PETROLEUM INDUSTRY ORAL HISTORY PROJECT
TRANSCRIPT

INTERVIEWEE: Ian Crawford

INTERVIEWER: David Finch

DATE: January 2004

DF: Today is the 10th day of January in the year 2004 and we are with Ian Crawford at his home at 3611 - 12 St. S.W. in Calgary. My name is David Finch. Can you start by telling us when and where you were born?

IC: Born in Edmonton, April 27th, 1920.

DF: And what were your parents doing there?

IC: That's where they lived of course, in Edmonton.

DF: Yes, but what was your father doing?

IC: He was in the coal mining business and worked in a variety of areas, like Beaver Mines in southwestern Alberta, Nordegg. I'm trying to think of. . . Mercoal, it's no longer in existence, it's west of Edson or was. Worked also for the provincial government in the Mines Inspector branch. He eventually became Chief Inspector of Mines and he retired in that position actually.

DF: His name.

IC: John Crawford.

DF: So he was an engineer?

IC: No, just his experience in the coal business. He immigrated from Scotland, I think about 1906 and had worked in the mines prior to coming to Canada. Came to Cape Breton, worked there for awhile and then eventually, as I say, he came west. He mentioned that he got off the train in Pincher Creek and took the stagecoach to Beaver Mines so that was pretty early days. And that was his career pretty much, in the mining business, coal all his life.

DF: And your mother's name?

IC: Georgina Crawford. Her maiden name was Brown and she immigrated from Scotland about 1911 I think. She married my father in 1918.

DF: So they met here?

IC: Yes. She was a teacher and she taught in southern Alberta and in Edmonton during her time. Then of course, she was a housewife after that.

DF: Tell us about your education if you would?

IC: I got Bachelor of Science in geology in 1944, a Master of Science in geology in 1947.

DF: Who did you study with, any persons there that you . . .?

IC: Oh yes. Dr. Rutherford, Dr. Allen, and Dr. Warren. That was the department in those days.

DF: Do you know if Dr. Allen's son is still alive.

IC: I'm not sure. I believe he was in Calgary for some time but I'm not sure if he's still alive.

DF: Okay. Tell us about, any stories you remember about these fellows, their teaching or anything.

IC: We were all highly respectful of them. In our opinion they were all very good professors. It was during war time, part of it, and Dr. Warren was head of the . . . they had an Army contingent there and all the male students had to be in. . . COTC and he was the head of that. He had been an officer in the First World War I believe.

#044 DF: What did COTC stand for?

IC: Canadian Officers Training Corps. Dr. Allen of course, they're all well known in the geological fraternity in western Canada of course. Dr. Allen was the head of the department and Dr. Rutherford taught mineralogy and petrology. Dr. Warren taught palaeontology basically.

DF: How large were your classes?

IC: In the first year there might be 30 or 40 but that was usually students in other departments taking a science course. So the actual number that were in geology beyond the first year was maybe 4-6 at the most. I think our graduating class was about 3 or 4 and there was about 3 or 4 in the Masters program I think.

DF: Did you have jobs related to geology while you were going to school?

IC: Yes.

DF: How did you get them?

IC: Through the department. I worked for the Geological Survey in 1942. I wasn't a graduate then but Dr. Rutherford knew the people in the Geological Survey of Canada and was instrumental in me being taken on, on one of the geological parties in northern B.C. The next year I worked in the Canol project in the Northwest Territories. I wasn't graduated then either but had some experience. I actually got hired by Dr. Link, I guess you've heard of him, he was famous.

DF: Any stories, any jokes?

IC: Yes. I didn't even know about the Canol project, although there was publicity in the newspapers about this project and the pipeline was going to be built. The signs were that this was a very difficult project and nobody that didn't want to stay there shouldn't even bother applying and it was good advice. But anyway, a friend of mine knew that they were hiring for the geological work that was done in 1943. He was talking about it and I thought, gee, I wouldn't mind going up there too. So he had an appointment with Dr. Link and I went along. They did their business and then he said, well, what do you want and I said, I was interested in going to work on the geological work. He said, do you have any experience and I said, I worked with Dr. Stewart and George Smith and R. T. D. Wickendon.

DF: This was the previous summer?

IC: Yes, this was the summer up Commotion Creek in northern B.C.

DF: And what company was that for?

IC: Oh, this was for the GSC. Actually, the reason that this party was sent out there, the British Columbia government had decided to drill a well for oil and gas up there. I believe it was way over budget and they were becoming concerned about this back in Victoria and they wanted some independent opinion of what was happening with this project, so that was why this party was out there. A friend of mine. . .well, T. B. Williams, was the

geologist on that well.

#095 DF: Did you meet him?

IC: Oh yes, and also Charlie Stelck was. . .Charlie had a Master's degree at that time and had done a lot of field work in northern B.C., he'd written his thesis on that I think, so he was very knowledgeable about this area. He was working in collaboration with Dr. Williams. Anyway, we did that work and then eventually, the work stopped. It got to the point where they were into a formation called the bullhead formation, it was a Cretaceous formation. Very hard, very quartzitic sandstones and the penetration was negligible on a daily basis and as I say, the costs were going up. So I think on the basis of the work that was done by the GSC the government decided to stop the project, which they did. I think that was the first well in that general part of the world actually.

DF: And what. . . Commotion Creek means nothing to me. . .?

IC: It's west of Dawson Creek. It was the end of the road at the time.

DF: So you had this experience from 1942 then.

IC: Yes. And then '43, so I mentioned that I'd worked with Dr. Stewart the previous year and Dr. Link said, I wouldn't hire anybody that worked with Dr. Stewart. So I said, well, okay, that was enough so I was on my way out the door and he said, where are you going. I said, there's no sense in staying here any longer, he said, well, I guess we can hire you. Actually Stewart was a great friend of his. So that was how that happened. So I ended up on the project for that summer and worked with Fred McKinnon, he was the party chief and he'd gone to the University of Alberta too, that's where I went. And Keith Huff, I don't know whether you knew him or not. The geology of the Canol project was under the auspices of Imperial Oil, they were doing the technical work and the field work and so on. At the same time the pipeline was being built by, I think it was a San Francisco engineering company called Bechtel, Price, Callahan. They're probably still in business as far as I know. And that was quite a big operation. Imperial had a refinery at Norman Well, that was the centre where the activity was. There was development taking place on the Norman Wells field itself, there was a drilling program going on there. The refinery that Imperial had was big enough to satisfy the demands for gas for the local traffic on the river. Hudson Bay boats used to go back and forth and Indians. It wasn't a big refinery but it was a good thing to have for all them

DF: So for gasoline?

