THEODORE (TED) CYR

Theodore (Ted) Cyr, Ph D was born on June 15, 1941 in Prince Rupert, BC. He obtained a B Sc (1963) and M SC (1966) from the University of British Columbia. He then completed a Ph D in Chemistry at UBC and several post-doctorates including one in Japan working with Shimetsu Onishi in the area of pharmaceuticals (free radicals). On behalf of the Government of Canada, he did some research for the US Department of Defence. In 1970, he went to the University of Montreal where he taught physical chemistry and, then, to Ottawa where he worked for CAN-MET (Department of Mines and Minerals). In 1976-77, he joined Imperial Oil at their plant in Cold Lake where he worked on the treatment of waste water in the UTF project headed by Roger Butler. In 1978, he joined AOSTRA in a research capacity ultimately becoming Research Manager working with inventors in the grants program. He notes that AOSTRA research was in two streams: Field research, i.e., pilot projects; and, upstream projects focusing on fundamental research. When AOSTRA was wound down, he joined the Alberta Department of Energy (1978) and became Senior Advisor, Business and Research, a position he held until his retirement in April, 2013. Cyr developed a system for estimating the value of crude using algorithms and also worked with Minister of Energy Pat Black on the "Beta Project" with an Israeli corporation. Cyr also served as an advisor to the CANMET Energy Technology Centre (CETC-Devon) and notes that there was collaboration among ARC, CANMET and the universities of Alberta and Calgary. He served on the boards of OSRIN, University of Alberta; Alberta Energy and Utilities Board; and Alberta Energy and Research Institute. He holds a number of important patents including one with Roy Coates and Marcel Polikar: Steam-assisted gravity drainage heavy oil recovery process. Alberta Oil Sands Technology and Research Authority July 2001: US 6257334.

Date and place of birth (if available): Prince Rupert, BC, June 15th, 1943

Date and place of interview: May 23, 2013, 4:23 pm at Adriana Davies' residence.

Contact Information:
Ted Cyr
3208 – 91 Street SW
Edmonton, AB T6X 1A2
Tel: (780) 991-9633
Email: Ted.Cyr@gmail.com

Name of interviewer: Adriana A. Davies, CM, PhD

Name of videographer: Jimmy Bustos

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

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Consent form signed: Yes

Transcript reviewed by subject: Yes

Interview Duration: 2 hours and 16 minutes

Initials of Interviewer: AD

Last name of subject: CYR

AD: Good afternoon, Ted. My name is Adriana Davies and I'm the Researcher/Writer on the Petroleum History Society Oil Sands Oral History Project and it is the 23rd of May, 2013 and it is now 4:23 pm and I am interviewing Theodore (Ted) Cyr, recently-retired Senior Advisor Business and Research of Alberta Energy. Is that correct?

CYR: That is correct, yes.

AD: Good. So, Ted, as we discussed, if you can just give me a potted biography and then of course we will deal with different aspects of it as we explore your working life – your work in the oil sands and other areas. If you can begin by telling me the date and place of your birth and then continue with your education and your working life.

CYR: Well, in Northern B.C. in Prince Rupert was where I was born. I was raised over many places: Coquitlam, eventually New Westminster, and Burnaby. I went to university at the University of British Columbia and I entered my exam, as was the habit in those days, in need of funds. I stayed at St. Mark's as a novitiate and moved on to graduate studies after the bachelors, three years for the bachelors and masters. I did the Ph D in one year.

AD: Wow, so what was the subject specialization in the Masters and, then, in the Ph D program?

CYR: Well, essentially it was a feeding frenzy in those days, learning just about anything I could grab my hands to; a good part of it in physics, the chemistry, the inorganic chemical physics. After doing my graduate studies, I did two post-grad doctoral fellowships, one at the University of Kyoto; there I was in a large group worrying about cell chemistry. Took some chemicals – piperidine-N-oxide was the free radical – we could use that as a flag as it would attach to food stuff. As the cell digested it, it would move down through the membrane, into the Golgi, down into the Golgi apparatus. We would follow it that way until the cell dynamics – but from a physicist's point of view. Then, I went on to do two post-doctoral fellowships. The first was in Japan and then at Nottingham. There, again, it was diffusion. I worked with the people amongst whom was Peter Mitchell who eventually got the Nobel Prize for measuring diffusion and things like that in cells [1978]. That's where MRI [Magnetic Resonance Technology] comes from.

AD: So then how did you, when did you return to Canada and what did you end up doing?

CYR: I returned to Canada as an Assistant Professor at the University of Montreal and then moved on to the NRC as an invited scientist, then took up work with CAN-MET [Department of Mines and Minerals] which led me to Imperial Oil and, then, to AOSTRA [Alberta Oil Sands Technology and Research Authority].

AD: So that's the trajectory.

CYR: With many stops in it.

AD: Yes. So, you've indicated this love of learning led you to pursue a whole range of subject areas.

CYR: Yes, almost like a feeding frenzy, somewhat eidetic. I read something; I can usually recall it years later, like memorizing a play. Robert Seville was memorized in one flip and it seemed to attract the attention of the Canadian Broadcasting Corporation, so I spent some time as an expert or a scientist; saw some of the things David Suzuki did and others.

AD: So, very diverse. So, in terms of your Ph D in engineering...

CYR: My Ph D was in Chemistry

AD: Oh, it was in Chemistry. Okay; and you did that in Japan.

CYR: In Japan I had a post-doctoral in Physics and the one in Nottingham in Physics. As a student, I took a wide range of courses. The annual fees were a flat fee, didn't matter how many courses.

AD: So, you took as many as possible. Now, when one thinks of free radicals today, you think of food, pharmaceuticals and stuff. So what took you from there to the Department of Mines and Minerals; there is a leap there isn't there?

CYR: Learning, applying my engineering skills. I did take some courses at the University of Alberta that qualified me as an Engineer. My first courses in Engineering were as an undergraduate at UBC, some courses in Electrical Engineering and I know it sounds pretty wild but it fit into my calendar, so being a flat fee, it was a natural thing to do.

AD: So, you started out as a University Professor in 1970, at the University of Montreal, where you told me that you taught Physical Chemistry. What enticed you to go to the Department of Mines and Minerals [CAN-MET] and, of course, the connection with the National Research Council [NRC].

CYR: I was moving to areas where I was better suited – the physical sciences, the engineering – it was made for me.

AD: So, what was your first project when you went over to Mines and Minerals?

CYR: The first project was on the combustion of coal; we looked at the collieries; we looked at the furnaces; for example, the furnace out at Battle River, there was a 30 megawatt unit; helped commission that; assisted in the commissioning of that. Basically, their problem there was that the hydrazine which is fed through the feed water to remove oxygen, somebody had neglected to fill it, which led to – they had serious corrosion in their unit. It was easy to identify once I was there.

AD: So, it was applied research.

CYR: It was applied, yes.

AD: And, so, what facility, what type of facility was it where you addressed this problem?

CYR: That was an example of a boiler where we addressed that problem.

AD: So, it was part of an entity that did what?

CYR: It generated power; it was a boiler.

AD: It was power generation.

CYR: It was a 30 megawatt unit there. I saw other units as well, but it was basically the same thing. And I recognized that my skills were best in engineering.

AD: And, so, the years in Ottawa were then involved with coal research or other types of research?

CYR: In combustion.

AD: All combustion?

CYR: All combustion; so, gas-fired, coal-fired, but most of the challenges were in coal-fired.

AD: And it was in getting existing systems to be more functional, is that correct?

CYR: Coal is an extraordinarily inexpensive fuel, so, it presents physical problems; the ash in it melts and fouls hot surfaces. The coal itself ranges in grade; some is oxidized, others aren't; so its combustion properties change with time. Most coal-fired utilities start up on gas and, then, they switch to coal and they can run for three-five-ten years with very little upset.

The challenge which was presented was to look at the combustion of coal – with Imperial Oil. I went to Imperial – would be about 1978, I think, 1977 I arrived there. They were about to set up a coal-fired utility. They had a system where they were running through, or planned to, or designed a system where they would pulverize the coal and send a slurry of coal out to Cold Lake. And, then, that would be fired in a utility boiler. By that time, I had enough experience to recognize why I was

hired, and that was to say that it wasn't appropriate fuel. The cost would be in treating water, then, you save on the coal; you're loose on maintaining your boilers.

AD: Now, in terms of Imperial, which facility was it?

CYR: It was about to be commissioned –Mildred Lake [in situ oil sands extraction project using steam-assisted gravity drainage].

AD: And that's your first connection to oil sands?

CYR: It was day one of work and, so then, I focused on the design of boilers and basically trying to understand how dirty can the water be yet generate steam. The water-treating costs would dominate in many cases and natural gas was essentially free. So, the use of methane as the preferred fuel made for a simple boiler, easily designed and focused one's energies not on the combustion properties but on the water-treating side, and there are ways of resolving that.

AD: So, give me an idea of what the plant was like at that point. You are sent out there to look at, was it already built?

CYR: They had several boilers; they were small units. They were essentially experimental, leading later on to commercial size. The smallest units were natural-gas-fired and they had problems with water treating, and on design. So, design evolved from a simple boiler you might find in those days in California to the modern ones where the tubing in the fire side, for example, was the "zig-zag" [type that] goes around in and out of the boiler but the hairpin bends in the end end outside the boiler so that, by cutting one side in the opposite, you have something in the shape of the letter "J" that you can pull out and replace very quickly. And, so, there were improvements not only in the design but in the methodology.

AD: So, it was, for you – the focus is in extraction and/or power generation.

CYR: Well, the focus of the method of producing the oil was through generating high steam – about 1700 PSI – and that would be conducted into the ground through the well; that would cause the formation to fracture, really just part sufficiently so that the steam could escape at great length into the formation. There – the cap rock (the rock above) – as the steam would rise, it would more easily crack there. The cap rock was substantial and there was no loss outside, but we did study the drill mechanics. Imperial had a – was essentially the world leader in that and, through Exxon, they had access to the work, the long history of work they had done in Venezuela at Faja del Orinoco – the Orinoco Belt.[1] And, so, Imperial was linked into an amazing network of – essentially I had access to

[1] In Venezuela, the major developments are the four Orinoco projects, all partnered with PDVSA (Petroleos de Venezuela, s.a.). From east to west, they are: Cerro Negro Project, operated by Exxon-Mobil; Ameriven Project (Hamaca), operated by Phillips and Texaco; Petrozuata Project, operated by Conoco Sincor Project, co-operated by TotalFinaElf, Statoil and PDVSA. From M. B. Dusseault "Comparing Venezuelan and Canadian Heavy Oil and Tar

the _____ Task Force Reports, which described every boiler in the world, not that I needed to do that but it meant there was a lot of wisdom in there. It was mainly to figure it out, the things that were relevant.

