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PETROLEUM HISTORY SOCIETY  
OIL SANDS ORAL HISTORY PROJECT  
TRANSCRIPT

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JACOB MASLIYAH, OC, FRSC, FCAE, FCIC, PENG: PROFESSOR EMERITUS, UNIVERSITY OF ALBERTA. DR JACOB MASLIYAH RECEIVED THE ORDER OF CANADA AND THE ASTECH AWARD FOR OUTSTANDING LEADERSHIP IN ALBERTA TECHNOLOGY FOR HIS WORK IN IMPROVING PROCESSES IN BITUMEN EXTRACTION, FROTH TREATMENT AND TAILINGS. AS THE NSERC INDUSTRIAL RESEARCH CHAIR IN OIL SANDS ENGINEERING, DR MASLIYAH OVERSAW A HIGHLY SUCCESSFUL COLLABORATION BETWEEN THE UNIVERSITY AND INDUSTRY.

DATE AND PLACE OF BIRTH: AUGUST 9<sup>TH</sup>, 1942, BAGHDAD, IRAQ

Date and Place of Interview: 9 am, June 24<sup>th</sup>, 2011 in a Boardroom at the University of Alberta Faculty of Engineering.

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JM: So this is a movie camera? Wow.

AD: This is June 24<sup>TH</sup>, 2011, and my name is Adriana Davies. I'm a researcher on the Petroleum History Society Oil Sands Oral History Project. I'm with Dr. Jacob Masliyah from the University of Alberta, Faculty of Engineering. Jacob, thank you so much for agreeing to be interviewed.

JM: It's a pleasure.

AD: I wonder if we could begin by you giving me your date and place of birth, as well as a summary of your biography.

JM: Sure. My name is Jacob Masliyah and I was born August 9, 1942 in Baghdad, Iraq. I got my high-school education in Baghdad, in a private school, and in 1960 I graduated. At the time, we did a lot of GCE [General Certificate Education] exams, which belonged to the University of London. I was able to get admission to England to go to university, and I got my bachelor's degree in 1964, from University College, University of London. I was 22, 21 at the time, and I had to make a decision what to do. It was really very hard for me. I knew from my background that I could not go back to Iraq, so I had to decide what to do. Whether to go to the U.S. or stay in Britain, go to Australia or Canada, and I felt Canada is a good place to go to. I got admission to go to the University of New Brunswick, and I remember so clearly – really I do – I went to Canada House in London, applying for a student visa. Things were so easy at the time, and the lady officer said to me, "Why are you applying for a student visa? Apply for immigration. It's just one more page to fill up." So I did, and then she said, "Oh by the way, the medical officer is not that busy. Why don't you go for your medical exam?" Which I did, and she said, "In six weeks you get your visa." Which I did, and then I went, at the time, to Liverpool to the Cunard airline. No, no, no, the shipline – the *Corinthia* ship.

So I went, and in a year and a half I did my Master degree, worked for a year and a half in industry, and I was really frustrated in industry. I really was. Things were very different at the time, because you can work until 8 o'clock in the evening, and they expect you back on time in the morning. And that really bothered me a lot. So I decided to go back to university and that was probably a good decision. So I went for my PhD degree at the University of British Columbia where I worked for Norman Epstein, who was a great man, and he still is. He still does a lot of research, and he's my best mentor ever. I got my degree there, and I graduated in 1971. The job market was horrible, horrible, so I took a year at the University of Edinburgh, for my post doc, and a job came up in Saskatchewan, the University of Saskatchewan. I went there, and I stayed there for four and a half years. I was doing a consulting job on heavy oil for the Alberta Research Council, and then I got



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contacted by Fred [Fred Otto, former Dean of the Faculty of Engineering at the University of Alberta]. Also, he was the chairman of the department [Chemical Engineering]. We had lunches. We had meetings, and on and on and on. Eventually, he said, "Why don't you apply?" So I did, and I got the job here in '77, in January '77, and I'm still here.

AD: Can you tell me a bit about your research. Was it always oil sands related?

JM: Not really. I was much on theory. I was on theory of sand particles in water, in liquids, in air. So really I probably didn't even know how to spell bitumen at the time. And I'm being serious. So my expertise was very, very different. But again, you are trained in fundamentals. Once you are trained in fundamentals, essentially you can speak to many areas. So when I came here, I have no inclination to get involved in oil sands, at all. So what happened was by sheer coincidence. Fred Seyer was involved in oil sands, and they were doing some experiments with Teddy Kwong in the basement and they were getting a lot of measurable results. And really the results didn't make sense at all, really they didn't. So Fred said to me, "Jacob, you are a bit strong in fluid mechanics, why don't you look at the numbers?" And I said, "You know what? The best way is to try to look at it from a fundamental point of view. Can you model it from fundamental principles? If you can, then things might make more sense." Which I did. That was really a breakthrough for me. And a lot of that knowledge really wasn't from my doctorate at all. It was really from Cliff Shook, when I was in Saskatchewan, who was very, very strong in slurry pipeline flow, and I learned a lot from him. So I used some of his ideas and really the model turned out to be really good. We started to mimic the results they were getting. Then, their results made a lot of sense. That's really my breakthrough to the oil sands.

And then we got involved with Syncrude. I was perhaps extremely fortunate that throughout my eight years the head persons of the department were very supportive, and I remember the day – I still really remember – it was minus 40, blizzard in Edmonton, and we had to go to Syncrude Research to talk to the researchers there and try to get some co-operation going on between our University and them. Fred [Otto] drove in the minus 40 degrees in the blizzard, and they were on the east side of the city, and we sat down and talked with them about what we can do together; and there we started some dialogue. If it wasn't for the fact that Fred came with me in the minus 40 degree weather, I don't think anything would have been started. And that shows you the support that the chairperson of my department demonstrated, supporting us to get going, in a very, very unselfish way.

AD: And do you know who at the time was negotiating for Syncrude?



