whole place will be as clean as a new pin, and we would put in a floor not made of concrete, but made of mixed up ground limestone as an aggregate, and we will solidify the floor that so that you're walking on a smooth, bare, clean surface.

PMB: Was that limestone that you actually mined?

STEPHENSON: Yes, yeah. So anyway, when people came to the opening, people were very impressed. And this particular gentleman, I was with him underground, he said, "Yeah, I see what you're saying, it's not a mine, Gerry, is it?" he said, "This is really impressive." And it was, though I say it myself. And he coined a phrase for me, he said "It's really a subway to the well head." And I've used that phrase ever since.

PMB: A subway to the well head.

STEPHENSON: To the well head.

PMB: Wow, is that ever nice.

STEPHENSON: Which it was, I mean that was, he did me a favour by doing that. Maybe he owed it to me, after all the insults. So anyway, we come back to Phase B. Phase B went ahead. By this time, nine participants had joined AOSTRA, and I think they put up something like $16 million apiece.

PMB: Now do you do remember the names of those companies?

STEPHENSON: I remember some of them.

PMB: Shell would have been...

STEPHENSON: Shell was a participant. Exxon was a participant. Mobil...

PMB: Is that Exxon or Imperial?

STEPHENSON: Imperial, yeah. I think Imperial.

PMB: Mobil.

STEPHENSON: Mobil. I think Husky was part of it. Oh, Petro-Canada was part of it. Syncrude was part and I think, Suncor was part of it, I think. And the Federal Government was part; they were reluctantly dragged into this, even though it was a western project.

PMB: Japan International...

STEPHENSON: Oh that's right, Japan Canada Oil Sands.

PMB: Canada Oil Sands.

STEPHENSON: I think they joined in.

PMB: Yeah, because they were, they had quite an interesting company.

STEPHENSON: Yeah.

PMB: Okay, and then maybe somebody else.

STEPHENSON: They all joined in, so now the situation...

PMB: Somebody told me the other day that the Chinese, SINOPEC or somebody might have actually been involved in this, is that possible?

STEPHENSON: Not at that point.

PMB: Okay.

STEPHENSON: So, Phase B operated and what we were getting was...we had estimated, that is...I shouldn't say we, AOSTRA's staff had estimated that the recovery might be somewhere between 30 percent and 45 percent of the bitumen in place. We actually got 65 percent recovery. In fact, by one calculation we went over 100 percent recovery on Phase A because we'd put the wells too close together. The result was that the steam chambers formed by mobilization of the bitumen spread way beyond the area that we'd expected them to be limited to, so obviously we didn't need to drill the well pairs as close together on Phase B as we did on Phase A, so we opened them up. Anyway, on Phase A I think the figures were 65 percent recovery, way beyond what we'd estimated. Over a late year period, Phase B got a steam/oil ratio which is the most crucial figure of all, of 2.3 to one. And we got a production...

PMB: Let me just explain; see whether I have this right - that means 2.3 units of steam per unit...

STEPHENSON: Per unit of bitumen, correct.

PMB: Per unit of bitumen, okay.

STEPHENSON: The reason that was so important was that the biggest single operational costs was the cost of natural gas to raise steam, so using the steam efficiently became one of the two or three key issues. The other was production level per well pair. And we averaged between 500 and 600 barrels per day of bitumen, per well pair on Phase B. So altogether, Phase B had done very well. I think it was about in 1992 that AOSTRA and the other nine participants decided to compare the use of SAGD through the tunnels, as we done at the UTF with the use of SAGD by wells drilled from the surface, and kicked off into the base of the oil sands. So that study was carried out, it was managed by AOSTRA on behalf of the other participants.

Norwest and I took part in the sense of helping with costs for underground tunnel shafts and so on for the underground approach; we didn't have anything to do with the study of the surface approach. And when the results were presented at a meeting in Calgary, I was able to attend. And very briefly, the results showed that there was no advantage to the underground approach. There was no big advantage to the surface either, but obviously, having got those economics, the major participants who are all mostly oil companies said well, we don't need the tunnels; we can do this just as effectively from the surface. So I said well, I don't understand your conclusion, how did you work out the figures for production levels, steam/oil ratios and recovery of bitumen using wells from the surface?