IC: Yes, they made gasoline.

#139 DF: Diesel probably.

IC: I don't know about that. Because the traffic on the river, at that time, that was the main means of transport. It went down to Aklavik at that time, and the Mackenzie Delta. They were Hudson Bay vessels because they were serving Hudson Bay posts along the river. They were similar to the kind of boats that you would see on the Mississippi, big paddle wheels and quite romantic looking things, they were quite huge. So that work started, the geological work started that summer, about the 1st of May. We operated out of Norman Wells.

DF: How did you get to Norman Wells and how did you get around once you were there?
IC: We flew in from Edmonton.
DF: What kind of airplane?
IC: I'm not sure that I know. It was not a very big airplane, my remembrance was that it might hold a dozen people, something like that. On the way up we stopped at Fort McMurray and then from there into Norman Wells. The U.S. Army was involved in the Canol project. Actually, I think there were 13 geological parties operating out of there. There was. . .well, Fred McKinnon had one and he was a graduate from Alberta, Charlie Stelck was up there, he was a graduate of Alberta too. There was quite a number of American geologists, some of them were in the army. I think they had a geological corps in the U.S. army at the time and these fellows were actually in the U.S. army, a lot of them. The parties were 3 man parties.
DF: Who did you work with?
IC: I worked with Fred McKinnon and Keith Huff. We did three geological traverses that summer. They were generally about 5-6 weeks long. At the end of each project we would return to Norman Wells and a report would be written by the party chief then we'd go out on another project. The first one we did was a section along the Mackenzie River from a place called Hoosier Ridge. Imperial were drilling a well there, it was a wildcat well. Then we went down the river to the mouth of the Ramparts River. That was a relatively easy assignment because we were on the Mackenzie River itself, so there was no problem with water or anything like that. It's a big river of course. The next. . .

#186 DF: Did you have a river boat or. . .?
IC: No, we had canoes, 2 canoes.
DF: How big were they?
IC: 16'.
DF: Do you remember who made them?
IC: I think they were made in Peterborough, I think that's a famous. . .I think they still make canoes down there.
DF: Yes. And your next traverse.
IC: The next one was on the Ramparts River. In going to that first assignment we went down by a river, one of the smaller boats that Imperial had there and then we just got dumped off on the banks and that was it. As I mentioned, these were 4-5 weeks jobs and you didn't see anybody during that time. On the Mackenzie you might see a riverboat go by but there was no contact with anybody else. The next one we flew into the headwaters of the Ramparts River. We landed up just in front of the Mackenzie Mountains, then you traversed down the river. When you're that far back up those rivers, you're nearly in the headwaters of them, the water's pretty fast, you're in rapids a good deal of the time. We had aerial photographs which were useful for the geology we were mapping but also, you had some idea of the shape of the river and you could see, maybe white water and things like that. So the early part of the work on the river was of concern in these rapids. We turned canoes over every once in awhile but fortunately nobody was hurt or nothing important was lost. We had tarpaulins that we put over the load because we had to carry

all of our food and everything that we were using, tent, sleeping bags, all that sort of stuff, and then laced it in so that was covered and if the canoe turned over you didn't lose anything. On occasion that did happen. That trip took about 3 weeks.

Tape off.

DF: So you're looking at these reports that you did for the government?

IC: No, no, these were for Imperial Oil.

DF: Well, but Imperial was working for the war effort.

IC: Yes, that's right. I'm sure they've got copies of these at the University of Alberta too.

DF: So this is the one on the Ramparts River?

IC: Yes. They might have dates here. Yes, we started in July '43 and the report was submitted in August, so that was a relatively shorter one. I didn't get a report on the Mackenzie River work. I asked for it and it may have been that they didn't report it.

#248 DF: What do you remember about this particular trip?

IC: It was the first one that we had done on a river that was a real river and of course, it was a learning process for us. What happens is that in the upper part you have the fast water and those rivers, as they get down towards the Mackenzie Basin proper, the gradient drops and the flow of the river is practically negligible. So down at the bottom end of it you pretty much had to paddle your way along whereas up at the top end you didn't have to do anything like that. We were planned to be picked up, on that particular trip, at Fort Good Hope. The Ramparts River empties into the Mackenzie just above the ramparts on the Mackenzie, which is a very narrow spot on the river. One of the parties that had worked in that vicinity before us had left a cairn and advised us that we would have to portage because there were some falls on the river there, which we didn't know about. We thought, we'd been through a lot and probably wouldn't have to bother but we went and looked anyway. Indeed there was some falls so we decided we better portage around them and we did. We proceeded down the Mackenzie, we could see some whites of a boat on the other side of the river and we thought, that might be the boat that was going to puck us up. So we, this was at night too, and we decided we would cross above the mouth of this narrowing part of the river, which we did. But the wind was blowing up there and the water was pretty rough, but we did get across all right and it was the boat that was supposed to get us. So we got on board and went down to Fort Good Hope and they took us back up to Norman Wells and that was a couple, three days trip. So that was a kind of interesting experience actually. Then the third assignment that we had was to do geological work on the Arctic Red River. I think I have some information on that here. We went out the headwaters of the Arctic Red River and started work there in the last 2 weeks of August and we got through about the third week in September, so that was 5 weeks.

#303 DF: That's pretty late in the season isn't it?