AD: Now, was Roger Butler also working?

CYR: He was my boss at Imperial.

AD: Okay.

CYR: An amazing fellow to work with. He already had the concept of the horizontal well, which we have today. His earliest patent had it right; he was reserving a few things in there to have a second patent, as he had a series of them. The first one had the horizontal well sloping upwards to drain the producing end, and the vertical well to be steamed above that. His idea was to stimulate that well until they communicated and, after that, to maintain the steaming; ingenious. Most people who read it the first time would misunderstand it, which was fortunate for the corporation, but knowing how to use the research author's intent, and reading it very carefully, he revealed things and made the appropriate claims. He built onto that to publish some very good books – I should have brought one of them with me – where he essentially introduces people to the "huff and puff" methods of producing oil. I think most people that knew and worked with him admired him.

AD: And, so, you were really talking about the first era, the research era of what now is SAGD technology.

CYR: He was the leader in that. It was amazing that the rest of the world was so slow in not taking up the concept. It was a big step for any corporation to take.

AD: I, guess, looking at it at that stage, you had Great Canadian Oil Sands [GCOS]/Suncor and Syncrude that were the miners, major investment in strip mining and processing, and here this was a totally different technology.

CYR: Well, the companies recognized that there was a greater resource buried, and it's inaccessible to mining – or potentially greater. And, so, it was an area to be studied. Mining presents many challenges; if you mine, for example taking Syncrude, where they mined the oil, they would use these draglines and stack it up in windrows, and it would oxidize quite rapidly. Freshly-mined ore behaved very differently from that which is aged hours, or days, or months. It took years to learn that, of course, but it did have an effect. The Aurora Mine, at that time, when they expanded, I remember

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Sands," Canadian International Petroleum Conference 2001, PAPER 2001-061. URL: http://www.firp.ula.ve/archivos/historicos/01_CIPC_Dusseault.pdf, retrieved June 27, 2013.

that they did quite an extensive mining into windrows for which they build the plant. By that time, it was oxidized and didn't behave as well, which presented challenges to the company. Fresh ore certainly reduces the challenge to be quite easily accomplished.

AD: So, what decided you that this was the area that you wanted to spend some time on?

CYR: Oh, wife and children; a boy and a girl, Reiko and Gregory. They went to school and that fastened me into one place. You don't move easily with young children who are entering school. And the wife Natsu went to work at the Alberta Research Council as a Senior Scientist. She was well funded there and I think accomplished many things.

AD: So, then, you worked for Imperial and did this work at Cold Lake; where were you living at that time?

CYR: At that time, we were living in the area near the Whitemud Freeway, on the west end of it. We called it Riverbend but it wasn't; it has another name to it, but it looks onto Whitemud Creek.

AD: So, you settled in Edmonton then.

CYR: Planted roots.

AD: And, then, when did you leave Imperial and work for AOSTRA [Alberta Oil Sands Technology and Research Authority]? Do you want to give me a bit of the history of AOSTRA and, then, your involvement?

CYR: I was invited to come up to Edmonton. I got onto the PWA [Pacific Western Airlines] – I guess they called it in those days – and I had a gentleman sitting beside me that I didn't know until later, It was our Premier, who encouraged me and asked me what I was doing and I said I was going to an interview. He asked me many questions, which were loaded. It was interesting, the hindsight – to recognize this burly fellow or two of them who he came onto the plane with; he had asked them to sit elsewhere. So, I didn't have to move, but we had passed through lives by meeting people who are much greater.

AD: So, that's interesting, you met Peter Lougheed on a plane.

CYR: At the entry on the Calgary end, when the plane was about to depart and these three people came on.

AD: Who were the others with him?

CYR: They were very big fellows, I wouldn't say they were body guards but they were there for a reason.

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AD: And, so, this was a casual chat on an airplane with Peter Lougheed and can you tell me the exact date more or less?

CYR: It was probably 1978 or thereabouts.

AD: November, 1978.

CYR: And he was sitting at the aisle and I was sitting at the window. He asked me a few questions about what I thought about Alberta, and a few other things. The recollection of the conversation became important, when others told me – "Do you know who you were sitting beside?" – because I didn't and he took advantage of that, I think.

AD: So, he was talent spotting, then, in other words.

CYR: I think he was being polite. He was a very generous person.

AD: So, what did he tell you to do?

CYR: He didn't really tell me; he was inquiring and I think he recognized early that I didn't know much about Alberta.

AD: And, so, the interview was for what position then?

CYR: It was to be a Research Manager, mainly of small things, some University projects. [AD: He was Manager of University Research Programs.] They had some money set aside as a special fund to sustain the inventors.

AD: So, this was then AOSTRA [Alberta Oil Sands Technology and Research Authority]?

CYR: That was correct, yes.

AD: And, of course, this was in the early days for AOSTRA?

CYR: It was a very tight accommodation, yes. If you shifted your chair too much you bumped into someone.

AD: So, where was your lab and office located?

CYR: I didn't have a lab; I was administering research projects and so one part was working with inventors and there was the Inventors Grant Assistance Program, which was essentially "free" money. People, if they invented something, they retained the ownership of the invention. That was sufficient to bring many people forward with their best ideas. And, then, I was also working with the people at the Council [Research Council of Alberta]. We funded some work also; at that time they

worked in Clover Bar and I got to meet Palle Hanson and his people at CANMET [Department of Mines and Minerals].

AD: So, who was your boss at that time?

CYR: Early, it was Roger Miller and later it was Maurice Carrigy.

AD: So at AOSTRA, then, and, of course, above Maurice was Clem Bowman.

CYR: Maurice was the Vice Chairman and he was appointed by the Government. Clem was on contract; both very inspiring people. Maurice had a cool head "when all about him," as the tale goes. It was moving; he held it together.

AD: Now, tell me about the scope of the funding and, then, the mandate of AOSTRA?

CYR: The first ten years they had a 750 million dollar fund to expend. As a Crown Corporation, it was independent of the politics, at arm's length, and, I think, there was a great effort to maintain that. Not from the side of the people within AOSTRA, but from the government side. The politicians felt it best be an enterprise, which would generate information, but not own it. It would be owned by the public.

AD: And, so, in your perception, what was the mandate of this entity?

CYR: It was to develop a healthy industry in the bitumen mining, extraction and upgrading. So, all those elements were there, but also meant to build up a large body of information by seeing what the rest of the world is doing; by educating people in the universities – students our major product there – attracting the right professors; and that was a challenge because Alberta was essentially unknown; essentially providing the infrastructure.

The target at the beginning was very evident to me – was the SAGD process – and, so, when AOSTRA reached its mandate, it was Roger Butler's process that was tested and proven to be the right one. That was the underground test facility [UTF]; in those days we didn't have very good directional drilling and, so, they built a tunnel under the ground and drilled out to them. The experience there – listening to it when they turned the fans off – was that it was a very noisy process; the steam going in, even though it's not high-pressure that creates a thermal gradient and, with any piece of pottery, if you heat it too much, it will shatter if you don't distribute the heat. [I] did succeed in one thing, persuading the fellows to turn off the air conditioning; it was a "snap, crackle and pop" noise which I really marvelled, hadn't heard when the fans were on.

AD: So, did people that work there have to wear ear protection, and so on, or you just got used to it?

CYR: No, when things are quiet, dropping a feather makes noise. The steam injected at modest pressure, essentially atmospheric or a little above that; we can't thermal gradient sufficient for the

ground to fracture through a metre or even three or four metres of shale, which meant that the SAGD process was rated, then, on the rate of looking at "heat in," which meant we had to deal with – we had pure steam, pure clean water and the rest of it. And, essentially, designed a system where we could get the steam in quickly – have a good wide diameter bore. We had clean equipment; it turned out to be the same thing you might do in a kitchen, not much different.

AD: But, on a much grander scale. Now, I'm thinking, so you are put in charge of this Grants Program...

CYR: And the University Program.

AD: As well?

CYR: Well, to work with the professors too; mainly, I saw my role there as mainly recruiting professors – to persuade them to work on things that were relevant to AOSTRA's goal, and provide funds for the University to attract the people that – whether they be in Lethbridge, Calgary or the University of Alberta. Just think of one professor - for example, we had Farouq Ali]Syed Mohammad Farouq Ali]. He had about 25 students in Alabama – I think that's where we recruited him from – but he will tell you. When he arrived, he took over the sixth floor of the building, and just generated his students that populated the industry with experts; marvelous effect.

AD: I mean, it's hard to believe these times that – where innovation was happening in significant ways, and that research establishments were being created, and whole new fields of studies – is that a fair assessment?

CYR: Quite accurate.

AD: Yes, that's what was happening.

CYR: Oh, yes, and it affected people. I got to work with the USDOE [United States Department of Energy] out of Bartlesville. I was managing – you will see my name on some of the reports at Stanford and elsewhere as Project Manager for the U.S. The people there, they look for an expert, and I was volunteered, or they asked, I wasn't volunteered but anyways I went.

AD: Was it research related to petroleum or...?

CYR: It was related to our oil sands; the Americans are as, or even more, interested in developing the technology to work in California, but their eyes were on Canada. So, they were spending more money than we were.

AD: And, so, did you have to live outside the country at that period?

CYR: I travelled; it was easy for me to get on a plane and, so, essentially I was co-managing or assisting in the management of projects there, and that was true in Japan as well and in China; I got

to meet many people. The scientists, without exception, I found to be innovative and they recognized the value of the tar. The Jindow Oil Company; for example, in China, they took technology that they learned here and the scientists that came and returned there applied that in Western China near _____. In fact, the first of the top-drive rigs were built there, or actually built near Shanghai but being used there.

One trip to _____, I went to_____, which was to the west of that – south and west – and there I saw the first of the top-drive rigs. It was an improvement on the Romanian design. There was tremendous electric generator, which is about the size of a barn; it was generating the electricity that would run the pumps that would pump the oil that would drag the gears that turned the rig. So, the handle would reach down to the pipe rack, latch onto a piece of pipe, spin onto it, that is, pull it up, spin it onto the exposed casing drill bit, and proceed on for another 10 metre length, which is 30 feet, or close to it. And we imported that; we managed to purchase the Morgan Oil – Flanagan was his name, and I forget the name of – Husky Oil, but the fellow there – it will come to mind but the President of Husky brought in one unit. It was disassembled and examined and copies were built, and it became [one of] our top-drive rigs here.

AD: What's amazing, as well, is that international cooperation.

CYR: I think we did copy things.

AD: But isn't that the sincerest form of flattery?