Well we didn't, we used the figures from the UTF. I said then why did you do the study at all? Somebody straight out of school could have told you what the results of the study would be, if you simply added on to the underground approach, the extra cost of tunnelling and shafts, and then used the good results obtained from the UTF, on a surface well approach. Well it didn't cause too much consternation, because I'm a Mining Engineer. What do I know about the surface process and so on. And I said, to be blunt, you're abandoning one of the main reasons why SAGD worked well from underground tunnels, which is using gravity to draw of the mobilized bitumen. You will only use gravity to draw the bitumen from the middle and top of the reservoir, down to the bottom, but then you will have to pump it from every individual well, whereas we are using gravity to draw bitumen, not just at the base of the reservoir, but down into the well head, into a pipeline system and using that system, the produced fluids from all wells, on a commercial operation, perhaps 30-50 well pairs, will be drained through a pipeline to a central shaft and pumped by one central pumping system. You will have to pump and maintain and service a pump for every one of your wells. You're abandoning that advantage.

Well it didn't do any good, I mean, minds had been made up, so companies started using the SAGD system in a way, which in my opinion, had never been contemplated in the early days of the UTF. Now they had their own reasons for doing it, yes, there was probably less risk involved. There was

less up front capital to do it from the surface, it was something they'd been doing, drilling wells from the surface for donkey's years, so you can sort of understand why psychologically, they would do that. But since then, I've been trying to raise interest in the idea of going back to the principles on which SAGD was first based at the UTF, and I've not had any luck.

PMB: But you've had some discussions with a number of...

STEPHENSON: I've had discussions with, generally speaking, with smaller companies in the oil sands business, where they're more prepared to look at new ideas, where they're more prepared to take some risks, and in particular in cases where people have properties where there's a disadvantage to drilling from the surface, like a lake on the surface, or an environmentally protected area because one of the big advantages of the underground approach is that, per unit of bitumen produced, it only uses two percent of the area occupied by a large surface mine, that it only uses 14 percent of the area occupied by a surface SAGD operation. You don't have any well pads, you have hardly any roads. You have hardly any infrastructure on the surface. I would say 80 percent of what you're doing is underground.

So you don't disturb the surface to the same extent. I'm coming now to my own ideas and why I think the underground approach, in the right circumstances, not always, but in the right circumstances, is better from tunnels underground. And the other big one is, simply while using gravity as I explained before, to your full advantage. Whereas a surface scheme has a large and expensive, not a large, but a high, capacity, expensive pump in each producing well. That costs a lot of money; it costs a lot of money to pull it out to service it. And it costs a lot more money to pump through say an 8 inch pipeline than it does to a 15 inch pipeline and a shaft. So the other advantage is that I believe that you can drill more accurately by drilling from underground. I think you could get better recovery because you can use lower steam pressures, if you use lower steam pressures, you're production might not be quite as high, but your recovery of the bitumen is going to be better, because you're allowing a slow process of heat soaking upwards by thermal conductivity rather than injecting high fracture pressures and so on.

The other big advantage of the underground approach is that you're operating in an underground climate in a tunnel, you're doing all your drilling down there, you're doing all your process manipulation work down there, and you're completing wells in an underground tunnel at a temperature of 58 degrees Fahrenheit. You do not have to clear snow, or clear ice. You can operate 24 hours a day, 365 days a year, instead of being confined with your drilling and your completions to those periods when you can drill on the muskeg and so on. You can do all these things in a safe, pleasant, but most important, a climate that allows you to work full time, 365 days a year. So I see many advantages to the underground process. Now there are disadvantages too. One is that your capital for the shafts and tunnels is upfront capital, at least for a large part of it. And until you've constructed those shafts and tunnels you can't do any drilling, whereas on the surface you can drill from the well pads, through roads and so on, so that is a small disadvantage.

PMB: How long did it take you to construct the shafts and tunnels?

STEPHENSON: I think it was about a two year period, for two shafts and the kilometre of tunnel. But bear in mind, to some extent it was experimental and we had in a way, to feel our way along, you know. My own inclination is to think that the ideal circumstances for underground would be... good circumstances would be depths of less than four or five hundred metres, I think we could go quite that far. We could also operate in shallow oil sands where there were only about 60 or 70 metres of overburden, as long as there was a capital. So we could operate very effectively, in that zone between mineable and what is now considered a SAGD operation, we could operate very effectively.

The other thing you do need in underground is you must have a deposit where, and what you don't want is a deposit where the sweet spots where you've got good reservoir, are widely separated. Because you still have to connect those sweet spots with tunnels. So in other words, if you have a deposit where the sweet spots are all widely separated it's no good for the underground approach. What you want is reasonably contiguous area of recoverable oil sands. You also need a rock underneath the reservoir which is competent for driving tunnels. But within those parameters I think there are huge reserves in the McMurray where you could apply the underground approach to SAGD.