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JM: I think at the time it was Ken Porteous [a Chemical Engineer who worked in the Syncrude Research Department before returning to the University of Alberta and is now Associate Dean of Engineering]. Ken is at the U of A now, in fact. He deals with the Engineering Co-op Program. And he still smiles once in a while by saying, "Jacob, we got you cheap, didn't we?" And I love that comment, and we both laugh when we hear it.

AD: What did that collaboration involve? What was the special relationship?

JM: It was really to build equipment in our labs to mimic some of their operations, especially in the gravity separation vessel. We did not put oil sands at all in it. We put some light particles to mimic bitumen, rising bitumen. We put in some heavy solid particles to mimic sand. We wanted to know the physics of the separation, and that's all we wanted, to understand the physics. When you understand the physics, then, you can graduate and go to understand oil sands.

AD: Through this research, of course, you were building on what Karl Clark and others had begun. How conscious were you of that tradition of research in this area?

JM: Oh, I mean what Clark did, and others, and Bowman [Clem], the work done at the Alberta Research Council, at Syncrude and other places, that was incredibly important. I mean there is no way for me to explain at all that we invented everything. That's absolutely wrong. We simply carried on from where they left, and that's all. These individuals really laid the foundation for oil sands research and oil sands understanding from a very fundamental point of view.

AD: What you are talking about, which was talked about in the 1980s, was technology transfer from university to industry. Was that a conscious policy of the department and the faculty at that point?

JM: When we work at the university we look, in a way, in isolation. We look at the short gain. I mean for us at the time, in the '80s especially, we looked at financial funding so that we can support our students. I was really conscious in the '80s of transferring that knowledge to industry but it wasn't my prime reason. I doubt it. As time was going on, maybe that became very important in my thinking. But at the time, it was a survival for us at the university to get funding to support students, to do research, and to get on with learning more.

AD: I know that you've published over 300 articles. Do you know how many of them relate to material relevant to the oil sands?

JM: Probably half. I mean my early work was very fundamental. But you see, this is not correct either because I remember where in the late '70s, we tried to understand what is the physics – now the fundamental physics we're talking about. We're not talking about a process. How, when you



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have a system of particles that are heavier than water and different sizes, you have another bitumen of different sizes and lighter than water, how do they separate? We know how the same density, the same size, how they separate – that we knew. But what about a different species? We knew nothing. I remember struggling to put theory to it and we published a paper. I published a paper in 1979 on that. Three pages, that's all it was, and it became the most quoted paper in my career. And of course people improved on it. In the '80s, there was a lot of work done to improve on what we had done. I didn't mind. It's great. And now a lot of theoreticians took that up and they publish my theory in a way – I don't even understand it anymore.

AD: Would it be fair to say the research you were doing around separation was going to be influential in terms of the processes that were being actually used at the Syncrude plant that was being built at that time? To make more efficient and practical that process of separation?

JM: That is absolutely so, because by understanding the physics we were able to mimic some of the equipment to a fairly good degree. I mean it cannot be perfect. There is no model that, no model that can be perfect, ever; and to make us understand how that piece of equipment is actually functioning. The beauty of it is that you take esoteric theory and you put it together in a practical way to understand a process. Actually, there is more to it than that. From my point of view, it makes a lot of sense, but from the industrial point of view it doesn't make sense. I think the industry recognized that from the very earliest time that, yes, fundamental work is important and they can better understand the process by doing fundamental work. That is very, very important, because we talk about industry as a mega process. You are mining what, ten thousand tonnes an hour, and there you are looking to fundamentals to explain things. So, it is two parts of the spectrum. On the nano side and on the mega side, and we're trying to put them together to our advantage.

AD: So when did you first go up to Fort McMurray and see what was happening?

JM: Oh that was very early. I think it was in the late '70s. I think there was a DC8 plane. It was fun to go.

AD: And so who did you meet and what did you see?

JM: Well, I was very much involved with Syncrude during the construction operation. The operation is very massive. I look back now when I was with other organizations, we really knew little about it – oil sands. Others before us did a lot of work, but still there remained much not known. Even now, the more you discover about things about oil sands, the more you're realizing how little you know about oil sands.



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AD: When you went up to Fort McMurray and realized what was happening. I mean it was a theoretical mind meeting with the practical side of it. Did you meet Jim Carter?

JM: No, at the time ... I think I started to know Jim Carter a bit later, maybe in the mid '80s, but you've brought up a very good point. And that is when you are modeling on a very practical basis sometimes you don't even want to see the real equipment, because real equipment has all the bells and whistles, and you cannot afford to include that in your model. So you have to strip it to the bare bones, what is the equipment is really doing, and then try to model it. Sometimes I don't want to see the equipment until I do my modeling.

AD: I gather that an in-house team was being built. How much discussion was there between the academic researchers like yourself and the in-house research people at Syncrude?

JM: I think things came to a height in the late '80s. Let me just go back slightly ... This is a rather interesting point in my mind. I was strongly influenced by fluid dynamics. I knew nothing about interfacial phenomenon. And let me explain. Fluid particle dynamics says that if you have so much solids they will settle at such velocity according to what you have in the process. But in the reality, oil sands have another aspect to it. It has surface phenomenon, meaning when two bitumen drops get together, really meaning approaching each other on a nano scale, what will they decide to do? Will they decide to coalesce or will there be enough force between them to separate?