IC: It was beginning to, yes, there was starting to be ice, just skim ice along the shore but the main rivers, there was no ice on them. On that particular river we did some work at the top end of it, we went back in the mountains a little bit. As I mentioned we'd been using

some aerial photographs and we'd seen something on the river that we weren't quite sure what it was. A few days later we got down to where this, it turned out to be white water and it turned out also to be waterfalls. So there was three of them and we had to portage around those, which was not an easy thing to have to do because there was no trail particularly, we just had to portage, that was all. From then on, much the same sort of thing, the gradient of the river slowed down and we ended up at Arctic Red River post, which was at the mouth of the Arctic Red River on the Mackenzie. We had just missed the boat that was supposed to pick us up, it had gone on down to Aklavik so we stayed around Arctic Red River post for a few days until it got back, then we returned on it back to Norman Wells. Well, that's not quite right, we got as far as Fort Good Hope. By that time the water on the river had dropped and the boats couldn't go up the river because there wasn't enough water coming down. There was a set of rapids in there that they couldn't go up when the river was low. So a plane came out from Norman Wells and picked us up, they used Norsemen, and they were float planes. We had picked up a few other parties on the way back from Arctic Red River, going back to Norman Wells at the same time. Everybody was interested in getting back to Norman Wells as soon as possible so we had more than 2 parties on that Norseman, to the extent where there was too much weight and it wouldn't take off. One of the fellows that was working there from UBC got left behind and eventually the plane was able to get off and we got back. But it was pretty much at its limit as far as load was concerned. And I had to go back to university so I was around Norman Wells for maybe a couple of days after that assignment and returned to the university to go back into 4th year and finish up. So that was the Canol River experience. We did the geology as best we could. It was pretty much the outcrops along the rivers that we were mapping. Where the river flattens out it was all just muskeg country and very difficult, impossible to travel in any time except the winter when things were frozen or fly, one or the other.

End of tape.

Tape 1 Side 2

DF: Could you tell us, oil had already been discovered at Norman Wells some time before this . . .?

IC: 1919 I think.

DF: 1919, that's right. So what were you doing in the 40's, like Arctic Red River is quite a ways away from Norman Wells. These geological field parties were being sent out quite a distance.

IC: Yes.

DF: And you were doing what?

IC: Mapping the outcropping rocks actually. Because very little was known of the geology up there so most of it was new and just normal geological survey type work. You were interested in the structure of the rocks and the age of the rocks and the type, sandstone, shales, carbonates, you were interested in all these things. That's what was reported in

these reports. I'm sure that eventually, in the long run, the work from all those parties was compiled. Each segment of these things would be put on, I'm sure, a larger map and then correlations were made of all this work on a broad scale. A lot of the palaeontology work was done at the University of Alberta. Charlie Stelck was a palaeontologist, Dr. Warren was and they identified a lot of the fossil collections that were collected at that time. So it was really quite new, absolutely new a lot of it.

DF: Do you remember what Canol, those letters stood for?

IC: No, offhand I don't. I don't know that I ever knew as a matter of fact.

DF: You wouldn't have any papers that would have that on it somewhere?

IC: No, it's conceivable that Charlie Stelck might know, he's at the university in Edmonton still, or he's an emeritus professor there.

DF: Yes.

IC: You know, it's amazing, I never thought about it.

DF: Yes. Can you describe your job for us in a little bit of detail?

IC: On this survey?

DF: You were the third. . .

IC: I was the third one, yes.

DF: Okay, what were you doing? Tell us sort of your daily routine, just so we can get inside. Like you probably had to cook and move the camp and everything.

IC: Yes. I didn't, no we all did.

DF: Yes, together.

IC: A cooperative sort of thing.

#028 DF: But just the three of you, you didn't have anybody helping you?

IC: No. Theoretically, we were supposed to be visited every 3 weeks by air. Naturally, they would fly up the rivers, I don't think they remembered to look down, they were probably looking sideways because we saw them but they never contacted us. The thing was, during the summer up there, it's daylight 24 hours a day. Time didn't really mean a lot. You worked until you got tired then you'd stop and make something to eat and go to sleep. There was a lot of mosquitos. When you were on the river they didn't bother you but if you got off the rivers very far, particularly when it was muskeg type country they were pretty bad. Often we wouldn't pitch a tent. We had mosquito bars which were, they had a canvas top and then mosquito netting around the side. So you could put your air mattress and eiderdown in there and get inside and you didn't need a tent unless it was going to rain or something like that. That was a daily occurrence, after you woke up, got up and made some breakfast and cleaned the dishes and took off. Because there wasn't much in the way of a camp to break really. So you spent your time actually working. I knew something about surveying. We had a plane table and as I mentioned, we had aerial photographs that we were able to use to locate ourselves on the river and record the data that was observed there. However, when the photographs were flown, I think the Canadian Air Force may have flown them but I'm not sure, they flew in strips so you had a constant picture. But if it happened to be cloudy that's what you got was pictures of clouds. So they were no use that way. So in areas like that we mapped the river and drew

our own map of it. I did that kind of surveying work. There wasn't much of it but there was some. I diverge. We went in to do some mapping at a place called West Mountain, this was on the Ramparts trip. Wanted to get some information on the geology that was available on the mountain itself, some of the formations that were there. Fred McKinnon, our party chief went up on the mountain and I was running the plane table. The problem was the mosquitos were so bad I couldn't stand still long enough to read the instrument. So Keith Huff got some spruce boughs, put them underneath the plane table and made a small fire and I stood in the smoke and I was able to get the readings that we needed at that spot. That was unusual but it was the only way we could do it, really, it was amazing. When we were on the river doing the work on the Arctic Red, this was where we ran into the problem of cloud cover. That wasn't the problem because we were right on the river and as I mentioned, the mosquitos were not so bad there. It was only when you got off into the muskeg type stuff that was bad. That was really life and hard times on that trip. That Arctic Red River trip was longer than the other one, 5 weeks or so and we couldn't carry enough food with us to go 5 weeks. So Fred, our party chief, when the Norseman brought us out, he went on with it and they landed downstream. They couldn't land in the river because there were too much rapids in it, but they did land up on the top of the river bank. That was several hundred feet high and there was a lake up there they were able to land on and build a cache. Unfortunately I think there'd been a fire up there or something but there wasn't much in the way of tall trees or anything. They did manage to build a cache above ground, I would say 8 or 9 feet because it was in muskeg and you couldn't leave it underground. So when we arrived there we went to check this grub cache and apparently bears had gotten into it and a lot of it was destroyed. What wasn't was knocked down on the ground. We had quite a lot of canned stuff and some of that the bears had just punctured with their teeth and drained the juice out of it and whatever. But we also had about a 2 ½ or 3 foot dried milk container with a lid and we packed stuff in there. Although there was holes punched in it, what was in it was in cans too, so that was saved fortunately. But we still had another 2 weeks to go before we got out and we had short rations but we managed to do it alright.

#104 DF: Do you remember what kind of food you had on that trip?

IC: Yes. Just about everything was dehydrated. We had some canned fruit. The problem was space. So dried beans and dried milk. I can't remember if we had Arctic packed ham, I don't recall if there was anything like that but it was kind of spartan. But it was okay. When we first came out we had bread, we had flour of course, sugar and all that sort of thing. And we had fresh bread but that lasted about 3 days and then you were out of that. I don't recall much more. We had dried cereal and eggs. Things that you could transport but space was a problem. You didn't have a lot of space in those canoes. So it was mostly dried fruit, I'm sure there was more than that but offhand that's about what I remember.