PMB: And apart from some of the environmental and human resource advantages, it might actually be cheaper.

STEPHENSON: Yes. You see...

PMB: Than just the traditional SAGD.

STEPHENSON: Yeah. Why is it more expensive? Well, ultimately their drilling would not be more expensive because you're not having to drill through overburden, you're drilling almost direct in to the oil sands. Secondly, you're not wasting heat by driving steam down from the surface, through a hundred, two hundred metres of well that is in sterile strata. You're getting better use of your heat. But the extra cost, on the underground side you need the shafts and tunnels, so that's a cost you don't need on the surface. On the other hand you don't need well pads and roads on the surface either, and you don't need pumps in each individual wells.

So just how that works out, I imagine that you'd find, if you compared the two now Peter, you'd find that underground, the cost of the shafts and tunnels would be more than the cost of well pads, and roads and individual pumps, but not very much more. And I wouldn't be surprised, the work I've done over the last 20 years, if the extra costs of the shafts and tunnels, was a dollar a barrel or less, which compared with your total production cost is relatively small. A lot of people think that these shafts and tunnels are going to be hugely expensive. They're not. But the disadvantage is going to be that at least some of the shaft and tunnel has to be completed, the money has to be spent before you can start drilling well pairs, and that's a bit of a disadvantage. Front end capital is always more expensive.

PMB: Okay now, this has been a great story, I'd like to shift from this if you don't mind, unless you have something else to say about this exactly, because I think you've covered it quite beautifully.

STEPHENSON: Well I'll tell you a story. I gave a paper at the Heavy Oil Conference in Edmonton, about, I think it was about six or seven years ago. By this time I'd retired from Norwest, I'd been Chairman and President for 25 years, so I'd always had to be careful what I said about this whole situation of the major oil companies refusing to take any interest in the underground. But at that meeting I'd retired from Norwest, so I was able to speak my mind. And I did. On my last slide I said that I felt that the major oil companies had not done their duty by the Province, by the owners of the resource, and not even by their own shareholders by refusing to look at the underground approach.

Now they may have done something that I'm not aware of, but I very much doubt it because I've been a proponent of this for the last 25 years, and I've kept my ear very close to the ground, so unless something has happened that I'm not aware of, no one has taken any real interest and compared this method with what they're doing now. For example, figures two years ago showed that of 11 SAGD projects that were operating, only two (McKay River and Foster Creek) had approached the levels of performance that we achieved with a pilot project ten years earlier. And bear in mind on a pilot, you're experimenting. You haven't a chance to optimize the thing. Our steam/oil ratio of 2.3 has only been matched by those two, McKay River and Foster Creek. The rest have ranged from three, four, and five and there's even one case, I think Long Lake, where it's as high as almost six.

So generally speaking, these SAGD projects have been disappointing, most of them, compared to what we thought what we knew we could do, most of the results of the UTF. So it astounds me that these companies have not said, oh, let's be a little bit visionary here, let's pump a million or two into looking at this process that we started with back in the 80s and 90s and they haven't done that. So coming back to the speech I gave at this point, being free of any concerns that my own reputation and Norwest's reputation might be damaged. I said that I think the oil companies owed it to the Province and the people of this Province, who are the owners of this resource, and to their own shareholders, to take a more serious look at just what can be done, in the areas that are suitable for underground, which isn't the whole of the oil sands, but which is a big part of it.

PMB: Okay now, I'm ending that topic right there, that's fantastic and you've done a beautiful job of explaining it. Now I want to ask you a question, and this has puzzled me quite a bit. If you ask anybody who is involved in the oil sands industry about SAGD, they will all say, well that was Roger Butler's idea.

STEPHENSON: Yeah.

PMB: And I don't know whether you know Chi-Tak Yee of MEG Energy, he was Roger Butler's first graduate student.

STEPHENSON: Yes, right, yes.

PMB: He basically said that he had seen a document which Roger Butler showed him, in which Butler, it was dated 1969, and so Butler had actually come up with this idea conceptually...

STEPHENSON: Yes, right.

PMB: ...going back to 1969.

STEPHENSON: Right.

PMB: It was based on his idea of how to develop, how to get potash out of potash mines.

STEPHENSON: I see.

PMB: That kind of thing that was kind of the origin in his mind.

STEPHENSON: Right.

PMB: Now I would like your opinion, because you worked with Dr. Butler...

STEPHENSON: Yes.

PMB: ...and I think with Ned Gilbert. Ned Gilbert?

STEPHENSON: I can't say I remember.