Fluid particle dynamics doesn't tell you a thing about that. So in the early '90s I was very fortunate to get the McCalla Professorship for a year. No teaching duties; no administrative duties.... I mean, it's great. So I went to the Alberta Research Council and they gave me an office, and they had a beautiful library at the time, and probably it still is. And I really started learning. And I have to tell you it was a hard experience. I was scared, and I truly was scared to open journal articles in the area of surface phenomena. Like *Langmuir*, the surface chemistry science journals.<sup>1</sup> I was afraid because I didn't even understand the title of it, of the articles. But I got immersed in it, and after a year I really learned enough to write a book in the area, and that was a turning point in my career. I called it the bifurcation and I became more useful to the industry. And by the time Jan Czarnecki joined

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<sup>1</sup> *Langmuir* is a [peer-reviewed scientific journal](#), published since 1985 by the [American Chemical Society](#). It publishes research in the areas of [surface chemistry](#) and [colloid chemistry](#). It presently has an impact factor of 4.268 (2010). Wikipedia, retrieved August 11, 2011, URL: [http://en.wikipedia.org/wiki/Langmuir\\_%28journal%29](http://en.wikipedia.org/wiki/Langmuir_%28journal%29)



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Syncrude, and Tadek [Tadeusz] Dabros came to Canada, working with CANMAT. Then later on Zhenghe Xu came, and he's very strong in the area.<sup>2</sup> With my newly acquired knowledge, we were able now to converse with industry. We were in a much wider range of research than before.

AD: So would it be fair to say that there was no-one with the Syncrude Research Team who had your knowledge and the skill-set that you were bringing?

JM: I don't want to brag, but probably that has some truth to it. You see, the oil sands is different disciplines. That is the issue of the oil sands. You are a chemical engineer; you are deficient in certain areas. You are a mineral processing engineer; you are deficient in certain areas. You are a surface chemist; you are deficient in some areas. And I was trying to learn at least a bit of each. That expertise was not widely available around us.

AD: You were in an area new in emerging scientific knowledge and technology. I talk about the buzzword of the '80s as technology transfer from the universities to industry. But you're also forging a new kind of relationship between these two establishments: the academic research establishment and industry. Do you want to talk a bit about that?

JM: I think it has many elements, really. One is trust. I mean, respect and a win-win. I think we developed a tremendous trust really, and respect, between Syncrude researchers and the university researchers. And we very quickly realized it's a win-win situation. The industry is benefiting from us, and we're benefiting from them. Really, things were gradual. There are R & D individuals who like to force events. I don't think we forced events. I think events came really very naturally. I remember so clearly when I picked up an award in research from the University of Alberta. Jim Carter was there, and others were there from Syncrude, and over the beer or wine, perhaps, somebody said, "Why don't we have an industrial chair from Syncrude for Jacob?" John Clark, who was the research director at the time at Syncrude and Jim Carter were together, and they said, "Ya, why not? Let's look into it." And I remember John Clark said to me, "Can you send me a two-page proposal?" With Jan Czarnecki working at Syncrude, with his help, we actually drafted these two pages, and within a week they said, "Ya, that's a good idea. We're willing to put \$200,000 a year for five years. Write your application to NSERC and see if we can get the industrial chair." And with Sieg Wanke, our chairman at the time, with his encouragement, with the Dean's encouragement, we put a proposal to NSERC, and we got the money that will fund the chair. And that was the beginning, a beautiful beginning, because that beginning created the opportunity for other researchers, good researchers in my department, to apply for industrial chairs as well. I think that in our department – I lost the count really – seven, eight industrial chairs were related to the oil sands.

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<sup>2</sup> Z Xu, PhD, PEng, FCAE (Teck Cominco Professor, NSERC Industrial Research Chair in Oil Sands Engineering and Canada Research Chair in Mineral Processing).



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AD: What year was that?

JM: I think it was ... I got the first industrial research chair in '96, so this should have been in '94, '95.

AD: In terms of the larger picture of oil sands, I'd like to ask some questions relating to that. Clearly government is a player. So let's look at the nearly 30 years of research that goes on through the Research Council of Alberta. No industry would have the inclination or the funds to be able to do that amount of research with the sum costs required. So let's look at the role of government, both with respect to funding research, as a regulator, as a beneficiary of the industry. Do you want to talk about that?

JM: I think way back we had AOSTRA, and we had a journal dealing with oil sands. Unfortunately, we do not have it now. And they were funding research in oil sands; and then we got the Alberta Energy Research Institute, and that was a good institute to get research funding from them. They were willing to entertain basic research, both AOSTRA and AERI, and that was good, and now we have others as well. So the government is encouraging research. Unfortunately, we don't have as many research labs within the industry doing research.

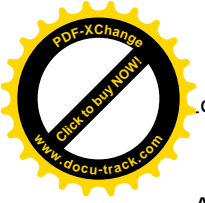
AD: Do you actually see a retrenchment in research within the industry itself, or not?

JM: Well, it depends on how you look at it. The industry might not do research in their own labs, because they might not have them or they are doing something else with these labs. But there are other outlets, like, for instance, the Alberta Research Council, now they have a new name [Alberta Innovates Technology Futures], or CANMAT. They can do basic research if they want to, really, and they have good people in both institutions. Or they can do piloting. For me, the university has no place in piloting. That is one of my strong opinions on the subject. So they are in essence doing "research" by doing piloting in these institutions or in the National Research Council, as well. So in a sense, they are doing what they need to do. But the beauty of research within NSERC and the research area, in my mind, is that you can do off-the-beat type of research. You might not see direct benefit today. And from my experience, and my industrial chair, that is something that is really important. Even though the industry is supporting say \$800,000 a year for a five year commitment, I have never, ever in my 15 years or so of involvement, had the industry telling me what not to do and what not to publish. And the industry advisory board, and we used to meet every three-four months, never imposed their will on what we do, or what not we can say. And what we can publish and not what we can publish. Their role was truly advisory.



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AD: In terms of oils sands, we've had heavy duty research since about 1920, so we're really into 90 good years of solid research. We had a number of other plants in process for Fort McMurray. What do you see for the next 20 to 30 years in terms of research? Are there any areas that require investigation in terms of all aspects of the extraction and processing?