CYR: Of course it is. Their students come here and they work here; and they come here and they develop their concepts; and many of them stay here; and that is very much to our advantage.

AD: Yes and, well, you think of the Chinese students [that] are now leading oil sands scientists and others.

CYR: Well, if you look at a country of many, several billion, and you take the top one or two percent, you still have more than Canada, as people.

AD: So, you know – were the granting categories and guidelines well established when you took on your position? How much leeway did you have in terms of the funding?

CYR: I got testing with frontiers and, so, managing the projects in the US was one of the frontiers; getting the Americans to develop the technology is important. There were groups at Stanford, for example, 20-30 students that most moved on to Canada, so, it was to our benefit.

AD: And, because I think that for me being a historian and a science and technology specialist, and having traced this on a national level, it's how Canada as a small power – you mentioned the comparison to our research establishments and universities versus the Chinese or any other country – that we were able to buy in some of that expertise and then generate all sorts of new knowledge and products and so on.

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CYR: I have a slightly different view on it, but it's somewhat jaded. I was at a meeting once in Washington – it was with the Deputy Under Secretary for Energy. He said, "You all may think you own that resource but we do – it's our companies."

AD: I think I may end up with a question around the whole ownership issue because it does come up, and the involvement of American research establishments.

CYR: It means a lot to Canada too – to sell the oil – and to Alberta; the cost of building a pipeline to the coast – tidewater in that direction – far exceeds that of building many pipelines to the refineries in the US. Oil is competitive with that coming out of Illinois, and they already have the experience. The Koch refinery at – the Koch family owned the refinery – at Corpus Christi with 470 thousand barrels a day. They built line; I guess, being line 11, from Illinois right down to Corpus Christi (the Mexican border) and our oil was soon entering that. We could drill and produce oil more rapidly, up the stream to the point where, eventually, that oil got into the pipelines on the coast; and most refineries converted to taking some of our heavy [oil] on.

AD: So, when you took on this job, did you consider that you were going to spend the rest of your working life in Alberta, essentially, AOSTRA, then the Ministry of Energy, and so on.

CYR: I don't think I anticipated it but it became that way, with a lot of circumstance.

AD: So, can you think of any of those bright young talents that you were supposed to nurture, in projects that either bore fruit or not? Do you want to talk about that aspect of your work?

CYR: Well, a good scientist will study anything; they can't help it; and they will invent. So, my job was to facilitate and that, of course, is something that_____ _____ _____. Imagine Farouq Ali bringing 25 students and I persuade the Dean to make space; so, he took over the sixth floor of the building. Funding is not just providing money; it provided an infrastructure that goes along with it. That was part of my challenge. I got to work with the professors, encourage them, especially their students. I'd take a student in Geology and persuade them to go into Civil Engineering. Civil Engineering is important to understanding what is happening in the rock structures; a geologist was the right person. Maurice Dusseault is an example you may interview.

AD: We have interviewed him.

CYR: Oh, okay, well, did he mention my name? I felt we had what we called the "Masters of Oil Sands Engineering Program" and captured students who were fresh graduates, and got them to move into the oil sands area, and many of them – a good percentage of them – went on to teaching, and even started their own companies.

AD: So, you had a very close relationship with the University of Alberta and, of course, Roger Butler ended up at the new University of Calgary. So, can you talk to me about the relationships that you had with each University?

CYR: There were quite a large number of professors involved in Calgary – those involving in situ combustion – because that was an alternative process to exploit. There were others working in the chemistry and the geology and, I think, they were closer to the industry and inspired on real problems. The ones in Edmonton – at the University of Alberta – the ones we recruited, some we took as regular engineers and potentially promoted them. They succeeded with having the cash and they had the wits to attract good students.

AD: So, you funded research; did you fund scholarships? What tools?

CYR: Well the MOSES Program was a form of a scholarship.

AD: Sorry, can you….

CYR: Master of Oil Sands Engineering and Science, and that took students and that was really trying to attract students – well, I should say, AOSTRA was trying to attract students of other disciplines, and being of another discipline, they would come into this engineering "stodgy old business" and make things much more interesting with the inventions, or just different ways of doing things.

AD: So, who is instrumental in creating that Masters of Oil Sands?

CYR: I think Clem Bowman and Maurice Carrigy; and the board of AOSTRA was essential; it came from them. I'd like to think that Maurice Carrigy was the most interested in it; the others, they would read the reports and they would tell me I was doing the right things. But, I think, Maurice Carrigy was the one for me, who was the driving force.

AD: In terms of the achievements of AOSTRA, you want to highlight some of those?

CYR: Well, we have the annual report here, which gives you an indication. The Research section ["Research & Technology Section" of *AOSTRA: A 15 Year Portfolio of Achievement*, published by AOSTRA in 1990] – you can see is mostly people. The others were focused on the in situ projects and upgrading projects, and they were essential. The UTF [Underground Test Facility] was the determining factor. It proved the principle that we could produce oil at great depth by the SAGD process; the credit of which goes to Roger Butler. It meant also that we had a clean oil we could produce without producing a lot of sand with it, and other things, and, so, the focus turned to the refining. And we managed to attract some projects there; some oil was shipped off to France, for example, to test at one of the units there. It didn't work, but the technology we have now, which essentially is delayed coking or based around delayed coking, which is a component of almost any refinery. And the technology dates back to the Hittite Tribes. In the times of Alexander the Great, they would essentially coke the oil with an alembic;[2] they would heat it up and the liquid that came is

[2] Wikipedia: An alembic (from Arabic *al-anbiq* الأنبيق, from Greek ἄμβυξ *ambyx* possibly from Semitic)[1] is an alchemical still consisting of two vessels connected by a tube. Technically, the alembic is the lid with a tube attachment (the *capital* or *still-head*), which is placed on top of a flask, the cucurbit, containing the material to be distilled, but the word is often used to refer to the entire distillation apparatus. If the lid and flask are in one piece, it may be called a

essentially diesel, which is a great vermifuge, and proved effective as a savior of the armies of the Greeks and the Romans, and was used up until the mid-1960s as intestinal vermifuge amongst humans. The replacements of that were more toxic.

AD: Now, did you envision yourself as going into management in this way – research management – rather than doing your own research and pursuing that, whether in an academic establishment or industry, or a research lab within industry?

CYR: I did explore other avenues, but none would provide the latitude that I had – a couple of people that would attribute my success to me, when my success was due to the people I was working with, until I recognized that to step out, especially with children at school age, I was better to be in a secure place, which was here.

AD: Now you mentioned one name – Maurice Dusseault – who, of course, a number of people have mentioned. Is there anyone else – any of that talent pool that...

CYR: Everybody that you see in here [points to *AOSTRA: A 15 Year Portfolio of Achievement*].

AD: Yes, but just in terms of anecdotes and your relationship with these people, can you share some of that; the interesting projects and interesting people?

CYR: Well, Maurice is interesting mainly from the way he developed. He was a geologist; we set up a modest program, and caused him to move into Engineering. He moved into the Engineering department. He is quite a "nosey" fellow, and so he generated much interaction with the professors, and I'll leave it at that level, but it was clear he was an inventor. He had shown insight into the geology and the geo-mechanical, which others were slow to accept. He had the intuition to be able to come to the mathematical expression, without having to do a lot of "grunt" work, and he also inspired the students. I think he was a capital resource.

Roger Butler continued at the University of Calgary and, really, he led the implementation of the SAGD process – was there as a resource – and I think he was fundamental there. I can't think of any person having more effect on the petroleum industry than he's had.

AD: When we talk about the earlier era, we're thinking of Clark and a separation process, which spanned 30 years.

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retort. The liquid in the first flask is heated or boiled; the vapour rises and flows into the tube, where it cools and condenses, running into the second flask. A modern descendant of the alembic (used to produce distilled beverages) is the pot still.

CYR: Well, that's still important; it's still the dominant process being used. The SAGD is growing but it's still a very small stream, compared to that produced by the mining.

AD: So, in terms of the nature of the research projects, could you give me examples of the different areas that were funded, and individuals involved with them, and which succeeded and which didn't, because not all research bears fruit in terms of practical application?

CYR: Those that don't succeed are somewhat – some are a nightmare – but they are there. I will give one which is debatable – which is in situ combustion. We funded research in there and – as the DUSD [Deputy under Secretary of Defense] – it's been done just about around the world. Romania was the leader there.[3] And that technology migrated just about everywhere it was applied. When I looked closely, it really wasn't a successful process. An early experiment by Texaco – around about 1980, or 1978-79 – they did an experiment; I think it was in California – it was one of the valleys there, not far west of Bakersfield. And, there, after they did the in situ combustion – quite shallow, about 10 metres deep – then, they dug up the hillside in which it had been done and you could see the combustion – the red ochre of something that looked like a tree root break it. You could see that was where the combustion was going but it would disappear and reappear some distance later, where the flux of the air was enough to oxidize the oil sufficiently so that it would start to combust – so that's experiment. Alex McKee [Turta?] was the one of the fellows from Texaco who was managing at the time – convinced me that that was not a good process. He, at that time, had a project up at Fort McMurray where they had 19 well pairs and you had an air injector beside it – potential producing well and very few of those where you injected air would communicate to that well, from here to that fence away; and, mainly, because, when the air would come in, it would oxidize the oil and cause it to divert. And, like we saw at their combustion experiment – in Sun Ardo was where it was – it was unlikely to succeed in the field.

So, we watched that project stop; Alex did a fundamental experiment, though. He set up three well pairs, each at three pipe-lengths long (that would be 90 feet), horizontal section, which were perforated and, essentially, had been _____ _____ and cut and wrapped in wire; just like the well point you put into your water-producing well in Edmonton, or the one I have at my house.

There they tried to inject steam and make something happen, and a lot of mud came out. What had happened was the steam had migrated to one of the wells, from the injector to three parallel wells, migrated to one of them, and the pressure dropped between the steam outside the well and that

[3] Suplacu de Barcau, Romania is the largest project of its kind. URL: http://www.terrapinn.com/2012/eor-and-heavy-oil-world-mena/Data/statusofiscprojects.pdf, retrieved June 28, 2013.

inside the well – was less than 70% of that of the outside. From the physics, we know that … the gas coming through that jet would probably be at sonic velocity, and, in the layer of clay or sand, would chew away the opposite wall, which it did, and that was why they had the blowout, which demonstrated the physics very well, and demonstrated to me and to Alex, who I admired at that time as being quite practical, that it was an impractical thing to do. And, so, we did say "No" to the in situ combustion project, but maybe somebody will think of a way to make it work.

AD: In terms of the interviews that I have done, it's the whole issue of controlling this and the variability of the terrain in which the oil sands is contained; these processes are not predictable and repeatable, which you have to have for commercial exploitation. Is that correct?