DF: So we should probably get on with your story then. We've so far just spent a couple of years on your career. So you were up that one summer with Canol?

IC: Yes.

DF: And then where did you go after that?
IC: I graduated the next year and I went to work for Shell.
DF: How did you come to be hired by Shell?
IC: Just normal recruiting, which they still do to this day I'm sure. And there weren't many graduates, I think the year I graduated there were 4 maybe. I don't know if you have records of their names, Bill Clemis was one, Norm Willson, I think Jim Humphries, and then myself. I got hired by Shell, Bill Clemis I think got hired by Imperial, Norm Willson, he went in the Army. Bill Macdonald also was, I guess there was 5 of us, he went in the Navy and Norm went in the Army. This was 1944. They spent a year, I think they went to an active service base in Chilliwack in B.C. and then the naval base I think, in Victoria or something. It was kind of toward the end of the war by that time. So that was about the story on where they went and what happened as far as I was concerned. I would have been in the Army too, Shell got a postponement through the Bureau of Technical Personnel in Ottawa. Then that started my work with Shell. The first year, surface mapping in Alberta. I was on a party that worked north of Jasper, in the foothills, up in an
#159 area of the Smoky River country. That lasted that summer and then in the winter time I got transferred, on a temporary basis, into the land department because the Jumping Pound gas field had been discovered in December of 1944. There was a large number of independent land holders out there and the best way to develop the field was to unitize all the land owners and that was quite a fair amount of work to do that. In fact, we had one of the people from Shell Oil come up from California who'd had experience doing that sort of work and he was responsible for doing this unitization project. So I was kind of seconded, not that I went and did any of that but I was in the office learning something about this, and eventually I got transferred back into the geological section. It was successfully unitized after about a year. The next year, that was 1945, so I didn't go in the field that summer. Then the fall of '45 I left Shell and went back to university and started work on a Master's degree. Then the summer of '46 I rejoined Shell on a summer job and worked with Con Hage, who is on the cover of the publication that you have written there. And we worked in the Peace River country that summer. So that was a change of pace. The first year we worked with horses up in the Commotion Creek area and the next year you're up in the Territory working out of canoes, next year back on horses up in the Smoky River country. It's about 100 miles by pack train to get into it. Then Con and I worked by car in the Peace River country, which was much easier to get around. And interesting work. We did a lot of work on the Peace River itself and some of the tributaries on the Smoky River. And on land too, on the smaller streams that came into the Peace River so we spent the summer doing that. Then returned to Calgary in the fall. I went back to university because I had to finish off my work on my Master's degree. That
#208 got finished in 1947. At that time Shell, the decision was made that Shell would cease operations in western Canada. There hadn't been anything found at that time. Jumping Pound turned out to be a gas field and Shell had been hoping they might find another Turner Valley. Gas had little value at the time, there was no market for it. Centres like Calgary and Edmonton were already being served by gas already discovered and found

and developed. Shell had been doing some work at the time we were out here, in eastern Canada and the Maritimes. So some of the staff from Calgary got sent down to the Maritimes, some of them got sent to Wyoming, some back to California. So I was rehired and got sent to New Brunswick. The office that we operated out of was in Ottawa, that was kind of the office for that operation. So we did surface mapping in New Brunswick for that summer. They'd already done mapping before, for a couple of years, some in New Brunswick, some in northern Ontario, some in Quebec. That was a nice assignment too because you were in a civilized part of the world and it was easy to get around. At the end of that summer we all went back to Ottawa and reports on the work were prepared that winter. I got sent back to New Brunswick the first of April to do preparatory work for some geophysical work that was going to start in May. What that amounted to was arranging to have shotholes drilled in preparation for the seismic crews to come in. That work got done and I got a call saying that I had to come back to Calgary. Because in the meantime, just before I graduated, Leduc was discovered, that was in February. A fellow by the name of Nichols and Feldmeyer, I think they were with Canadian Superior. Art Feldmeyer and Nick Nichols was the way we knew the other fellow. They'd been doing some exploration and this fellow Nichols came to the university and we were talking with him. There were 3 or 4 of us in the graduate program and he said, there was a rumour of oil discovery at Leduc and he was going out there to confirm it or look around and make sure that, indeed, that seemed to be the case. He wanted to know if anybody wanted to go out with him and I said, yes, I'll go. It was only about 20-25 miles out of Edmonton
#269 anyway. So he and I did go and drove around, there was a well, it was shut in, there was nothing happening because Imperial of course, were not giving out any information at all about it. Nichols was interested in whether or not there might be land available out there. Eventually we came back and he dropped me off at the university and he went back to Calgary and I went home. So that was my first brush with Leduc or knowing anything about it. It turned out of course, it was a discovery and everything just went wild here. But Shell had already committed to work in eastern Canada at that time. When I got transferred back here, that was May of '48, there was only 2 or 3 people in the office and they were all being transferred out. I was kind of, with a secretary, looking after Shell's office here for the period of time when all this great exploration boom was in progress. Notifying people in Toronto, our Shell Canada head office, and in Las Angeles where the exploration phase of the business originated from, earlier, as to what was happening here. And there was a lot happening because there were discoveries made during that year quite regularly. Redwater and Golden Spike and some other fields. Eventually the decision was reversed that they would then return to Calgary. The difference was, the operations, because they were not necessarily structural geological situation like the foothills was, which is why we had people from California here in the first place, they were structural people. This was a different type of geology with reefs, basically reefs of course. So the people that came up from the States at that time came from Louisiana, some of them. The vice-president that came up was from Louisiana. He'd been working or in charge of the offshore stuff down there. So it took about a year to get everything back together again. That would have been during 1948 I guess. There was no land available anywhere near