JM: Tailings is a fairly large issue right now. There's a lot of research still needed to understand how we can coagulate the solid particles in the tailings ponds. It's a good example, way back, including me, everybody used to say, "Oh because the fugitive bitumen that we are losing in the tailings pond is part of the reason that these solid particles will not coagulate together and make a dense sediment. Some of us nowadays, in my group or in Dr. Xu's group, are finding, "No, this is not true." In fact, they have no effect, or just the opposite effect from what we used to think. You have to sometimes keep repeating some of the work to be sure the statements we have are correct. And, unfortunately, you also have a lot of myths. And sometimes it is very difficult to distinguish between a myth and a true fact. A good example – and that is a really intriguing one – everybody believed that we had a water layer around the sand grain. Water layer, I mean a few nanometers thickness. Well, is there one? I don't know. But as a betting man I will say, "Yes, there is." But everybody believes it as absolute truth – there is one. But is there really one? I don't know. So that type of thing, it is good to know, because you can influence your process by knowing it.

AD: You've mentioned the tailings pond. I would say that over the last 30 years there has been a real push toward remediation for all industrial processes. Do you think that at any point research can ensure that tailings ponds, in a sense, will become redundant because we've processed and reprocessed until all you have to do has to do with land reclamation?

JM: Well, there is no free lunch, right? That is the truth. Let's look at it this way. Suppose you have a tailings pond the size of a swimming pool. What does it really mean? Well, it means the following: that you have to do water treatment, extensively, because you are recycling that water over and over again. You're going to pick up all the salts in oil sands. The water will not be suitable for extraction so you have to put in water treatment. Water treatment is on question too: financial ones, economical ones, carbon dioxide ones, and on, and on, and on. So, really, what you try to do is minimize the size of the tailings pond. That's one, and to make it manageable in a way that doesn't have any significant or, rather, very little significance or negative impact on the environment. It is a mining process, and mining processes need a tailings pond, but the question is the size of the tailings pond and how you are going to handle the tailings pond. We talk about a non-aqueous approach,



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i.e., use a solvent. Well, it has a lot of advantages, but it has a lot of downsides too. Is the downside greater than what we have now? Science has to tell us that. As I've said, there's no free lunch. You want that energy, so you have to accept some negative impact. And the issue is that we have to minimize it to the extent that is negligible.

AD: Would you say that in the terms of your research in this area that a shift is emerging toward the remediation side of technology?

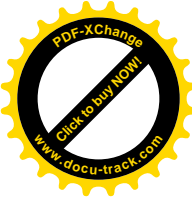
JM: I think if I look back from my own view, I think we were not good in catching up with the stakeholders. I think that is what happened. The stakeholders were ahead of us by maybe 10, 15 years. Meaning that everybody was thinking about reclamation; everybody was thinking of looking at the tailings pond, but somehow down the road. Not today. And the stakeholders, in essence, gave us a rude awakening. Listen folks, this is not acceptable. So that's good. There is nothing wrong with somebody telling you, "Wake up." And the waking up now is being actively pursued by the oil sands industry so they are all actively looking at tailings ponds to minimize the size. Directive 074 on tailings came out a couple of years ago. It's a fair directive, and the industry looks at it very seriously, and they are taking it very seriously. Everybody in the industry is looking at tailings ponds in a very serious fashion, and just lately, in February, there was an announcement that the oil sands industry will share all the IP [Intellectual Property] in tailings, and that's great. And I understand they signed the agreement formally. That's great. And I hope they will use that agreement as the way, as the approach to do other things: reclamation, water management, air management, and, in this way, the whole industry is working together so that we don't waste resources in that area, so that benefit will be maximized. And the industry is doing that. They compete on other aspects, but that is not environmentally oriented.

AD: In 1980, when I started as the Science Editor of the *Canadian Encyclopedia*, this was the era of mega projects. Everyone was into this. I mean it was bragging rights. It was the size; it was the economic advantage, all of that. And also the emphasis on innovation, which is to do with the science and the technology; now, 30 years later, the views are different. The public and the media interpret these things in different ways. Do you want to talk a bit about that?

JM: I will try. I mean let's be honest; in 1960, we have GCOS, which is Syncrude, no, I mean Suncor. Then Syncrude came about in the late '70s. And they were really small operations. It was more operation in terms of how many barrels of oil per day or per year. Now we have others joining in the production of oil sands, so really it became way more now than in the late '60s, early '70s. Well, that is one of the reasons the public is becoming more aware. That is the reason why the newspapers



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and the press becoming more aware. But the unfortunate part, in my mind, is that we are looking at the negative aspects of the oil sands. As I mentioned to you earlier, when I was in the U.S. just two weeks ago, I was giving talks to universities and to other U.S. national labs. I didn't hear the word "dirty oil." I never did. I mean for the U.S. neighbour it was a North American reserve – a secure reserve. So there is no doubt we have a negative environmental impact. There's no doubt. If I am breathing today, there's a negative impact on the environment. If I go to my yard and plant a vegetable garden, I will be disturbing the soil and the earthworm will not be happy about it. There is no doubt about that. But the question is we have to minimize, and the industry is working very hard to do that.

AD: Do you think that we're going to see major changes in the way the tailings are handled and when can we expect to see those changes?

JM: Well, I think the change is already occurring. I mean Suncor, as they have announced two weeks ago, a month ago, that they have already reclaimed to some extent tailings pond one, which was very close to the river, and I'm very glad to hear that. I think Syncrude will be announcing, sooner or later, another reclamation of their tailings pond. But one has to realize that you cannot reclaim a tailings pond or a mine unless you have actually finished with that process. You cannot keep reclaiming a tailings pond and still be using it. So you have to have some lead time.

AD: Now, in terms of the regulatory framework, to go back to the role of government, do you want to talk a bit about that?

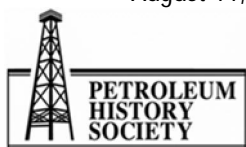
JM: I don't think there is any harm with having some good regulation. There is no harm, because regulation will sort of focus you to do something about that [tape ends]

AD: Let's go back to government and the regulatory framework and also should it be more stringent?