CYR: That is correct. The demonstrating of the Physics of it at San Ardo where the flame would disappear and reappear quite a distance away, essentially in ways that could prompt the question, "Can you control it?" The oil that is produced is very acidic, and can affect – the refinery would not want too much of that in the oil. Recent tests – we set up pilot tests – it's the border – by the Alberta Department of Energy have demonstrated that. The innovations show that it's complicated. Some inventor, of course, will find a way to make it work, eventually – but so far we haven't seen any success. There they injected the air at the Petrobank – injected the air at great pressure, near Conklin and, eventually, the well blew out because the sand would migrate in and cut out the well head.[4] That was similar to the experiment at Texaco, the same basis and experience. We couldn't see anything different or new, other than being a timeless past, and the thing that we had to control was what occurred inside the reservoir – not at the surface. But the challenge is there; we leave it open for somebody else to find a way to make it work, if it can be made to work – it would be very attractive. The problem with fire oil is it's an acidic one, and it will dissolve steel. The problem with in situ combustions, you are injecting out an enormous amount of gas which, if it accelerates the _____ constraint, it will migrate in its own direction, or cut through well casings and things. If we want to cut a hole in steel, we can sandblast with the air at high velocity and the sand will cut through almost anything.

AD: So, tell me about other research that was funded.

CYR: Well, we tried many things; they are in the handbook. There was much experimentation in the refining of the oil. Some of the oil – there was a process developed in France for handling that, and some oil was sent across. They weren't able to handle the oil; in fact, it plugged their unit, which was

[4] Whitesands project – "Development of our oil sands oil assets first began in 2006 with the construction and commissioning of the three well-pair Conklin demonstration project. It was developed as our first THAI® demonstration site and was used to develop our THAI® production technology and other enhancements." URL: http://www.whitesandsinsitu.com/about-us/conklin, retrieved 15 June, 2013.

bad news for us. The process looked interesting. The delayed-coking method seemed to be the one that was proven, but that was proven in 1968 – it was proven long before that. And the hydrocracking – I did some experiments in that with some scientists at the Alberta Research Council. We invented a process that would work; the problem with something like that is that it is very attractive theoretically; practically it isn't. The test comes whether you would put it in a refinery. The refinery manager likes to run that refinery three/five years continuously. And, so, it's designed to run with a particular mix of feed and, if you put something strange in there, you have to made accommodation elsewhere to have that "right mix" for the refinery.

One of the problems that occurred, for example, at the Husky Refinery at Lloydminster; they had some problems. They were taking some dirty oil and that shut down their hydrocrackers. When I got involved, there was about a cubic metre volume of it inside the reactor, which is five feet wide, and 75 thermal couple bundles going through it; very busy. It was a marvelous type of coke and they were able to continue running it at a much reduced level – about 30,000 barrels a day. Bob Miller, then the MLA there, asked me to get involved. So, I went there as an agent of the Crown and we managed to persuade them to refit the refinery, and they were back to their 76,000 barrels very soon. So, I was there – I had other functions – I was the "go-to" boy.

AD: Now, it's an issue today and, of course, more recently, both the Federal Government and the Provincial Government have instructed universities, state research agencies to focus on research on what is exploitable by industry – to simplify it. This is not an easy process is it? I'd like you to comment on that.

CYR: I found it easy; it's a matter of how you manage the people. You cultivate; you move people. Research really means to "look again," look at something again and again. Something needs to – it has to be live. Inventors will invent; they can't help it; they do that; they see problems; they look at the world differently. And, we put it at [a] university; we hire professors to teach and instruct and carry on learning; and, amongst those, there are some inventors. Those inventors make the whole thing worthwhile. This is the same at research institutes; you may have 30 people and one inventor keeps everyone busy.

AD: And, so, how do you choose those inventors?

CYR: I wish I knew how to choose them.

AD: That's the crucial thing, isn't it?

CYR: You recognize inventors because they are already inventing; they can't help it.

AD: Okay, so you don't make them inventors.

CYR: I think it's part of their nature. It's like a poet or a musician; it's part of their nature, and that's a tested theory. I think many people would admit to that. Roger Butler was an inventor at Imperial; he did all sorts of things. The inventions, at first, would cause us to think about it and, if that didn't seem to be practical, after a while, we'd start to thinking – he is on to something, and he was very good at that – in explaining things.

AD: So, you think, then, that AOSTRA's success was in providing funding and helping to create mechanisms; for example, research entities within government, or industry, within universities in collaboration to do this kind of very focused research.

CYR: Inventions come by opportunity. You can't say to somebody, "Go and invent something." You invent by the opportunity and I've had a few inventions but – and I can attribute most of that invention to other people – but the opportunity [was mine]. A friend and I were traveling to Calgary to a meeting and we stopped in Red Deer (it was the midpoint) for relief and a meal, and we were talking about the business. Somebody at a table nearby came over and asked us, "Can you help us? We have a pipeline pigging unit [technology applied for pipeline cleaning]….and they described the unit and I got involved with them, and they eventually were a company called Hydroclean. I said, "Well I understand the design of your unit"; then, as an engineer, I was able to demonstrate how to make the unit work.

When you have a pig and you send it down a pipeline, it will hit an obstruction and still no shock. It's like steam or something going through; it stops in the wings and you hear the noise. If that noise – you can feed it back to the system and push the water feeds back and you can change the direction of flow by putting some pipe valves here so that the shock comes back. This one and that one are open and these two are closed or vice versa.

So, I set up a mechanism that the shock mechanism would cause to vibrate back and forth. Then, I looked at the pipe and said, "Well you have a problem, you won't get it out of the furnace." We want a pig there that, if it hits an obstruction, if it's too big, it will fall into tubes so that it tears in half. So, the bits and pieces come out and they aren't left with a problem of retrieving [it]. And the best scrapers are tire studs; they stay in tires at high speed and they should stay in the pig. So, out of that came an invention; and that was my job in working with inventors, to basically plant ideas in their head and develop businesses; and they did. They became very successful and, eventually, through growth, I think at one time they had about 90% of the pigging business in North America, about 50% of that in Germany and Europe. Then, the father moved on and the pig business fell apart as happens.

AD: So, how many years were you at AOSTRA doing this?

CYR: Well, AOSTRA essentially continued in a different form under the Department of Energy and, so, the transition would have been about 1980. The idea of funding projects, which are on the frontier and test them, migrated into the AOSTRA Innovation Program. And, so, the ownership remained with the company. The impetus to fund was similar – examination of the science – maybe these fellows have a different idea; we would take another hit at the problem; we tried it before and these fellows would chew away at it. They have a few bright people there that might make it work. Most advances in science come about by people having the right turn of mind at that point. I described the pipeline pig as an example. I think that was my function at AOSTRA. I did participate in inventions that occurred and, I think, about 18 patents have my name on it as a co-inventor but, in fact, others did the work. I think I had a small part, which was basically spotting something good, or maybe they were persistent enough so I didn't share the credit entirely.

AD: So, in terms of you running that area, how many projects were funded and how many of them bore fruit?

CYR: Well, if you were to say "bearing fruit" or whether you succeeded or failed, I think all of them bore fruit in the sense that, it if you close a door, it may open something to the next person, and so it's very difficult to say, "No, that couldn't be there," and somebody will say, "That didn't work. Oh that idiot, he forgot to do this..."

AD: Okay, so that is how you build on the people that have gone before, even learning from their failures right?

CYR: It's in the reporting function; the reports have to be untrammelled, and they are offered there; and the company gives a full disclosure. That full disclosure is really vital to the continuing research, and that's really what the Fund [AOSTRA] would do, unlock the information, that which was hidden and not protected by patent, and would become – the whole patenting process is based entirely on that.

Someone has an idea and they say, "Well, you can't lose it first to file," and they will, begrudgingly, describe as much detail as they can do. Others, may look at that and say, "I can see a better way to do it," and, so, it is the availability of information that I hear many Americans talk about, not in the public service, but individuals will say, "We should do away with patents; they prevent me from doing what I want to do." Amongst those are many that say, "It prevents me."

There is almost always a better way to do it, and so that patenting process is essential to the growth of the industry. To see the first integrated search of the patents there in the 1960's – but they weren't quite there, but they certainly drove the engine that caused people to think about how to make the very large integrated-circuits work. Same thing goes on in research. I've met some

researchers or scientists in companies that make photographic plates and things like that, and saw them make new paints. My role as a facilitator extended to industry, extended to participating in various funding organizations – the National Research Council, for example. There I was with many professors and others – very bright – and I found out, when I was there, that I was a bit more generous than most. As an adviser of the people, they allowed me to talk, and I was very cautious. I was hoping to, essentially, spread the wealth as much as I could. The people that are involved in these funding committees are very bright people; they are chosen for that purpose, and they essentially expect the inventors to be as bright too, and they look for that brilliance, but the average inventor is not always bright.

AD: So, did you have a kind of peer-review process; did you have an advisory committee that screened?

CYR: Yes.

AD: So, can you tell me the number of years that you were in charge of research and grant funding – that's my first question. So, from what year to what year, did you do this at AOSTRA?

CYR: I guess it was an evolution. I was there as the facilitator and became in charge and I'm not too sure where the transition occurred. At first, I would make recommendations and, after a while, they would just go straight to the Board. And, so, I suppose, in that sense, I became in charge and the Board was quite generous with me throughout this period.

AD: So, the Board then basically either approved or rejected your recommendations, because I assume you met with inventors, researchers who were seeking funding, is that correct?

CYR: I think the success there really came about in my setting up review teams, or committees, not just me – it's a group of professors, if we are dealing with professors or other experts. And, by setting up committees – I had some experience with the National Research Council as an invited expert in which the others were mostly physicists or chemists, or depending on which board I was working with. My first experience there was reviewing a bunch of professors on the TRI-University Meson Project (TRIUMF) [Canada's national laboratory for particle and nuclear physics located on the campus at UBC housing the world's largest cyclotron].

We met in Montreal and I was surrounded by people that I thought were marvelous people, great scientists, and wondering why I was there. And there was another fellow like me, but he was from industry, and we communed in the corner and, this is interesting, advanced physics and both of us had read a bit. But, to be knowledgeable of Mesons, there are other particles. I think we both were knowledgeable of the efforts on the cyclotron but, in terms of the fundamental physics, it was something that we might study at a later date.