Leduc that was for sure. Shell took lands in northern Alberta, some in Saskatchewan and started exploration. They've been here ever since. It was an unfortunate time that they were out, that one particular year. But that was the way it happened. They never really did get back into the central part of Alberta after it because Imperial and Texaco and the major companies, Gulf, had already got all the land that was available. In those days you could get 100,000 acre blocks from the provincial government, but you took on work
#333 commitments too. You could retain that land forever just about, if you did work in drilling and so on. And if you made discoveries and were producing they were indefinite how long you could hold them. So it was a pretty tough proposition to try and break into that. We did get some large blocks in northern Alberta, up near Peace River and north of Lesser Slave Lake, southern Saskatchewan. Some of that turned out to be okay. But it's been just a long process of, Shell's built up a good production history over the years. A lot of it has now been sold off or whatever, because the interest nowadays is in, for major companies anyway, frontier regions like the Delta or east coast offshore, some of the more difficult exploration areas, expensive. Because the work that's been done in the basins, in southern Saskatchewan and Alberta and even a lot of B.C., it's been worked over for a long time now. It's a good time for smaller companies because major companies are divesting themselves of a lot of marginal properties and things of that sort. But for major companies, they're looking at bigger possibilities in the way of discoveries. So there has been earlier waves of exploration in the east coast offshore, starting in the 70's. Shell drilled a lot of wells out there and other companies did too, in that period. And in the Mackenzie Delta and Beaufort Sea, Arctic Islands even. And some of that work was done back in the, that would have been in the 60's. The problem with it was that, even though discoveries were made, there was no ways. . .natural gas had been discovered in the Beaufort Sea and the Delta but there was no pipelines. For various reasons they weren't able to build them.

End of tape.

Tape 2 Side 1

DF: Go ahead, no pipelines because. . .?

IC: There were political problems that made it difficult. They were expensive anyway. So some, not some, all of the oil and gas that was discovered back in the 60's was shut in, nobody developed them very much because there was no need to. Only now are people again, looking at building pipelines from the Mackenzie Delta and the Beaufort Sea. And the reason for that is pretty obvious, is because gas is not being discovered now to replace what we're using. So it's become important now, some of those deposits.

DF: Wasn't it some time in the 1950's that the amount of gas or oil found per well started to dip on a per well basis? It's been quite awhile hasn't it? Like those big discoveries of the 40's were really quite spectacular weren't they?

IC: Yes, they were big fields, like Jumping Pound is quite a large field, Turner Valley. Gas was discovered in Turner Valley, I think in 1924.

DF: '14 actually.

IC: '14. And then, in 1936 they found oil in the downdip side of it. The problem was that they burned off so much of the gas that the pressures dropped. It's too bad, it's really a shame. It wasn't known I guess, at that time. And there's been, Jumping Pound, West Jumping Pound, quite a number of foothills fields have been discovered, not only by Shell but by other operators. So the supply has always been there. The thing is that phase of exploration wave has kind of gone by and the reserves are not being replenished. Down here, they're not being replenished.

DF: It's growing too.

IC: Drastically. I have a hard time thinking that using natural gas to develop electricity is a good idea. It seems like a waste of something you shouldn't be doing. Here you've got shortage of this stuff and we're using it for air conditioning and everything else, it's rather a strange beast I think. I don't know when that's going to stop but I think it will have to one day. When you look at pipelines that are going to take several years to build, coming out of the Arctic, there's quite a gap in there where that shortage is going to continue, in Canada. Certainly it already has in the U.S. for many years. That's a real problem. It's not one you can cure in a matter of a short time. Same with the east coast offshore. Even now with the work that's being done, from what you read, it hasn't been as successful as they'd hoped. That may improve because the work is still going on but the original discoveries that were made, there seem to be, the main source of natural gas, some of it's being shipped down to the U.S. and northeastern United States.

DF: Were you involved with the west coast work?

IC: I wasn't directly involved but Shell drilled, I think, 14 wells offshore. Off Vancouver Island in the 60's. That was certainly exploratory, there had been none drilled before. Then the work stopped, I can't remember how that timing went. Shell might have decided to stop it at the time themselves and then there was a moratorium put on work offshore because of . . .I don't know if it was concern of oil spills with tankers running up and down the west coast from Alaska. And then the Valdez happened. I can't remember the timing of the Valdez, I think it was after Shell had already stopped operations on the west coast. But then there was a moratorium put on exploration work. B.C. didn't want to have anything like that happening. So Shell retained the land but they didn't have to work on it, they just postponed the commitments that were made. Eventually, I think Chevron took an interest in some of Shell's holding. They're still under moratorium, nobody can do anything. I'm pretty sure it was Chevron, I know it was a major company anyway.

#059 DF: So what were some of the projects that you worked on during your career?

IC: After coming back here and operations picking up here I did geological work, it turned more to subsurface work after that. As I mentioned the interest in the foothills declined because it was mostly gas. Although there was drilling done and there was more gas discovered but basically people were hoping they were going to find oil with just normal exploration work.

DF: But it had to change because you were doing mapping in the foothills where you could see formations, whereas out on the prairies you can't see that. How did that change?

IC: Of course, you're dealing with the information that is gained by the wells that are drilled

of course. So it's subsurface mapping based on geological information from wells that are drilled, geophysical work that's done.

DF: So that was becoming more important?

IC: Absolutely. It was essential. And still, that's still the kind of work that's being done today. The technology has improved of course, the geophysical technology is much better than it was back, 30-40 years ago. I'm sure it's more expensive now but it's a lot better. The problem is that even in the earlier work that was done was not as good information or not as good geophysics, a lot of this had already been found. It was good enough to make discoveries. And with the amount of work that's being done by all the companies and all the independent. . . the original Alberta Geological Society, when I first came to Shell, there were 75 geologists in it. Now the luncheons we have, there are over 2,000 at some of those luncheons. You know, 1,000 but 2,000 I'm sure, are registered geologists. So there's a huge amount of brain power and effort being concentrated on this area compared with '75. So there's a fantastic amount of brain power I guess, and hopefully, new ideas. Although you don't really see a lot coming out of that in the way of anything new anymore. That's what drives people into these more difficult areas, the Arctic Islands. Nobody is back there yet but some day maybe there will be. There was work done back in the 60's in the Arctic Islands, a lot of it, which was way too soon. Even the oil that was found in the Arctic Islands, there was no way to get it out. There was one tanker I think, that tried to take some out to show it could be done. And it was done but I think it took about a year or so to get it out.

DF: Yes. What other changes have you seen in the industry in your time period?

IC: I've been out of it now for about 17 years.

DF: What year did you retire?

IC: 1984, but I worked for a couple of years after that for Shell. So '86 is really when I parted company from doing any business. I guess, it was certainly new to Canada, the offshore exploration work that started. That was in the 60's I guess, although it had been going on in the Gulf Coast long before that.