JM: Well, I don't want to say stringent. I would say fair regulations. I mean, for me, a good example is Directive 074 that deals with tailings.<sup>3</sup> I think it's good to have. Unfortunately, it deals only with the future generation of the fine solids. And I just wish we had another one, and maybe others would not agree with me, on the legacy of what we already have; the legacy of the last so many years. I would like to see a regulation on that and, specifically, because we have large tailings ponds, and the new regulation will actually make sure it will not become larger. But what about what we have

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<sup>3</sup> Directive 074 was approved by the Energy Resources Conservation Board of Alberta (ERCB/Board) on February 3, 2009. It deals with "Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes." Retrieved August 11, 2011; URL: <http://www.ercb.ca/docs/Documents/directives/Directive074.pdf>



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already generated? And I think it should come soon. I hope it will, because we have learned so much in the last while. How to deal with the future generation of fine solids, and we can use that knowledge to deal with the legacy we have generated.

AD: [not discernible]

JM: Absolutely.

AD: What is role of government, the industry and academe in regulation?

JM: I think we should do more in collaboration and consulting with each other. I think it would be very foolish, in my mind, to have the government put up regulation without consultation, because I'm sure you have good people in government who understand the oil sands industry, but I don't believe they can understand it to the extent that industry understands it. A good example - now we have a regulation that says that if the bitumen content in oil sands is above 7 per cent by weight, with other criteria being met, you must mine it. Why seven? Why not five? It's because 5 per cent grade will not be economical. I mean, do we have people in the government who understand the economics of that? [Government needs] to consult with the industry, then we can put a reasonable measure in place, because I can assure you, if the grade is 5 per cent and if that particular outfit in industry can process it effectively, economically, they will. Why not, if we make some profit out of it? So these regulations have to be reasonable within the framework of what the industry can do with the present technology.

AD: And, then, in terms of public perceptions, you have the ducks incident which just put oil sands on the front pages of the media across the world. And, then, of course, David Schindler's report dealing with Aboriginal People and the documentary by Tom Radford that was shown on "The Nature of Things." Do you think that's a fair way of presenting the industry, and do they have a case?

JM: I think the duck incident is very unfortunate. I mean I do not want to have a single duck to actually die in some misery. This is not right. There is no doubt about that. But, having said that, that was of course a series of unfortunate events, and I don't think anybody in the industry is happy that it did happen. Who wants to have any animal suffer? Nobody would but, on the other side, having said that, I hear that in Alberta we hunt over 100,000 ducks a year. So why don't we talk about that too. I mean, these are the same ducks, and probably we maim as many. That's not right either. I am not a hunter. Many people are hunters, and they would not agree with me, but if I'm



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going to make an issue about ducks in the tailings ponds, I should make an issue about other ducks too. Anyway, if you have one duck die in a tailings pond, it's not right either. Don't misunderstand me. I think we tend to look at the negative part and I will come directly to the question in a minute.

You hear that we use in the industry 18 barrels of water for every barrel of oil we produce. That's absolutely correct. But what about the second part of the truth? The second part of the truth is maybe 85 to 90 per cent of that water is recycled in the plant. So why don't we say that at the same time? We are giving the number 18. Why don't we say 85 per cent of that water is recycled? In Court, we ordinarily say the truth and nothing but the truth, so why don't we abide by this method? That bothers me. But Schindler - I mean a rude awakening of any kind is good to have.

I don't mind when people say, "Jacob, that work that you are doing is no good. Why don't you do this? Why don't you do that? Why don't you do this to get that? It's not complete." You might be upset when you first hear it, but if you are really smart, you listen to the voice and say, "How can I improve things?" I have not read all of Schindler's papers - I have not. But I did read a couple, and, in all fairness to David Schindler, in one of his papers I remember reading about the toxicity in the tailings pond. He actually began many of his sentences by "maybe," "can be," "perhaps," so he's not very strong in his wording because some of these measurements are very hard to make. But, unfortunately, they are translated by others into hard numbers. David, in his favour, did not say that. And, as far as the toxicity with the First Nations, I have very little knowledge of this. You know, I'm not in the medical field, so it's very hard for me to comment. In one aspect, I don't mind David talking about things, because it makes us think a bit, which is not wrong. It is good for us to listen and act accordingly. But we should not blow it up out of proportion of what he is saying.

AD: Where do you see the industry 20 to 30 years from now?

JM: I think we'll have higher efficiency. Mind you, now, in the mining operation we have over 90 per cent efficiency. I mean, that's a huge number. I'm sure we'll come closer to 100 per cent eventually. I think the carbon dioxide will become less, that the carbon dioxide emission will become less. The tailings ponds probably will be extremely small to the extent that it will not become an issue. The water drawn from the Athabasca River will become much reduced, maybe from 5 per cent to two or three. And the negative of any impact will become much less. The process might change. Whether it will be water-based or something other liquid-based is debatable. I hope I will be alive to see that and know what will happen. But I think the impact will become much less.

AD: So what would be the new oil sands research? Can you forecast what that would look like?



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JM: I think we will look at more at the nanoscale, like at the moment; way back we looked at the microscale. And with Dr. Xu and others we are looking at maybe the microscale. And I think now we are entering the area of nano and molecular scale, to really understand how these molecules behave in a way that we can use that knowledge to improve the process. And, of course, I know I am very narrow in what I'm saying, because I am only referring to the basic research in this area of extraction. But again, you have to look at the mining operation. This is a massive approach. Are we going to have trucks all the time? I doubt it, because the trucks tend to be expensive to operate. They produce a lot of carbon dioxide; you need truck maintenance, and so on and so forth. I think that most likely this will be eliminated. Most likely the operation will become more efficient in terms of that you mine at the face of the mine; you process it at the face; and secure the sand in a safe place; and you send the bitumen for upgrading. And maybe one day we will combine mining and upgrading in a way that becomes very compact and efficient.