We set about to – since we had some time to scribble on the board, and we sensed, we produced Einstein's equation, but in a roundabout way, and agreed that it was wrong, and off we went. We came back an hour later from lunch, and the rest of the team was still busy studying, trying to find the mistake. The answer was that they could have done it. That was good humour in jest, but showed an advantage because, both of us had some similar characteristics, I think. The consequence, I think on that, was I got involved with – that was my first effort with the NSERC [Natural Sciences and Engineering Research Council] system. I got into other committees, perhaps because somebody there mentioned my name, and they are always searching for somebody. The committees would look at the professors and, one of the things I always looked at, were how many students was this person recruiting, and that to me was a signal, and that's the project really. And, so, I would look to that and give weight to it. The other members of the committee – everybody had their own opinions – and being professors they did not hesitate to voice their opinions. I had some impact on the panel; perhaps, I was more generous than the others. But, then, I'm not too sure; I think they were generous in listening to me.

AD: So, basically it's a kind of peer review process; that's what these committees that you struck.

CYR: No, they were struck by NSERC and I participated in them.

AD: Ok, but in terms of...

CYR: In AOSTRA, I struck them. I willed the collaboration of everybody I could get at hand because there is nothing better than a professor to recommend who could be on a committee.

AD: So, how many committees would you have had, advised in?

CYR: Well, some had NSERC and, then, had the Inventors Grant Assistant Program; they were at ARC. Basically, I gathered about me those who were knowledgeable in that area, and had experience. For the university program, we had a standing order. We had representatives from each of the universities – the universities had some say in that. We wanted people that were interested in oil sands research, but it wasn't actually restricted to those doing oil sands research. We looked at their publication record – and how many students they were able to attract.

AD: So, which universities were you drawing on?

CYR: Drawing on Lethbridge, and Calgary and Edmonton. But we also brought in people from other universities, and that was actually a recruiting exercise – get a good look at them and make sure they became staff members. I wouldn't say it would be "piracy" but I could say we were taking advantage of circumstance, and some professors would move from, for example, the University of

Toronto – a Chemical Engineer came out here with 16 or 11 students, plus post-docs. What a scoop for the University – that's John Shaw by the way.

AD: John?

CYR: John Shaw – "S, h, a, w."

AD: Oh, yes, John Shaw. Now, the hallmark of this was that industry was to be involved, and can you tell me philosophically why that was decided and, then, the role that industry played in this research?

CYR: Well, perhaps I can give you an example. I've got a book on refining; it's one that was published not too many years ago, and I picked it up having the mind of an engineer. I looked at the data in there and converted it into an algorithm. That piece of software is now used by the Department of Energy and has been for the last 10 years or so as part of the "How do we assess the value of petroleum." And what you do is, say, "I blend so much of this bitumen into fundable crude; how does its characteristics change?" And, on that assessment, you can arrive at the "marginal addition effect" and, so, that refinery can afford to take this without changing or modifying the refinery. It gives them an easy entry into handling bitumen; later on, they become specialized; and, so, that's an example. It turns out of your mind and, so, my habit on these things, if I can turn it into an algorithm, I will.

That got me involved, for example, with the CMG [Computer Modeling Group]. They were a bunch of scientists and they had the right idea in the modeling; it fitted all the books, the best education of that time. I did some studying there and, for me, that was a challenge, but the people there were willing to collaborate. We did fund them to bring in bright people and, eventually, caused them, by reducing their funding, caused them to go commercial with great success; an organization that has an effect around the world.

AD: Was the commercialization possibilities of the research there at the "get go"?

CYR: Not at the "get go" but, when a group reaches a certain size and we are getting industry to invest, and by persuading them to invest, that gives them confidence that generates some independence.

AD: So, in terms of the funding formulas, how much did industry contribute to this research?

CYR: I'm restricting it to the university program the "Inventors Program"; I would say in those cases the government provided most of the money but, if there was a professor who was successful, very much of that success was there as a result of funding from other agencies; whether it be

Stanford University, or Berkeley, or any of these other universities. I saw both sides, as well as that which is going on in parts of China and Japan. I did migrate beyond the boundaries.

AD: So, in essence, you were dealing with inventors, and their research was theoretical but it also had an applied side. Now, my understanding of it, AOSTRA also funded projects where researchers and scientists worked with companies on specific initiatives that improved what the companies did in all aspects of dealing with bitumen from mining to extraction.

CYR: That's a result of the focus. You can entice someone into the program by encouraging them to be independent whether it be – at a certain point if there is a practical application the funding will grow, and they know that, and that rapidly moves the...

AD: So, there's the carrot approach in terms of...

CYR: Well, it helps the professor recruit students. When each is connected with a company, the students see a career. It helps the university because those companies very often will invest. We look at the University of Alberta, those magnificent buildings you find around the Engineering Building are owed very much to a few professors – Jacob Masliyah amongst them, the Dean of Engineering there as well as others. But these people have affected all of Alberta's industry. Did they arrive at it independently? I think they arrived at it by doing collaborative research; they have the insight into the fundamental chemistry and physics, but also the willingness to find how to make the technology work elsewhere.

AD: So, do you think that, then – is one of the legacies of AOSTRA that collaborative research model funding for these key professors who had that inventive streak to be able to develop research teams and pursue…?

CYR: If you extrapolate that to not only the professors but also the researchers within the industries, because it's – I brought some books here today and some of these people – I guess I did bring one of them – examples of this work by John A. Bichard [*AOSTRA Technical Publication Series #4: Oil Sands Composition and Behaviour Research: The Research Papers of John A. Bichard: 1957-1965*]; we published that. We persuaded Shell to let us publish the results of the data, and he wrote the book and, we then distributed that at very low-cost to people, and researchers, and to industry. His methods of cleaning the oil, of handling it, showed great insight – making sure you don't expose it to air, if you are having the oil in a refinery and you have it through a catalytic cracker, for example, recognizing some catalysts might be in the product in the end, don't send it back to the beginning.

AD: So, this is the AOSTRA technical publication series and this is Number 4, which is *Oil Sands Composition and Behavior Research*, which are a series of research papers by John A. Bichard from 1957-1965.

PETROLEUM HISTORY SOCIETY Sponsors of The Oil Sands Oral History Project include the Alberta Historical Resources Foundation, Athabasca Oil Sands Corp., Canadian Natural Resources Limited, Canadian Oil Sands Limited, Connacher Oil and Gas Limited, Imperial Oil Limited, MEG Energy Corp., Nexen Inc., Suncor Energy and Syncrude Canada.

CYR: There are many other examples; I happened to have this one at hand.

AD: And, so, how many of these technical publications were there?

CYR: About this much on my bookshelf [arm span gesture].

AD: So, a lot.

CYR: Yes.

AD: And, again, this is – if companies are doing research, it's proprietary. But, this collaborative research model, whether mostly at the university level but some within industry research labs and the publication of this makes it accessible to others, so there is a philosophy behind that isn't there?

CYR: That, and also when industry sees its success in a program like that, they start releasing their information. One of the benefits of having worked at Imperial was that I had access to Exxon's Coker Taskforce reports, and they were generous; they continued that for many years. One time one fellow's truck arrived and I was overwhelmed. But it was confidential material, but it gave me great insight into the refining, and I was able to suggest to professors or to people doing research, in the US at various institutes, "Why don't you look at this?" Basically, the delayed cokers were invented within the Exxon regime, or Esso, in those days. And the understanding of how they operate and how well they operate has improved over the years. Distillation is the prime process for upgrading. At Suncor they were surviving at $12 a barrel, when Syncrude had problems with $25 a barrel and Syncrude was supported by government funding; and Suncor with Howard Pew at the helm was surviving at $12 a barrel, and I can remember Pat Black the Minister asking me, "What is the difference?" And, I said, "It's that will to – Suncor was willing to be innovative," and proved itself to be an extraordinarily innovative company. You can see their success today really derives from that perspective of not getting as much as the others.

AD: Now, you mentioned Pat Black and, in previous discussions...

CYR: Well, there is a whole slew of ministers and premiers that I happened to encounter – and I have good memory – and Pat Black had a lasting effect because of her insight. She came from the petroleum industry and amongst politicians; I didn't have to say too much. When OPTI Canada came in, Ormat was the parent company to invest into a gasifier to be set up in Fort McMurray; it was a proven technology.[5] When I was asked to be involved, at that time, my concern was the

[5] Wikipedia: "OPTI was founded in 1999 by Israeli energy company Ormat Industries, which had developed the OrCrude process in the 1990s. Ormat was approached by Calgary-based Nexen, who sent a delegation to Israel to supervise a test of the process. However, using OrCrude in the oil sands appeared uneconomical to Nexen, who withdrew. Ormat instead contacted Calgary's Suncor Energy, with whom it founded OPTI as a 50-50 venture, with the

resource. It hadn't been drilled – how much oil was there? The investment in a gasifier, if it could be made to work, would generate the fuel that would – low BTU fuel, inexpensive – but that could be used to generate the steam that would, then, be injected into the formation. Being that it would handle – since its low BTU, the flame was soft, and you could eventually generate enough steam, but it would be less fouling of the boiler surfaces, but it lent to a unique boiler design, that if you used rich fuel like natural gas, it wouldn't work very well.

And, so, there was a system that was amazingly complex. In the petroleum business there is a factor called the "Nelson Index," which is on a "processes" complexity.[6] How many streams of fuel you have and, if this affects this over there, it starts to become complex. It's like designing a complex piece of equipment where the feedback everything is held together and, if nothing goes wrong, it works beautifully. In this particular case, the boiler was designed for low BTU gas and there was a soft flame, which meant that you didn't have to treat the water. The ____ of using gas with not much heat in it – they had a gasifier that would generate that and generate also liquid products that you could use, speciality products, diesel oil, jet fuel and other things. Well, that was a marvelous idea, but very complex – if something doesn't fit – and, of course, the problem that happened there was the resource wasn't right. If the resource had been richer, we would have had a marvelous example for the rest of the world to follow.

AD: Now AOSTRA effectively wasn't formally shut down as such but, then, people like you then became employees, not of AOSTRA, this Crown Corporation, arms-length...

CYR: Well, it did continue with Eddy Isaacs and the Alberta Innovates Group. He has a group that resembles, in many ways, the old AOSTRA days – a wide spectrum of people. I've watched afar from what they are doing and, I think, they are going to accomplish something. I haven't yet seen their focus.

AD: That was going to be my next question. But you then became an employee of the Department of Energy, is that correct?

Nexen delegation's head, Jim Arnold, as its first employee. Suncor's land at Burnt Lake was used by Ormat to build an OrCrude demonstration plant, using oil supplied by Suncor." URL: http://en.wikipedia.org/wiki/OPTI_Canada, retrieved June 16, 2013.