#111 DF: So you were involved with that, east coast offshore?

IC: Yes.

DF: Can you tell us about that, how you came to be involved?

IC: I wasn't directly involved. I ended up in the planning department, which meant that we were concerned with more budgeting and controls of that sort on the operation. And yet, we were kept up to date on what was going on, on the budget meetings, we would be there when people were talking about programs and projects they were planning to do. The same with the Northwest Territories, and in the normal programs that were happening in western Canada too. So, although I wasn't directly doing the work I was quite aware of what was happening because that was required in the planning operations of the company. So I got more into administrative type work and that was how it went. I was directly involved in southern Alberta back in the 60's and in northern Alberta. . .let me think when that was. . . that was in the 50's actually, from about '56-'60. Southern Alberta was about '60 to about '64. That was about the time that things started to go on

the east coast and the west coast. I had responsibilities for some of the stuff in the Territories but this was earlier on. I think Shell was involved in a well up there, I think in the late 50's, drilled a well up in the Delta, there were a number of companies participated in it. They kind of moved northwards until there was quite an active program in the Northwest Territories, not only by Shell but by the rest of the industry too. Shell had drilling programs in the Peel River country and of course, in the Delta too. We made a gas discovery up there in. . .oh boy. . . I'm not sure of the date. There was a number of them at the time, Gulf had one in the Delta, Shell did and Imperial had a lot in the Beaufort Sea offshore. I just am not dead sure of the timing of that now. It would have been, I suppose, in the 1980's. So there was these frontier regions took up Shell's interests early on. They were kind of forerunners in a lot of that frontier work, certainly in the east coast offshore and the west coast offshore and even, as I say, in the Delta. I think they were part of a group that drilled a well up there early on. Because nothing was known about the geology and the subsurface. Eventually the rest of the industry became interested too.

#167 DF: What have you enjoyed most about your geology career?

IC: Just all of it I guess. Even still, I have a daughter that's a geologist so she keeps me informed as to what she's doing.

DF: What's her name?

IC: Her name is Holly Crawford. She works now for Burlington Resources. I have a son that works there too, he's an engineer.

DF: His name?

IC: Doug, Douglas. And he originally worked for POCO, then they got taken over by Burlington and then Burlington took over Canadian Hunter and that's where my daughter worked so now they're both working for Burlington. And I have another daughter who's a CA and another one who's a teacher. So one way or another, they're all into some kind of a profession.

DF: Great. So tell me more about the things you've enjoyed about your career, like the ideas, has that been particularly interesting?

IC: Yes. Well, just to see the way the whole industry developed. And the new ideas that have come out of, certainly the reef discoveries in 1947, that was a remarkable thing. And yet, the work that was done in the Northwest Territories on the Canol project, the idea of a reef field came from that operation. I think Imperial probably had a better idea based on their knowledge from Norman Wells as to what to look for, say in Alberta. Based on the kind of sedimentary deposits there were and just a general idea that these are the kinds of things that could be here. So I don't think they were particularly surprised with their discovery at Leduc. Whereas I think a lot of the industry apart from them were. Because this idea of reef production was something quite different than anything we'd known before. So to Imperial's credit I think that they used the knowledge that they had, that no one else had, in maybe some of their exploration work in Alberta after that time. And once other people got the idea of course, it just mushroomed, because you can't keep anything very secret for very long after something is discovered. So that was one big step

forward. And also, changes in thinking about modes of deposition, say, of sandstones and the kinds of deposits that you could look for and how to recognize them. There's been huge progress made geologically in understanding geological conditions and how they occurred, that you could interpret from subsurface data. I'm no expert in a lot of these things but the kinds of deposits that make good reservoir rocks, like delta sand deposits, which is a major one. When you get, for example, offshore in the Gulf Coast, you've got the Mississippi Delta is dumping sands offshore there still and understanding of how these river deposits occur can be applied in other areas in the subsurface based on what you can see in some of these regions. The Gulf Coast is a real lab for some of that sort of development. So there's just been a real progress on the whole geological science I think, over that period of time. I'm sure there's more being understood today on a lot of these conditions. And they apply not only in western Canada, but they apply anywhere geologically, worldwide. The delta deposits are of interest in Europe, some of the big rivers coming out of the European continental rivers. Same in Nigeria and Africa, those are offshore fields there that are delta deposits. So I think a lot of it is applicable everywhere, these geological conditions. Once they're understood then the application becomes widespread.

#254 DF: This deltal deposit research, has it contributed much to the search for oil in, say the St. Lawrence? Like, did that affect your New Brunswick work?

IC: No.

DF: No, that was all onshore?

IC: It's all afterwards. The work that I did down there was in 1946 and a lot of these developments occurred afterwards when people started to study delta deposits created by these rivers. The Mississippi is a major one where a lot of this stuff was developed. And an understanding of the depositional occurrences. Down offshore Galveston, well, you've got offshore sand bars there, these offshore islands that are just sand deposits. They're wonderful reservoirs if you can find similar kinds of occurrences in the subsurface, they're wonderful traps for oil. The fact that they're occurring today, in modern times, they also were occurring in historical times, geologically. Some of those are found from time to time and being able to recognize what you have is important. These sorts of things have been developed in the last, or an understanding of them have been developed in the last 30 or 40 years I'd say. And it was a lot of that kind of research, I'm sure every major oil company did a lot of the research work on those sorts of things during that period of time. I know Shell did and I'm sure other companies have done the same thing. And you can see these kinds of occurrences in the outcropping rocks that are, you know, in the geological sequence. And you were able to recognize them, as to how the deposition occurred in these things. And of course, reefs are fairly well known today I think. I remember going to geological conferences where people were talking about reefs back in the 50's. From the work that I'd done going to university very little. . . reefs were just reefs, like the Australian Barrier Reef, you never thought of it in terms of reservoirs for oil. It took that discovery in Leduc to make a huge difference in people's understanding, or even thinking about it. So I don't know, have I bored you long enough?

#314 DF: Oh no, I've got some more questions for you? Given that you lived through some of these, what are now, historic events, would you care to comment on the whole National Energy Program in 1980 and its effect on the industry from your perspective?