AD: We now read in the media discussions about using pipelines to take the bituminous sand elsewhere. What do you think about that? What do you think about the science and the economics of that?

JM: You have to send that bitumen [somewhere]; we will produce probably in 20 years way more bitumen and oil than we can consume in Canada. So you have to sell it, if you are going to be in business. I think many economics are involved in it and political involvement. I, personally, would love to have a pipeline going to the west coast because I think that China will need that oil, and I think we should expand our market not just to the south but to the west as well. And the reality is very simple, very simple. If you need that oil to survive, you have to build that pipeline. But, again and again, you have to do it in a responsible manner. If all these hesitations make it more responsible, that's wonderful. But if the hesitation is political, then I am not happy about it.

AD: In terms of the roles that academia plays in the theoretical research that may then have applications in industry, what do you see as the role of engineering in the university now?

JM: I think their involvement will be intensified. I have no doubt in my mind, because the industry does recognize to a very large extent that basic research done at the university, as esoteric as it might be at times, is vital to their improving their process. I remember some time ago, the industry decided to go to a lower temperature. We basically, in research we'd done in the lab, discovered very quickly that temperature is crucial to that process, if you don't go above [a certain temperature], your



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efficiency, will be low. That basic research was used as a guide to the industry as to how to raise the temperature of their process, so it is not the equipment, it is not the engineers working on it, it is not that the operators are not smart enough to operate properly. It is the basic science going against you. And when the industry recognized that ... [end of tape]

AD: So you were talking about maximizing the efficiency of the extraction process. Do you want to go on?

JM: Well, it's not just the maximizing; it's doing it efficiently. Meaning, there is a certain temperature below which the process does not give you, most of the time, high recovery. The ability of high recovery is not that high when you are below that temperature. From our basic research, we found there is a critical temperature below which the process doesn't really go well for you. And that knowledge was used by the industry to guide them to increase the temperature. Nobody wants to increase the temperature because it means that you have to burn more natural gas, and nobody wants to do that from an economical and environmental point of view. But the reality of the process is that you have to go above a certain temperature.

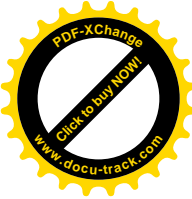
AD: I look back to the whole Clarke-Ells debate. The feds way back when, I mean 1920, had a rival cold water separation process at a theoretical level, but the University of Alberta's President Tory, and the researchers here, became the dominant technology. Is there anything happening, at the National Research Council or at other universities that is relevant?

JM: Well, there are some places within Canada, but it's not that many unfortunately, touching on oil sands. But the thrust is really in Alberta, and the U of A, in particular. You see, the business of working, research working on bitumen and oils sands is really not the "in" thing. I mean, think about it. This is not nano technology. This is not biotechnology. This is not molecular technology. I remember when we first started publishing. It was hard to publish, because the reviewers would say, "Oil sands, working on bitumen, non-reproducible ok? results. How can you reproduce results?" And, then, it took us what - 10, 20 years - to convince the university academic audience that "No, this is really solid research." And it took time, and now you publish in the highest calibre journal on oil sands. There are no issues. But it took a while. It really did.

AD: Do you see any threats to the research infrastructure within the university, especially the University of Alberta, with the money ... It's chasing the money isn't it?



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JM: If the money does dry up, then you collapse the whole research structure. I can assure you of one thing, when it collapses, you will have a hard time reviving it; when you downsize a research lab, that's the end of it. It would take double the time to take it up to where it was before. And I hope that will not happen, and I don't think it will, because that resource is not just important to Alberta; it is important to Canada. It is important to the whole world. And sometimes we, as Canadians, we don't see that. Look at Ontario, look at Quebec, look at Saskatchewan – they are all benefiting, and rightly so. We are one country, [benefiting] from the oil sands. But, somehow, the public doesn't see that or perhaps doesn't know that. Unfortunately, the press is not emphasizing that.

AD: Now it seems with respect to oil sands that there is a symbiotic relationship between the university research establishment and the industry. And not just the research arm of the industry, but the industry as a whole. You were speaking, for example, about the temperature of the water which bears out that symbiotic relationship. Do you see any other touch points like that?

JM: Well, there are quite a number, for example, calcium in the water. What does it do to your extraction? The role of calcium in the water? What does it do? What is the role of the fine solids attaching to the bitumen preventing the aeration of that bitumen? All these are basic science, and the industry understands that very, very well. They are really smart. Sometimes we go to these meetings of advisory committees, then a student might talk about his or her research from a very narrow point of view, from the student's point of view, and, then, after an hour or so over coffee, a few people will say, "You know what. You can use that knowledge to do this and that and this. And we are going to look at it." And we discover a certain chemical will improve a process, and sometimes the next day people try it in the lab or in the field.

AD: You've mentioned advisory committees, and I'm going to ask, what organizations or committees or associations have been influential in oil sands development or are currently influential?

JM: When I say the advisory committee I meant the representative of the oil sands company that contributes, the response to the research of that particular individual. These are the advisory committees. And they come to listen to what we are doing so that that knowledge can be transmitted to the industry, because if you publish a paper, it might not be read. Well, here I'm wrong actually. I think I'm wrong on this one, because sometimes I visit the industry, and I'm really serious, and you have somebody in the room say, "Jacob, that paper of yours in 2007, you said that, and what do you mean by it?" So, to my surprise, actually, they do read what we publish. I mean that



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really amazes me, and sometimes they really read it extremely carefully so that they use that knowledge and augment it. That's the beauty; they augment that knowledge with their experience and improve on it to their own benefit. So we are just the starting point. We are the spark, and they use that spark to light, to do something for themselves.

AD: In terms of other research ... [tape stopped here].

AD: Jacob, you were given the Order of Canada. Do you want to tell me a bit about that? And when did you do that and why?