[6] Wikipedia: "The Nelson complexity index describes a measure of the secondary conversion capacity of a petroleum refinery relative to the primary distillation capacity. It was developed by Wilbur L. Nelson in a series of articles in *Oil & Gas Journal* in 1960-61 (Mar. 14, p. 189; Sept. 26, p. 216; and June 19, p. 109). In 1976, he elaborated on the concept in another series of articles, again in Oil & Gas Journal (Sept. 13, p. 81; Sept. 20, p. 202; and Sept. 27, p. 83)." URL: http://en.wikipedia.org/wiki/Nelson_complexity_index, retrieved June 16, 2013.

CYR: That is correct.

AD: And when was that?

CYR: That would be 1980.

AD: Nineteen-eighty; and, so, then talk to me about what you have done [since] then, because, of course, you have just recently retired – right – at the end of April – n this lengthy period – 23 years where you have been an employee of the Ministry.

CYR: I came in as a senior advisor at the ADM level, which is simply a lateral transfer. I was there to solve problems; that's as far as I'm going.

AD: So, then, was it problems to do with technology or was it problems to do with the politics of the petroleum industry or oil sands specifically?

CYR: Basically, I had a good understanding of the industry and, so, I participated in groups that would anticipate a turn down of the economy or other things – so, strategic information. My strength was in knowledge of people in industry. My Blackberry, which I didn't have in those days, meant that I maintained contacts throughout here and, in other countries, and I continued to work with the JNOC in Japan and China and, so, I had that oversight to go to Stavanger, for example, or Houston and recruit Stat Oil, and they invested here; CNOOC Oil [China National Offshore Oil Corporation] came in from China; and so on.

AD: So, you were a part of that, then, government assisting – because people feel now, that with the whole environmental criticism of the oil sands, that government should have oversight and only deal with regulatory regimes. But, we have seen governments from the 1890s, when the Federal Minister of Mines drilling the first test wells up in Fort McMurray. We've seen both governments, both the provincial and federal government, both deeply involved through research, and through incentive programs; and, with respect to Syncrude, the Government of Alberta took an equity position in that. And that the general public isn't aware of that, and it goes back to Henry Marshall Tory, the President of the University of Alberta, the founding president, that then led to the establishment of the Research Council of Alberta, and helped to set up the National Research Council, and went over to head it in Ottawa. That his vision of the University [of Alberta] was that it would not only create the professionals – whether doctors, lawyers, whatever, the whole range of professions – but also do core research for resource exploitation that would build the economic might of the province. Now, that's been going on for a hundred years but now people are fixated on the regulatory regimes and specifically in the environmental protection area.

CYR: Government has been interfering in business from the time of the Sumerians – setting the environment, providing the protection, developing the infrastructure in order for trade routes and things that create – essentially create – a new world. When Britain sent its armies into India, and to China, they conquered the cities along various rivers in China. They did the same thing in India and even claimed Tibet in the process, but they essentially recruited workers; they recruited natural resources and, so, government has long been there as a knowledgeable supplicant too, but as a benefactor of the free and natural industry – recognizing that if you give people the freedom to do what they can do, and one kick-of-the-block will set an example for others to follow, and protecting them with patents and a few other things sufficiently that they will continue to disclose their inventions.

The patenting process is a good example of revealing technology; letters patent were around in the time of the Romans so it's not an innovation; and so that is a part of it. The Greeks funded - essentially provided room for the researchers – people to measure the habit of the world. They weren't too sure how they would use it but they eventually found means of using the information. Some of these people were – if you read them today, you can see the same support they got from benefactors. So I don't think we have changed that much.

AD: So, in other words, you feel that this is still an essential role for government.

CYR: Well, the government builds roads; they build airports; that's part of the infrastructure – the intellectual infrastructure, the universities, the schools, and the other things. The immigration policies, all these things come into it. I think that, if you want to immigrate out of Canada, all at once you get a healthy jolt with the income tax and, so, there are ways in there that become important that we maintain our skilled [work] force. Canada's advantage is its people.

AD: Now, you see, people would say, "Oh well, research benefits industry, therefore industry should do more, pay more; government shouldn't do it," but this goes in the face of historical experience, which is what you have said.

CYR: Well, in any study of – a student of economics would recognize that industry or the individual will drive half a mile to save 5 cents on a litre of gas, maybe. It's not practical, but there is an advantage to be a little more efficient, and that thread flows throughout the industry, flows through the university students who have a destination in mind; they see their career and they define that career quite early. They will husband their resources and focus and, essentially, get very good marks in that area that counts; be recruited and contribute to the industry. Our support of our school system – the infrastructure of the university and the professors there – are just part of that.

AD: So, basically, then, as you described it – [you] made a lateral move and have basically been an advisor to government in various areas – is it to do with policy frameworks, regulatory frameworks or the economics of ....

CYR: Fixing problems.

AD: Fixing problems.

CYR: Recognizing one turn down of the industry, it will be temporary when people were panicking; recognizing the refineries in the Gulf Coast were metalled up; they were able to take the bitumen – they might pay less for it but we'd still get a fair price. And, so, with the crisis going on around the world, people saying, "Dirty bitumen," we have refineries on a very large market that made the modifications to capitalize in this oil, and the return on their investment is good.

AD: So, in essence, government is championing the industry, and helping to create new market and to retain established markets.

CYR: Well, wealth flows in both directions; it flows into the US; it flows here. You have to be cautious in that you can't pick favourites. It's tempting to pick a favourite, but you don't know what's behind it. The person that's the first up to try new technology sometimes will succeed and, when they do, they succeed fabulously and that's enough for others to try in front of it.

We have a patent system that protects people and causes them to publish. If you don't publish it, someone else might publish the patent and, then, you are stuck. You can't sell your inventions since the other person is the first to claim and, so, there is a lot of that behind it. Our structure in our economy favours the person who is the innovator, sufficiently, [so] that many people will go out and try things. We also recognize that people will invent – they can't stop – they think differently. They don't have one invention; they have two or three, ten, twenty, and you may think, "Why are they inventing?" And it's probably the way they think – they imagine – they imagine chariots in the sky; they put wings on it, a propeller and it's an airplane.

AD: Now, you have talked about some involvement in the economics and determining value of the resource itself, etc. Did you have any involvement in royalty regimes or anything?

CYR: No, not directly.

AD: So, it was just a different area.

CYR: A technical advisor, so I didn't set policy; there were brighter people that could do that. The policy is - essentially sets up guidelines and how people will work, and they have a very far-reaching effect and, so, it requires people who look beyond the horizon, and have a long experience doing it.

I'm pretty good on the short-term stuff, but I would hesitate to develop a policy that effects education or something else.

AD: So, in terms of your career in the oil sands, when you started, basically, there were two functioning entities – Suncor and Syncrude – that in the 1970s – Syncrude really didn't get functional until later, of course, than GCOS/Suncor but they weren't making money and that you....

CYR: But Suncor was though.

AD: But, not to the extent that they would have wished in terms of return on investment when you think of how much...

CYR: Once you have sunk your capital, you trade it the same as if it were something of lesser value; so, if you buy a new car – if it's a Cadillac – do you drive it differently? You don't. If you had a Volkswagen – markedly efficient, zips around the corners – would you consider it to be inferior to the other one? The answer is we use the technology that is there. So, the security of the investment is a major step. People can choose if they have the money, and can put it any place in the world. If we are lucky, they will put it here – that gives us a bigger impact in terms of export of oil. It develops markets elsewhere. Once those markets are developed, and we have a footprint there, it's pretty easy to retain that footprint.

AD: What's interesting to me is you came into Alberta with Imperial, as Imperial was in its experimental phase in Cold Lake and the beginnings of in situ, but you have seen in your career, then, the diversification of the other companies that have come on-stream.

CYR: It's marvelous; it's a real race to develop the technology to be first. Look at the corporations who have the right type of management, have an innovative management; Nexen is an example. To visit their sites, I marvel at almost everything I look at – I can see; that's much better than they did in my early days at Imperial – the Bell heads, the way of drilling, the ways of laying things out in the field so they can exploit the resource. Of course, I have the same marvel at looking for the inventions when I visit the other companies as well.

AD: Now, your perspective is unique because you have been involved in facilitating and nurturing the research that has made it possible for these other companies to develop as they have done. Can you talk about some of the other – you have talked about one of them now – Nexen. Do you want to talk about some of the others and, then, the research fit that made the actual development of the plants possible, and the processes that they used?

CYR: Well, that extends right across North America and into Europe, and other places. I did some work with the METI [Ministry of Economy Trade and Industry], the Japan Ministry of Economy,

Trade and Industry in Sunshine City, and I worked with their scientists, basically to work on oil, hopefully to recruit their companies behind them. I did the same thing in China and, so, my role there was as a recruiter. I have some fundamental knowledge of the physics and chemistry of refining and extraction, but my duty there was to communicate with them, and persuade them that it was a safe investment. For Stat Oil and CNOOC to come into Canada meant education about the markets. If you produce a barrel of oil here, and you are putting it into a secure market in the Gulf Coast, it was the same as if you were to produce it somewhere else and put it into a secure market. You have the capital that comes out of that; you can invest it here; you can have a return on earnings which would go back to China, or wherever they would invest; recognizing very quickly that once they invested here, and their people moved here, they would become just like you and me in one generation.

AD: Now, what is interesting is that you have had the debate about CNOOC actually getting a larger stake in the oil sands in terms of the recent purchase, raising the issue of foreign ownership...

CYR: But, they also put in a tremendous investment into equipment to improve the refinery there; we call it an upgrader but it really is a refinery to improve that to the point that it is competitive. I wouldn't say that they are a "white knight" because they are working in their own interest, but it's our interest as well. It's a wealthy industry; people work, many of their engineers come here; once their children are on the street, they are Canadian, indistinguishable from the next person and they will remain here; that's part of the growth.

AD: Because what has emerged in the discussion around that in the media, and I'm thinking specifically [of] Thomas Mulcair, the NDP Leader, that it's the whole "flag-waving nationalism" around these enterprises that they deem to be in the national interest.

CYR: Our interest or what interest; you say national?

AD: Well, Canadian, and so that they would go, they would ask questions about the ownership of the industry. Well, the industry has always had diverse companies – American companies involved, and British companies involved – in its exploitation. So, I'm asking you the question, is Chinese or Japanese ownership different from American or British or Belgian or French? I just asked you that question because it is being asked by some.

CYR: The amount that they withdraw from North America is really a very small percentage of their revenue stream. It would be equivalent to, if you put your money into a local business and you took out one or two percentage of their revenue stream, it would be equivalent to, if you put your money into a local business and you took out one or two percent; it's not a very – it's a return, it's a very secure return, but, in effect, the benefit remains here. We have an industry that was there to exploit,

to grow; it develops independent of Alberta. It's very fickle to draw out examples without having access to the full picture. I assure you that the full picture shows that the people – they become Canadian; in fact, even work in the local interest; their children are here; if the [companies] go back, they are still here.