IC: That was a disaster. I was involved in the planning program at that time and the things that happened during the National Energy Program, they happened with such rapidity that it made a shambles of any kind of budget planning you were trying to do. Because you'd no sooner have some kind of a plan or forecast of what your budget was going to be and suddenly the economics of it would change, because of new rules. And you were changing these forecasts, practically on a daily basis. Naturally, the officials in the companies that had to be looking at the forecasts, they would be obsolete in a matter of days sometimes. It made a huge difference, it amounted to a means of taxation really. The economics of many projects became non-economic. It was not a good period of time and unfortunately, I think a lot of people still remember it and I think, even today politically, it's one of the reasons a lot of people in western Canada still don't trust what's going to come out of Ottawa. That was a disastrous period of time. And it influence, I'm sure in a detrimental way, obviously, a lot of the work that was being done at that time, in every company. It was designed by people who didn't understand the repercussions of what they were doing I think. And I think that probably even today, there are still effects of that program. The Liberal government seemed to have a problem understanding why they never seemed to make much progress in western Canada. Well, the memories are very long out here I think. Is that enough comment about the National Energy Program?

DF: Well, do you also remember Joe Clark's version of it, when he was in power?

IC: I never really remembered much of anything that he ever did. The only thing I remember is that he couldn't add up to 19 or something, in seats, and he got thrown out of office.

End of tape.

Tape 2 Side 2

IC: . . .yes, provincially.

DF: Provincially and federally. So NEP in 1980, versus Lougheed in the mid 70's when he came into power. So go ahead, the comparison.

IC: I don't know if you can compare them but what Lougheed did, in raising gasoline taxes and some royalty rates and so on, I think the province had a provincial deficit at that time.

DF: Maybe, I doubt it but go ahead.

IC: So I'm not sure of that either but I had the idea somewhere we ended up with a number of billions of dollars provincial debt. It may have been afterwards, Lougheed might have done this prior to that situation, I don't know, I can't remember exactly the timing. Certainly royalty rates did go up but I don't think they were anywhere near as onerous as what the federal government's NEP did to the oil business in general here. I suppose one argument you could say, what Lougheed did applied to Alberta, what the federal government did applied to western Canada. So it had a much broader implication and comparing the two, I can't do that. I really can't remember for sure if there wasn't

something to do with the level of the provincial debt at that time. Because Lougheed started spending a lot more money on, I guess, highways and various infrastructure programs.

DF: Well, that already started well before Lougheed. The Social Credit government, I mean, for the 50th Anniversary of the province they built the Jubilee Auditorium, they created the University of Calgary, there were a whole mess of those things and more paving of highways and so on, many of those things happened before Lougheed. But certainly that first 5-10 years after Lougheed came in there was much more wealth again.

IC: I was thinking, when you mentioned those Jubilee Auditoriums, I think they were worth $3.5 million each weren't they, I think that's the number. It sticks in my mind, and I do remember, as you say, the Jubilee project which was accepted by everybody as a good idea. As far as infrastructure is concerned we still have a problem, big time.

DF: Because?

IC: Because of the expansion in the population we've got in Alberta, thanks to the buoyancy of the economy here. I guess from the point of view of highways, the buoyant economy has produced a lot of new businesses. There's much more trucking back and forth on the highways, there's greater upkeep, they're expanding 2 of the 4 lane highways to take care of the traffic and so on. So that all kind of comes back into the economy of the province as a whole, which is a good thing. The only thing that makes you wonder is what happens, maybe when the oil business starts to wind down. I'm sure that won't happen for a long time with the tar sands but someday there will be other factors that are going to take account here.

DF: Don't you think that's already happening, what with tight budgets and health care and education?

IC: I think that's right.

DF: Competing for money with roads and everything else?

IC: I do indeed. Education, certainly hospitals, health care and so on. More and more of certainly, the provinces right across Canada, budgets are going into these items. Alberta's just luckier than anywhere else that they happen to have more money to apply to it.

DF: Right now.

IC: Yes, that's what I mean, that they have it now. But looking into the future it can be a real problem.

#048 DF: But we also have a cyclical economy here. When Ralph Klein first went into power

we had some severe deficits, so some very hard cuts had to be made. The last few years have been quite surplus, but that doesn't mean it's not going to dip again.

IC: Not at all, I'm sure that's probably going to happen. Really, when things get better and suddenly everybody wants more, that's fine as long as your incomes are staying at high levels and the provincial income is too, you can satisfy those demands. But when the thing starts to turn down, you're already obligated at these higher levels, based on a higher income level and if that stops off that expectation stays up there. If anybody starts

to cut it then they've got a problem. People don't like to see things get cut. They don't care who pays for it but . . . No, you're right, it is cyclical. We've been lucky, it hasn't been so cyclical here because the demand for oil and gas has stayed high and growing. Today the prices of oil are over $34 a barrel, that's what I heard on the TV, and the outlook is maybe $40 a barrel.

DF: And strong gas prices too.

IC: Yes. Strong gas prices, although they came off some today.

DF: Did they?

IC: Yes, quite a bit. But can you imagine what you're going to pay for gasoline for your car, at $40 a barrel. And everybody will say, the government better do something about that. Do you want another NEP?

DF: Any regrets about your career, places you wish you could have gone? Did you go overseas any?

IC: Yes.

DF: Tell us about your overseas work?

IC: I was fortunate to get an assignment to Holland. I was gone for about a year and my family too. We were in New York for about 3 months that year, visiting the head office there of Shell Oil.

#073 DF: What was this in aid of, what kind of assignment?

IC: Kind of an observation kind of assignment as to what happened in the head office in the U.S.. In New York, that's for sure. And in Holland it was similar, to see what the operations were there, because that's the technical centre of Shell. I got assigned to Algeria, working in The Hague, reviewing the Algerian programs. I was lucky enough to get sent down there for about 3 weeks or a month. Shell was operating in the Sahara at that time and they had an office in Algiers and a group of us went and spent about 3 weeks on a geological field trip down in the Sahara. Because there had been oil and gas discovered down there at the time. And that was quite an experience because that's a different world. Visited some geophysical operations that were going on in the Sahara Desert itself. The problem that you had there with geophysics, because of all the sand, the kind of record that you got were really bad. They were doing experimental work in trying to improve geophysical data. I spent about a week in the geophysical camp that was operating down there at the time. The really interesting part was the geological side of it because we were able to look at the geological sequence. The rocks come in off of a pre-Cambrian shield and dip down so we were able to observe a lot of the outcropping rocks on the surface. Which to me was interesting and the kind of an assignment that you couldn't buy, there's no way. There would be no way you could do it and today there's a lot of work being done in Algeria. At the time I was there, there was some huge gas field had been discovered. 1959. There was also a bit of a revolution going in Algeria at the time, which didn't affect us but it was something that people were aware of, that's for sure. There was a curfew in Algiers and you weren't allowed out after 8:00 at night. As I say, it didn't affect me particularly. From there I went over to Libya. Only spent about 2 weeks there because Shell had an office in Tripoli and there was a lot of exploration work