PMB: Okay, then let's just talk about Roger Butler. What is his role in SAGD, because he's really seen widely within the industry as the guy who came up with the idea.

STEPHENSON: Absolutely, yeah. I contributed nothing, personally, to the idea of SAGD as a process. Roger was... I met him occasionally, not a lot, because he was doing work at that time, for AOSTRA, on the SAGD process and I guess what the UTF did was provide a platform on which Roger's process could be installed, experimented with and optimized; to me that's the way it worked.

PMB: Can you give you me a little background on how Roger actually developed SAGD and what's significant about it?

STEPHENSON: Not really, I can't, because I think he'd done a lot of this before. You see, I became involved with AOSTRA in '75, but I really didn't become involved in anything to do with what went on with what was called SAGD until about '79, when the mine we saw in Russia, which was an underground oil mine in '76, what grew out of that was the idea of a similar underground project in McMurray, which would be about '80-'81, parallel with what we'd been doing on that. Roger with AOSTRA had been developing the SAGD process, so the fit between the two, I guess someone in AOSTRA, probably the technical people there, possibly Roger himself, probably Clem and Maurice saw the fit between the underground approach that they'd been working on using my experiences as a Mining Engineer, using the fit between the underground application and what they'd done with Roger and Roger had done with them on the SAGD process itself; so the two came together fortuitously.

PMB: So you are not suggesting in your commentary that somehow, you know, the well and the shaft and tunnel idea is really where SAGD developed?

STEPHENSON: No-no, no. What we did by coming up with the underground idea was the find the ideal way to apply SAGD. And it proved to be the case.

PMB: Okay. Now, I just want to ask you one other question around this. I've been asking a lot of questions about Roger Butler and the development of SAGD, and the dates that I'm getting are a little bit different from yours. You know, for example, it's my understanding that the first horizontal production well was drilled by Imperial at Cold Lake with Roger Butler's involvement in the early 1980s, so maybe the idea or the first tests of SAGD come a little bit later in the years that you put out.

STEPHENSON: Yeah, maybe.

PMB: Maurice Carrigy talked about, in my interview with him, talked about that trip to Russia, and I thought he gave a slightly later date, and I'm not sure of that. Do you think that might be possible?

STEPHENSON: Could have been but it was certainly in the '76-'77 region.

PMB: Okay, you're very sure about that?

STEPHENSON: Yeah, I'm pretty sure about that.

PMB: Okay. Is there anybody else that you would you say has really contributed a lot to the SAGD thing. Now shaft and tunnels, you've explained that very nicely, but in terms of SAGD?

STEPHENSON: Yeah, Neil Edmunds.

PMB: Neil Edmunds, I was thinking of Neil Gilbert. Neil Edmunds, that's who I was talking about earlier on. What is his contribution please?

STEPHENSON: Well Neil played a huge role when he was working at AOSTRA. I had a lot of contact with Neil at that time and more so than with Roger actually, because Roger was at the University I think at that time. But what I found with Neil was that, what had really impressed me, was his development of computer programs that would allow you to input data on the reservoir characteristics, the geology, the nature of your steam injection process, and to simulate the results you would get with the steam chambers as they formed. And now, in all fairness, I was pretty easily impressed because I didn't know anything about the process at all, except what I picked up, more or less by osmosis, by working alongside Neil and working with AOSTRA on the underground approach, so I learned a bit about it but I wouldn't claim to be an expert. Although, I still say that sometimes we lose sight of some of the more basic common sense things.

Because SAGD has become very complicated and necessary to do with things like non-uniform beds of bitumen, lenticular beds of bitumen… How do you connect all these together? And how do you overcome the problems of clay beds between beds of bitumen? How do you overcome water problems within the bitumen? I don't know enough about it to say much more, but I realized that you know, SAGD is a very complex process that probably I will never understand, but I do understand the basics of it, heat rises and liquid flows downhill. And my contribution, such as it was, was mainly to convince AOSTRA that they should build an underground test facility, that it was worth it, and that it would form a good… I didn't realize it at the time, but now I realize that what we did was to create a platform on which Roger's SAGD process could be developed and Neil played a huge contribution on that.

PMB: Great. Neil Edmunds. Is he still alive?

STEPHENSON: Yeah, very much so.

PMB: Where does he live?

STEPHENSON: He's Senior Vice President of Laricina Energy Ltd.

PMB: Oh really?

STEPHENSON: Yeah.

PMB: Oh, okay.

STEPHENSON: Now Neil I can tell you does not believe that the underground approach is better.

PMB: We're always looking for people that we should interview.