AD: In terms of research establishments, what people don't understand is, for example, I was at the University of Alberta in 1962-1967 and, then, came back to work on the [Canadian] Encyclopedia beginning in 1980, well the University that I attended was very different from the University that I came back to, and the offices were there. In terms of the professorial staff, it was so international and we look at - in terms of the Engineering Department, the number of engineers that came from India, for example, and, then, more recently, oil-sands related, the Chinese researchers. Jacob's [Masliyah] successor (Jacob himself came from elsewhere) – and his successor, from China, so in terms of research establishments, this seems to be an understanding that it is international but, in terms of, then, company ownership, it becomes a red flag somehow.

CYR: If we reflect far enough back in history, you would find that most of the people here come from Europe someplace.

AD: Exactly, so in other words you don't think that these are serious concerns, about the Chinese state oil company having a stake in the oil sands?

CYR: They come here; their children are coming here and they become indistinguishable from the rest of us.

AD: Now, the other issue about – I mean we have the pipelines debate and I will get you to comment on that but also this – the whole issue of further development of upgraders in Alberta because, of course, this is where we have seen the jobs develop, and we've seen the research establishments that have seen the diversification of the industry and the rise of new companies, etc. Do you want to comment on these areas?

CYR: Well, refining was one of the first ones you mentioned. If we have a refinery here and we build because there are maybe 10-15 streams coming out of it, we would have that many pipelines heading somewhere. If we look at the capital cost of that pipeline, it soon becomes important and, so, the competitive advantage is to – if you want to have a market – is to locate that refinery at the other end and have one pipeline. A pipeline carrying bitumen is innocuous compared to, for example, gasoline or diesel. Gasoline is benzene; you wouldn't want a leak of that in your neighborhood and, so, you would find that environmental constraints would favour, and economic constraints would favour, putting it at the other end.

If I set up a refinery here, as the Shaheen Refinery was set up in Newfoundland, I would discover as Shaheen discovered that the US wouldn't allow manufactured products going into it. That goes back to the Petroleum Administration Defence Act; there are five districts in the US and they must have – according to the Act – the refining capacity within to handle the needs of that district. That is a protective mechanism. It was adopted in the US to ensure that, in times of difficulty, the imported gasoline being kept at the ocean – easily and vulnerable – that there would be sufficient petroleum, essentially refined, production of gasoline, diesel amongst other things in each of these districts. The Americans – the second part of that, this goes back into the early 1960's and maybe even earlier, favored the bottom of the barrel. There was little competition for that; others were glad to be rid of it; they would just distill off the light ends and the rest would go to the US. And, so, we learned how to handle the dirtiest of petroleum; at the same time, we learned that as well.

The "bottoms" that they were importing were very much like our bitumen – almost indistinguishable – smelly and all the rest of it; in fact, a little more harmful to breathe and, so, we have an advantage with our bitumen, which they didn't have from the refinery bottoms that they were importing. So, would we have done it if we had displaced a noxious compound, or something that is easily useable; so, in a sense, they are benefiting by having something which isn't killing the grass and other things that grow upon it.

I guess we could argue to no end but the convincing part is in the economics – it's in our favor to export the bitumen. We look at the NAFTA [North American Free Trade Agreement] agreement; it protects the boundaries as well, so it is unlikely, if we are to build a refinery as Shaheen discovered, we would not have as much chance at exporting the refined product. The synthetic crude is in the Agreement [NAFTA] that essentially that is acceptable – has a lot to do with making the bitumen transportable and it's in the US interest to have that. The U. investment in the industry here puts our industry at a favoured position and, so, it may be a complicated story, but I think most students would understand it.

AD: Now, we have the pipeline debate. On the one hand, as you have eloquently stated, the agreements with the US and the fact that – in terms of conventional crude – that they took the bottoms, so that they were able to deal with that so that – and of course the US has the under-utilized refinery capacity in the Gulf States – so, of course, they want the bitumen. On the other hand, in terms of accessing global markets, we have the governments of Alberta and Canada saying, "We need to take it westward. We need to access those other emerging markets, whether it's China, India, whatever, because then we can get better price."

CYR: Okay, I can start on that one. The term under-utilized is inappropriate, I think. If you owned a refinery there, and you have a market and you are trying to defend that market, you will take your feed to here from somewhere. Those are refineries that were designed to take the Saudi bottoms

which are, since they have seen heat and a few other things, are less fungible then our bitumen.[7] Our bitumen is a secure supply, so, and with sufficiently secure supply that they would build the pipelines as Koch did, the Koch family did; it's a marvelous family by the way, to study their history. They saw the benefit merit; they concede the Illinois law but it was all for their benefit that the bitumen flow into that. If something happened, they lost a few wells in Illinois, they have another source; so, that is the security of their operation, of their refinery. If you work in a refinery, and I know many people who do, the chant is "feed the refinery," because they have customers waiting. If they lose a customer, will that customer come back? Well, it's not like somebody here going to the gas station at the corner; its building of a pipeline, and the pipeline is built and they shut the one you were using, you've lost perhaps forever a market. So, they like to maintain their markets that generate a competiveness that is felt right down to the gas pump. And, so, at some point, the Americans may look to Alberta or Canada as another defence district; then, maybe, we'll have some North American rationalization; would have a long-term advantage.

AD: Now, if you were a betting man, how do you think the pipeline debates, the two will end? Do you think that the US will approve Keystone and do you think the Canadian Government, because in terms of legislation, it is within their bailiwick, the Alberta government doesn't approve pipelines because they cross provincial boundaries, etc. So, Northern Gateway, what do you think is going to happen with these two?

CYR: Politics are a different nature; its finding a solution that essentially minimizes acrimony amongst various people and, in [doing] so, it's finding a practical solution, and some people are very good at that. When there is a mistake, it hurts all of us. But its success has been recognized since the time of the Phoenicians, and the Greeks established that they are more so than the Romans, and so on. So, I don't see much difference between what the Romans did in their politics than ours, perhaps, except they had a few more generals after Caesar but the consequence is that political solutions are the workable solutions. So, if we didn't use the word political, and we substituted the word "workable," I think everyone would agree. I wonder often why the term political is used. I think it's because, at one time, it was a highly-favored statement but, in fact, workable is almost a synonym in there. I haven't seen politicians make decisions that they didn't believe were workable and, so, if they are well-informed, then, we will get that workable solution.

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[7] Wikipedia: "Fungibility is the property of a good or a commodity whose individual units are capable of mutual substitution, such as sweet crude oil, shares in a company, bonds, precious metals, or currencies. It refers only to the equivalence of each unit of a commodity with other units of the same commodity. Fungibility does not describe or relate to any exchange of one commodity for some other, different commodity." URL: http://en.wikipedia.org/wiki/Fungibility, retrieved: June 16, 2013.

AD: Now, in terms of your years in the industry, you've seen – in the early days and, of course, I talked to tailings experts like Alan Fair at Syncrude that, to begin with, it was simply that you needed to have appropriately-build earth dams to contain the tailings, but now, of course...

CYR: It was more than that though.

AD: Simplistically put. But, today, of course ,now the whole basis of not only the strip mining operations but also the tailings operations, the dead birds, all of those things are used to really blacken the reputation of the industry, and how it conducts its affairs. How could/should that be dealt with; is it a simple phenomenon that is going to go away or, if it isn't going to go away, then, how does government, as its regulator and industry as the perpetrator – this is a very polarized view, how is this dealt with?

CYR: I'd like to say political solutions but the reality is being practical. Industry – they are sort of like the corner garage – they have customers come; they have passersby and they try not to be a negative eye sore; and they are a part of the community. That rings true whether they are located within Edmonton, or in the north of Alberta, or under the view or outside the view of the public.

Our appreciation of what is acceptable today is very different from what was 50 years ago. There was a time when they would blow off the wells in Turner Valley because they didn't know how to handle the gas, and they would pump the oil afterwards. And, when they were blowing off ,they would set flare and there were days that they would say, south of Calgary, was a light off the clouds. They probably burnt a quarter of the resource – wasted. Those were the days, but it did form the seeds for our petroleum industry, and if that hadn't been done, it might have held Alberta back; it might have been like the Northwest Territories because it was a territory once. And, so from going from territory to province, really meant economic independence; that's the federal system. If some provinces were independent, because of their success then they became less; the federal system makes it a good living no matter where you are in Canada.

So, the inequities are solved by our federal system. There were times when Eastern Canada was the wealthy part and Ontario was a loss but, eventually, it became industrialized and we look back and say, "What happened?" That's essentially part of our history. A student of history will say that the mistakes were repeated, which is true, but they aren't always for the same reasons. I expect that someone, 20 years from now, will say "You wasted all that bitumen; we could have done something else with it." But the technology isn't there yet. Some inventor will come up with something or maybe someone will say, "I can use that stream." The oil on the tailings pond at Syncrude, I don't have direct access to that information, others do. I suspect that, perhaps, they were having some difficulty in some solvent or diluent got involved because it shouldn't have been floating at the surface. In the winter, that oil should sink to the bottom and, so, the inspection causes me to say

they had some light ends in there. So, they were adding something, or some light diluent to their bitumen. Why would they do that? That means they had some problems with their separating vessel. I could have gone and interfered to find what the design problem was because I suspect it was a design problem, but I was too busy with other matters. It could be an operational problem. The company is embarrassed by that; I suspect they are doing their best to get around it and, whatever piece of equipment is causing that, will be replaced, or something else will happen.

AD: But, as you can see – governments, both provincial and federal governments – are having to address these environmental concerns, which have got huge traction now.

CYR: That is true; huge traction is a matter of timing. What is important today may not be important tomorrow, could be the public excitement is elsewhere. There are fundamental issues which people voice, and I respect that. I don't think we will find the solutions by making drastic change; a very large change can have repercussions everywhere.

AD: Do you see, we've seen 40 years of research – the initial 30, although during the Depression, of course, the Alberta Research Council ceases to exist as such – so, we did that first generation of research in terms of the industry; now, we have had a second generation of research that has dealt with all of the issues around mining, and extraction – all of these issues. Do you see the research establishments really focusing on environmental problems that, then, make these other processes more acceptable, and minimize the impact on the environment?