being done. I think Imperial or Exxon or Esso or whatever they were called in those days had made a major oil discovery in Libya. That was prior to 1959 I guess. So there was a lot of work being done in Libya at that time. That was before Ghaddafi ever appeared on the scene. They had a king in those days. Then from there, flew back to The Hague, through Italy. So that was a very interesting period. I wrote a report on that. Because I did subsurface work in The Hague on Algeria and did an interpretation based just on subsurface data. I didn't have any geophysical data to operate with, it was down there. I've often wondered how good that report was, based on what I had to work with.

#!33 DF: Anything else you wish you could have done?

IC: No, I think I was pretty lucky in my time with Shell because I had an opportunity to visit some of the research facilities in Houston. They organized various geological trips that you could participate in where they discussed new ideas in the outcrops based on research work they'd done in their facilities. It was a means of keeping you up to date on new ideas that were generated elsewhere. And most companies spent a lot of money, I think, doing that for their staff. I'm sure Exxon does and major companies of one kind or another.

DF: What was your position when you retired?

IC: I was in charge of the planning.

DF: And did you do some consulting after that?

IC: A couple of years. Along the same lines. Because we had a change in. . .let me see how this worked. . . the vice-president we had retired and I'd been working for him. The new VP came and he was Swiss and he'd been at Shell's international operations and he'd been at Indonesia. So he got transferred here was his assignment from there. The idea I guess at the time was, it would be good if I stayed on. Like when my original boss retired I was going to stay with him for 6 months until he left and then I was going to leave. Then it was considered maybe a good idea if I carried on for another period of time while this new vice-president got established. And that's the way it worked. Because he operated somewhat differently, they always do. So after, in total I stayed 2 years. Then there was a downturn in the oil business and everybody started to. . . let's see, that would have been 1986 I guess. . .people started to look at their staff levels, including Shell. Because there was more than me that carried on as a consultant at that time. One of the first places that they look is at consultants because do you really need them. So I've forgotten how many but there would have been close to a dozen consultants I guess, that, when their contracts were up, they weren't renewed. But then there was also staff downsizing that occurred at the same time.

DF: What have you done in your retirement?

IC: Not a lot but I seem to be busy all the time. My son and my daughter, who are both in the oil business still, keep me up to date pretty well on what they're doing and what's going on in the business. I go to geological luncheons every once in awhile, conventions that occur here. And that's about as much as I've done, I haven't tried to actively get back into the business or anything like that. And I've been busy, it seems, with other things. Nothing important but busy. I guess, nothing too exotic. Talking to nice people like you

every once in awhile.

#197 DF: You're too kind. Some golf?

IC: Some golf, yes. Not very good but some golf. My wife passed away last May, prior to that we'd always gone down to the States in the spring time for about a month or so.

DF: Where did you go?

IC: California. We had some oil friends that had retired from Shell down there, that we used to visit. We'd see them for a few days. And then we'd spend about a month down near San Diego and return home and spend the summers here.

DF: Good. Well, unless there's something else you'd like to discuss.

IC: There really isn't very much else I don't think, that would have a bearing on what we've been talking about. I'm sure I'll think of lots more things when we're through but offhand I think we've covered most of it.

DF: Well, you've seen some very interesting times haven't you?

IC: I was lucky, just pure lucky. Because everything that I happened to do turned out to be one of a kind, kind of. Even the first geological survey that I was attached to, somebody was drilling a well up in northern B.C., the next year there was the Canol project and it was one of a kind situations.

DF: Yes. A year earlier or a year later you would. . .

IC: I would have missed them, that's exactly right. The year we worked west of Dawson Creek was the year that Dawson Creek was the supply starting point for the Alaska Highway. That was the year they started to build the Alaska Highway. It was incredible. Because that was the end of the rail line at Dawson Creek. That was quite a project too but to have been there. I did do some other field work I'd forgotten about, out of Fort St. John, that was about 1952. But it was just a brief month or so survey, check some information up there.

DF: That's in muskeg country too, isn't it?

IC: In the foothills it's not.

DF: Not too bad?

IC: No, but it can be terrible, terrible muskeg. Because Shell took a lot of land there. . .that's something I missed telling you. In 1949 when they moved back in here they took a lot of acreage in northeastern B.C. and a lot of that was in that muskeg country. I think they took a dozen fairly large blocks there. Extremely difficult operating conditions. It was really winter work, it was the only time you could do seismic work. If you were in there in the summer there was no way to get the equipment out again. That's still the case I think.

DF: But that is gas country isn't it?

IC: Yes, it is now. No, just about everywhere you go there's been some success one way or another. Even the most recent discoveries I guess, were made in there, Ladyfern I think is the name of the field. Yes, I'd forgotten about northeastern B.C. But that was very difficult country, east of the Alaska Highway for sure was difficult. But west in the mountains and foothills, not so bad.

#252 DF: Any horse stories? We're just about out of tape.

IC: Well, no.
DF: Did you and horses get along okay?
IC: Yes. The ones that we had were pretty docile. They were pack strings. The year that we worked north of Entrance, in Jasper, we had a pack string there, in total I think we had 24 horses. We were in that country for the whole summer and never came out but that wasn't unusual at that time. So horses at that time were one of the things that you did get experience with. But they weren't animals that were too wild.
DF: Well, some people certainly have stories to tell.
IC: Oh, I'm sure they do.
DF: Spent half the day looking for the horses.
IC: We never had that problem. We had 2 Cree Indians from up in that part of the world that looked after the horses. They had hobbles on and bells around their neck so we could usually locate them pretty readily. We never did have a problem with that.
DF: That's good
IC: But I'm sure there were cases where there were.
DF: Yes. Well on that note Mr. Crawford, I'd like to thank you so much for inviting me to come to your home.
IC: You're most welcome
DF: On behalf of the Petroleum Industry Oral History Project and particularly myself, thank you very, very much and we'll end the formal part of the interview at this time.
IC: Thank you very much indeed.
DF: Thank you.