JM: Well, I got the letter in '06. And I was extremely surprised that I got it, but I did know that my name was there because our President [ Dr. Indira Samarasekera] really wanted to put my name forward. I remember that. And I was really very surprised, and very humbled, of course. I didn't recognize [my achievements] at the time. Is my work really that good to be recognized by the Order of Canada? That was very surprising to me, but it was a pleasant surprise that I was acknowledged.

AD: There is a reason that you're given an Order of Canada. It has to be based on your achievements and at the level that you received it at. You're an Officer of the Order.

JM: That's correct.

AD: What particular achievement did they flag?

JM: I think they flagged my contribution to research in oil sands and the creating of the collaboration between the industry and the university. Even though it was not my major thrust in the beginning, but it turned out to be a very important thrust, that collaboration. And I did it, not knowing I'm doing it. Only toward the end, I became conscious of it, and it's really based on a very simple premise. You trust others. You respect them. And it has to be a win-win.

AD: Are there any other Orders of Canada that you know of in this area?

JM: Not in oil sands. We have very few people from academia in oil sands. We have Dr. [Norbert] Morgenstern; he got it some time ago, but he was more on the geotechnical aspect of oil sands and tailings ponds. But I got it more on the fundamental research in extraction. And I got the other thing. I got elected as Associate Fellow (associate because I'm not American) of the National Academy of Engineering for my research in oil sands. And I just got that, and that surprised me tremendously because I thought of the negative reputation of oil sands, nobody will touch you. But there you are, I got it too.



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AD: Thinking of the notable people you worked with in the industry as well as the research establishment. Do you want to talk about that?

JM: Well, there are really a large number, I have to admit. Very large, and very competent individuals who did a lot of work. I remember Koichi Takamura in the '80s; he was at Alberta Research Council; Eddy Isaacs, also at the Research Council. They did really good work; very fundamental work, and we really took off from where they left, if you like. And we were fortunate at the time, because we had better equipment at our disposal. And that is another advantage we had over the others. We had Czarnecki at Syncrude – he did a lot of fundamental work. Tadek Dabros at CANMAT. He's a great scientist in the area. I admire him a lot. Of late, meaning 10 years ago, was Zhenghe Xu [NSERC Industry Research Chair in Oil Sands Engineering Canada Research Chair in Mineral Processing], who is now carrying on where I left. He is a very competent individual as well. So really we have a lot of good people. Murray Gray, working on the upgrading [Ph.D., California Institute of Technology, NSERC and Canada Research Chair in Oil Sands Upgrading, University of Alberta]; John Shaw [NSERC/Alberta Innovates, Industrial Research Chair in Petroleum Thermodynamics] working on the area of high temperature and pressure. We have Sirish Shah [P.Eng Professor and NSERC-Matrikon-SUNCOR-iCORE Senior Industrial Research Chair in Computer Process Control] working on automation, and on and on. Subir Bhattacharjee [Ph.D., P.Eng. Professor, Department of Mechanical Engineering, University of Alberta; NSERC Industrial Research Chair in Water Quality Management for Oil Sands Extraction] working on water issues. So you see we have a lot of good people, really good people I consider them to be very, very exceptional individuals.

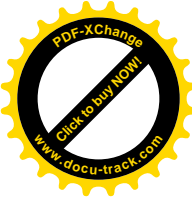
AD: Is there any other issue that you would like to share with me that I haven't asked about?

JM: What comes to my mind is something that again I didn't plan. As you notice, I didn't plan; things just happen. But maybe it's not true. At the back of my mind I know what I'm looking at. Like with Murray Gray ... we started a professional course in oil sands, and really I don't know how many people have taken that course in the last 12, 13 years; maybe over a thousand, from the industry. So we furnished them with handbooks and, lately, Gord Winkel was with Syncrude [P.Eng, Syncrude's Aurora Bitumen Production Vice President and 2002 Canadian Institute of Mining Distinguished Lecturer], and he was seconded to Exxon Mobil and we have a lot of fun, because we were educating the practitioners in the area of the fundamentals in oil sands, and that was really important. So that contribution I think is the result of our research.

You see, like you always say, you do research, but is it being transmitted to the industry? And that is very important, because research not transmitted, what good is it? You might have self justification for publishing, but that's not good enough. Our transmittal was through our research papers, cooperation with industry, but also through the courses. I remember many, many occasions when operators come to me and said, "You know what, I worked in this area for 15 years, but I never



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really understood why I was doing it. Now I understand why I am doing it." And for me, this statement tells me that the individual now understands it better. It means he's going to improve on what he is doing.

AD: When are the courses delivered, what are the lengths of them?

JM: It started as very ad hoc. Murray and I said, "You know what? Let's put a course together," in the late 1990s, actually. They are delivered in two different ways. One is to a specific oil sands company or a consulting company. They say, "Murray, Jacob, are you available in July?" It's two days, and he [Murray] does upgrading. I do extraction. And we give it in-house. It's all public domain information. And sometimes we give it to a general audience, meaning we say we are offering a course in Edmonton, Calgary or Fort McMurray, and people simply register and if there is a sufficient number, then we give the course. And now, these days I'm doing one that's two to three days only on extraction, very, very extensive. And we do that for certain operators and engineers and even lawyers sometimes join us; and even people from acquisitions join us; and even human resources, they join, which is rather interesting.

AD: I gather that you've been at work on a book. Do you want to tell me a little about that?

JM: Sure. It's a project. It's really out of love more than anything else. As you know, having a handbook out is very difficult. What happened a few years ago is I said to myself, "You have handbooks in virtually every area - in mineral processing, chemical engineering, mechanical engineering, structure, and on and on; power transmission. But there's no handbook on an industry that is about a \$100 billion industry. This is very, very odd." So with Jan Czarnecki and Zhenghe Xu, we decided to have two volumes: one on fundamentals first, and we wrote that handbook and hopefully now we are in June that in July/August it will come out. And that will deal only with fundamentals, and three of us wrote it. Then, we will have a second handbook, which is in progress now, where each chapter is coming from the industry. Industrial people wrote it, and I think we have most of the chapters in. And really it is hard for the industry people to write it because, by and large, they write it on their own time, and they're really very, very busy individuals. So now we're working on that particular volume, and we got funding from AERI to initiate it. The money's gone, because we are really far behind. And now we are trying to find new funding to finish volume two.