CYR: We are living in a time of change; knowledge-transfer is very fast now days, compared to what it was 20 years ago and, when I was a student, it was a very feeble pace. The first book that I read was James Clark Maxwell's book on *Electricity of Magnetism,* as an entry student at the University of BC. I had bought it – it was a thin, I think it was maybe 80 pages, but it was a whole universe. Suddenly, I had a different reason for looking at differential equations and reasons for studying mathematics. The science that was used then, the mathematics hasn't changed. What has changed is the application of new problems to new data, information. That dramatic change has changed our whole industry. Today, we have access to hundreds of thousands of books, millions of text books; how many books on the oxygenation of oil – there are probably 10-20 that I can think of. If I did a search, I could get many more focused on, for example, Green's Function, which is a branch of mathematics. They seem to be coming out with mathematicians every student graduation. So, we are having a plethora of information. The handling of information has changed; now we learn about "quarks" and "mesons."

Recently, I heard people talking about the tomamak [donut fusion] versus the inertial [confinement] fusion [ICF] of nuclear fusion in the United States National Ignition Facility - this experiment is part

of the US DoE [United States Department of Energy].[8] And I looked at what is happening there – and I have access to some of the information – I sure wouldn't have done it the way they do it, but there are good reasons for it. By compressing it, they didn't follow the original precept of having very pure lithium to determine that. They added a few things that allow the heat to get away before you can use or harvest it. That's a technical explanation. The practical explanation – I think what they are trying to find is a solution that allows them to get around the purification problem, so, I'm the idealist; they are the practical.

The same thing goes to refineries, to designs of equipment, airplanes – we see the change of the wings of aircraft. Right now we have got little "winglets" on the end there; now that was studied, and the efficiency improvement was understood 100 years ago, but that winglet allows it to get about 23% extra lift. Well, somebody might do that on a propeller next.

AD: So, in other words, you're optimistic that the whole, that the science, not only in terms of the various processes within the oil sands but in terms of these environmental issues that have been raised and, certainly, are legitimate in some instances; focusing interest and dollars on that is going to assist. Because I'm looking at the whole new generation of organizations that – you know the Oil Sands Tailings Consortium that is now part of COSIA [Canada's Oil Sands Innovation Alliance], so that you have collaboration among the companies to look at specific issues and that they are looking at – and a number of these agencies have EPA after them so that they are around environmental protection so this is a – it's going to be a major thrust for government, the new provincial/federal agreement with respect to water and other aspects of the...

CYR: But it's a natural evolution. If it's in the public eye – what is occurring around us all the time – and it is a continuous process; we have established speed limits on the roads; we have established grading, how you may lay the road. But also there are caveats on the manufacture of vehicles – how we have protection devices – and there will be a time when you don't have to have a steering wheel; someone else will control it more reliably. It's difficult to forecast the future because, if we get there in a hurry, we violate a few principles of physics, but I'm confident that society will change. We are healthier than we were generations ago. I was born in the days before they put fluorine in the waters so I had to go to the dentist; that's a concern of my generation. We can carry a memory stick today that carries a lifetime's reading. Will that change our learning process? I expect it will. If I read a book, I now prefer the electronic version, because I can plant it on my screen there and it's a big one; I can read it sitting six to eight feet away, even 10 feet away, and turn the pages. It has some

[8] "The National Ignition Facility, or NIF, is a large, laser-based inertial confinement fusion (ICF) research device located at the Lawrence Livermore National Laboratory in Livermore, California, USA." Wikipedia, URL: http://en.wikipedia.org/wiki/National_Ignition_Facility, retrieved June 28, 2013.

voice interaction, so I turn the page and it knows to turn the page. If I say something else, it doesn't pick up the language so that, again, that's in computing. That was unthinkable; you can carry a memory stick – that stick in your pocket – and it has 1.5 terabytes of information.

AD: In terms of putting on your futurist hat, even more so in terms of the industry, of course, we have seen fracking and other technologies resulting in...

CYR: I'd use the word "stimulation," even though we use the work "fracturing" that is an abusive term.

AD: Well, in interest…

CYR: I "bust" the fence when I open the gate; lift the latch, I bust the fence; there is no longer a fence when I open the gate, so I destroy the purpose of the fence just by opening that gate. That's equivalent to someone saying, "You just destroyed the purpose; you aren't retaining the _____. The choice of vocabulary has very much to do with whether we think something is practical or not. Maybe I am exceeding my position in this one but I like to think, in the-long run, we find solutions. We now have highways but we also have speed limits. And we are able to follow a car electronically, and not chase them at high speeds and have someone pull them over at some great distance ahead, and if they have an infraction, they may get by with it. That's part of the adventure of the driving, but if we see that throughout our society we, now, we monitor the handling of pork in the rendering industry to a level far beyond which would have been there a generation ago. We act horrified because the meat was bad; when I was young, bad meat was – we just didn't eat it. You smelled it before you bought it, and, so, in time, we don't have that sense of smell. In my earliest days, I went to a little grey community school; we had one teacher – Mrs. Wait her name was, and she had 30 students; some people like me and others, and in the room there we spoke five different languages. We really have to wonder how did we succeed out of that and, yet, I'm still in contact with them, and they have become successful in their own ways. Do I think that is a disadvantage in that time? I can see that everything has improved.

AD: So, you feel that, in the normal process of things and with increasing government regulations with respect to the industry that these environmental issues are going to be addressed?

CYR: I would put it differently; I would say industrial habits or practices, because if you regulate and that regulation may force a change, and initiate it, and if you are lucky, it evolves its own life and we end up with something quite different. And, so, it's a dynamic process. The regulation itself doesn't solve the problem; we put a speed limit on the road and, then, sometime later nobody is obeying it, and we put officers there, and one day we put a sign, warning speed bump. Will they slow down even if there is not a speed bump? Only the locals will go fast to benefit from it not being there.

Everyone else who is not used to traveling there and they are the ones most likely to have an accident on the corner nearby.

AD: Now, with respect to the reassessment of the reserves in the US that are now going to be accessible through new technologies, do you think – well two questions: one, is the US market going to be less attractive to Canadian bitumen producers, could we be shut out? And, secondly, what are the implications for the industry which is now ramped up; although we have seen a couple companies back off from projects because of the glut and borrowing environments and so on, all of that?

CYR: It has an effect on perhaps the investment of new capital but perhaps not as significant on the existing capital. A refinery that is built and designed for a specific mix will probably continue with that mix; it's predictable; it's less complex. When you change that it, it enters risk. I did mention that complexities are something we can actually estimate. Nelson had the method and we continue to use it. Complexity of a refinery – if something little goes wrong in the corner, it reverberates and you end up with everything going off; but that complexity allows it to me more efficient, so people watch very carefully what is going in, measure it before it is fed. That refinery is designed for the heavy oil; if capital is invested, the time for them to make a change might be 10-20 years from now. So, that will probably continue for as a secure client. With the noise that is around that which puts a depression on the price of bitumen, which encourages them even to stay longer, and, so, will we lose markets? Eventually, but in those 10-20 years, many other things can happen; 20 years ago we wouldn't have imagined we were here.

AD: So, then, putting on your futurist hat, where do you see the industry 20-30-40, even 50 years from now?

CYR: Well, if I push it to the limit, we see the change in our communications; we see the changes in our communication, not only in terms of travel and transport but with the internet and electronic communication – computers. Soon, there will be a computer that is smarter than I am, and maybe life will evolve in a different direction; hopefully, it will be a friendly one. Is that a threat? I don't think it's a threat; people accommodate many things. Human kind is spread around the ocean and that makes us susceptible to things that wouldn't have been thought of before. Warfare is at least likely, because it is easily-recognized as being a problem; famine is another; again that is recognized; it can happen through climate change, through _____and many other things. So, I think there are many threats to worry about, and the human kind – the behaviour of our governments –gives us the least to fear. The most to fear are those things we didn't anticipate.

AD: And, so, what about the oil sands then?

CYR: It will continue to have a market, maybe a different market, but it will there. We see companies coming here to invest; they look ahead 20-25 years, that's pretty good. There are politicians that look forward to the next election, perhaps, some even beyond that, but they always make their decisions in the way that it gives them an advantage at the polls. That's a natural selection. And, so, our change in terms of administration of the industry is going to be a slow process, and a cautious one.

AD: Now, is there any other question that I have neglected to ask you? Or you have brought these resource books, do you want to talk about anything in them or do you think...

CYR: Well, basically, I guess these pictures here show it, and you can show them to the camera [refers to AOSTRA book]. There are people; and, unfortunately, it's the only part of the textbook that focuses on people, and it's the Board. But, this was composed with Harry Gunning; we both agreed immediately that was the way to do it, and we were a bit astonished that the others didn't show the people. Because I think innovation, scientists would innovate; very much it's the function of the person being there at the right time. I mentioned the pipeline pig and the use of the tire stud. It happened to be that, while I was driving to Calgary and when we stopped at Red Deer that I was worried following the trucks, that would I catch a stone chip or would it be from a tire stud? When they had the pipeline pig, I immediately thought of the tire stud, because it wouldn't let loose. Then, I looked at the pig and I said that will get stuck in the system; if we design it to break apart into pieces if it hits an obstruction that solves that problem; that was design. The other part was to resolve it so that, if it hit a rough part in the pipeline –remember that water hammer – that would cause it to change direction, automatically, it wouldn't require somebody setting the frequency. And so that's sort of part of me as an inventor, extends in public through our industry and our roads, our backyards and this wonderful room in which I am being interviewed; by the way, which is not the original room, is that right?

AD: No. So, adaptation and change, I guess, is your saying and that's a part of the human condition and, so, the industry is going to evolve, and individuals are in research establishments of whatever kind – both public and private sector – are going to continue to do this. Any summative remarks?

CYR: Well, I'd like to give the example of caffeine or coffee. At one time, the weed was grown and the tea was grown as a pesticide. The caffeine that comes out of it on the sunny side of the mountain is enough to kill you. The Chinese invented the method of putting fungi in there to digest the caffeine, and that the bromine in there – to the point that it would be drinkable, as a stimulant. It's really a poison and the body fights it with the air so it goes in the joints; it actually decreases our arthritis and, so, I've been fighting the same thing. And, when we look at our chemistry, our food stuffs – that probably were the major inventions will be and will continue to be, and have the longest and largest impacts. Communications, telecommunications that will continue; it will be

different from what we have. I think what we see now with the network and number of text books and literature that's available – they still have their printed information. But, in other ways, they are communicating; I'm looking forward to seeing that. It's different for every person. Will it be productive; admirably so. Will it survive the growth of population? That is probably our biggest threat as is over-population. But we have been saying that for a few thousand years and, so, in fighting wars over it and the rest of it. We have moved from having England control the oceans of the world to the US controlling it; now it's shared; must more peaceful.

AD: Thank you so much for agreeing to be interviewed and to really giving future researchers in this area an understanding of the value of research and innovation, and the human element.

CYR: I think the researchers already know that, and are way beyond me.

AD: Thanks so much.

CYR: Thank you.

[INTERVIEW IS CONCLUDED.]