STEPHENSON: He's worth talking to, yeah.

PMB: Okay, I'm going to quickly... you retired when?

STEPHENSON: Oh heck.

PMB: Or have you really ever retired?

STEPHENSON: No, I'm not retired yet. No, I have a year or two go yet.

PMB: Okay. I'm just going to ask you a couple of final, quick questions. Is there anything that you would like to say about the social effects of oil sands development and aboriginal aspects if you think that's relevant; impact on local communities?

STEPHENSON: Well I'm very much on the fringes of that Peter, but I can tell you from my involvement with one company, I'm on the OSUM Advisory Board. I was on the Board itself... And

so I've got involved on the fringes of what they're doing with the community in their area of interest.

PMB: That stands for Oil Sands Underground...

STEPHENSON: Well it used to be Oil Sands Underground Mining.

PMB: Mining. That's right, Oil Sands Underground Mining.

STEPHENSON: But they changed the title, at my suggestion, because they weren't mining oil sands, that wasn't the idea that they are based on now, their idea originally was to use the underground approach for SAGD, and I pointed out to them, you know, better to stick with...I'd rather you'd not publish anything on that because it's not in their interest that OSUM should be recognized as Oil Sands Underground Mining.

PMB: Yeah, I've got a fairly good friend who works there, actually.

STEPHENSON: Who is that?

PMB: But they are not...my mind is just going blank, he is the Environmental Manager.

STEPHENSON: Oh yes.

PMB: He used to be with Amoco, where I worked. They were effectively using the, help me out with this, were they using the UTF?

STEPHENSON: No.

PMB: Were they using an underground system?

STEPHENSON: Off the record again, they don't want this publicized, it's not in their interests. When the company was originally formed it was based on the idea of mining oil sands underground with large tumbling machines; processing it either behind the machine or on the surface, and then injecting the clean tailings back into the used, mined-out tunnels. It was a very, very clever concept, but unfortunately, it had so many new engineering aspects, that they would have hoped to solve all the five or six engineering aspects that would be new to this idea and put them all together to work properly, there was a very remote possibility of success. Plus the fact that with the price of oil in those days, particularly when it was 30 or 40 dollars of barrel, to be able to...

The big problem with a surface mine is, you take off the muskeg, well first you freeze it. You drain it, you let it freeze and then you take it off. Then you take off the clear water shale overburden, then you take this McMurray oil sand formation and you move it a long distance, perhaps three or four miles to a processing plant, either originally as through conveyers or with a slurry system as they do now, and in the plant, you take out the 10 or 11, or perhaps even 12 percent that is of interest to

you, the bitumen and now you have to move the rest back to the mine. Again, three or four miles you have to move all the material back, some of it is sludge that has to be dumped into a tailings pond that causes you...even now, causes you a lot of problems. So it isn't so much a mining activity, it's a materials handling. And that is why I believe, that in the end, the best way of producing bitumen with the least environmental impact, the least social impact and the biggest social benefits is definitely SAGD.

PMB: What is OSUM doing now? Is it doing standard SAGD?

STEPHENSON: Standard SAGD techniques at Cold Lake and at Saleski.

PMB: How is Saleski spelled, I'm trying to remember.

STEPHENSON: S-A-L-E-S-K-I. Now I do know that from my time as a director with them, and subsequently, I got involved on the fringes of their work with the local communities, and to my mind, they were really doing an excellent job in that respect, and I think that's being reflected in their acceptance of their projects by the local community. They've made that ethical investment in doing that and its going to pay off for them, because these kind of things you know….Do you do them because it the right thing to do, or do you do them because in the end, its economically and financially better to do them. And I think most companies, when they do that, they do it for those two reasons.

PMB: Not one or the other.

STEPHENSON: You won't do it just for one, because it won't work. You've got to do it for both reasons; otherwise it's not going to be effective.

PMB: Okay, I think we have had a hell of a good interview; it's been almost two hours. I'm going to give you the last word. What have we missed that you'd like to talk about?

STEPHENSON: If the major oil companies aren't going to look at underground access for SAGD themselves, why isn't the Provincial Government stepping in and saying that if you wish to operate on that lease, and there's a possibility that underground access might work as well or better than surface access for SAGD, why aren't you doing it? Give us the reasons why and prove to us that either you are doing it and that you've looked at it sincerely and impartially, or let somebody else take a look at it for you, somebody who is interested on your property. So that really would be my...

PMB: Your final word.

STEPHENSON: Yeah.

PMB: Thank you very much, I really enjoyed the interview.

[END OF RECORDING]

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