AD: So who worked with you on volume one?

JM: Zhenghe Xu and Jan Czarnecki.

AD: And can you share any of the names who are doing the industry side of it?



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JM: Ya, we have Joy Romero from CNRL [Joy P. Romero, Vice President, Technology Development, Canadian Natural Resources, Ltd., Calgary]; she's a vice-president. She wrote a beautiful chapter on how you actually initiate a project. It's fascinating. We have Peter Read from Syncrude [Manager of Business Development] and other authors dealing with the mine. And I think this is a very important chapter, because you go to chemical engineering people or mechanical engineering, they say, "Oh mining, it's so easy. All you do is to dig." And in that chapter they brought a lot of issues saying to us, "Listen guys, mining is a very complex engineering system." So this is just two simple examples.

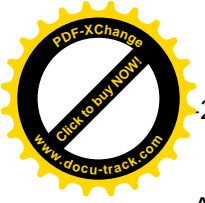
AD: Do you think there's the need for a publication that really presents the industry, from research to extraction processing, all that side of it, for the layman? *Oil sands for Idiots?*

JM: There is no such a thing, because we don't have idiots around at all. I think we have a bigger issue, to be honest with you. And the bigger issue is that we don't have enough publications coming from the industry, so that such publications become public domain. And I think it's very sad. This is a sad situation. We used to have more before. You might ask, "How can a person pick up information about oil sands that are public domain so that you can use it." Well, they are really very limited. One is ST-98 [Annual report by the Alberta Energy and Utilities Board that details Alberta's reserves of and supply/demand forecasts for crude bitumen, crude oil, conventional natural gas, coalbed methane, natural gas liquids, coal, and sulphur for the province of Alberta] that comes from the Alberta government every year [ERCB]. This is a volume that comes in June that I cherish very much, because it has a lot of information, statistical information. We have the submissions to the ERCB from the oil sands companies – what they plan to do. This is public domain. I use that. Sometime, they submit information to the ERCB that is done -sustainability reports, annual reports, but really the buck stops there. But we are fortunate. As a good example, we have froth treatment – low temperature, high temperature. Low temperature we have some publications, because it was done some time ago. But the high temperature – I would love to see some public domain literature so that my students can read it; I can read it; and so that we can understand what the process is and we can work on it. But unfortunately, we don't have that, and it comes from many reasons. One is time - time for the people to write; and one, IP [Intellectual Property]. So the issue of IP becomes sometimes a stumbling block.

I would like to see more publications from the industry; not just on PowerPoint. PowerPoint is fine if I am present at the presentation, so I understand what the slides mean. But the PowerPoint I get from the web, that particular slide from the PowerPoint might mislead me not knowing the basis of it. So we really need black and white, in words.



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AD: Do you see a gap in publications to do with the industry and all the aspects that doesn't violate intellectual property?

JM: I think now, Adriana, we have more on the Web, actually than say a year ago. OK? You can go to CAPP [Canadian Association of Petroleum Producers]. You can go to individual companies. Suncor has a beautiful one; Shell and Syncrude and others. But the question is, "Does the public access these sites to learn from them?" As you say, *Oil Sands for Idiots*, maybe it's not such a bad idea, but will people read them? I don't know; I really don't know.

AD: There's the whole issue of the information sharing on the oil sands or information dissemination, to use that neutral term. CAPP supposedly does this. And you see those paid public service announcements developed by the companies.

JM: I tell you what I really want to see. I want to see it from those who are critical of oil sands, and those who are very pro oil sands. I want to see a balanced story. And I mean balance. When I talk about oil sands, and I just gave one to NSERC [Natural Sciences and Engineering Research Council] in Ottawa, I say the good things and I say the things I don't like. And when you are putting a story together, regardless of who you are, regardless of who you belong to, if you bring the two sides of the issue [together]. Water withdrawal is an example. Yes, we are withdrawing water from the river. Does the river, can the river sustain it? Today, tomorrow, 20 years from now? We should say it in a very objective manner.

AD: Could that be a role for the university, in terms of the communication? You've got academic integrity and codes of conduct.

JM: Some of us do that; of course. I do that; others do that. There's no doubt about it. But the message has to be more widely disseminated. I think the industry on their websites should give me the cons and the pros, in a balanced fashion. When I read that story, I trust it more.

AD: Maybe you need a third party to do that.

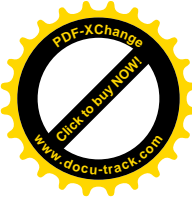
JM: But who's that going to be?

AD: Government is viewed with distrust.

JM: If you read government websites they are more or less pro oil sands. OK? Naturally, the company ones should be pro oil sands. You go to others who are environmentally oriented, by and large, they tell you the whole story. But again, they don't tell you the whole truth either. They are not



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lying – all their numbers are correct. Don't misunderstand me, but they're not telling me the whole story and I want to hear the whole story.

AD: They're talking about good and bad science, but in effect it isn't good and bad science, going back to Schindler in the most recent reports. It is really how the truth is rolled out, because the science can be used in various ways. So that we're really talking about an information gap, aren't we?

JM: You do things because you have a purpose for doing it. If you are going to write a new article in the newspaper, not bringing or magnifying or slightly not interpreting the subject properly, then you have to be sensational to some extent. Somebody crossing the street safely is not anything sensational, but if you are hit by a car it is becoming sensational. We have to strike a balance, and I don't think we have it. I really don't think so. There are a lot of negative articles about the oil sands, really negative, and the question you have to ask is, "Why are they so negative? What is the purpose behind it?"

AD: Would you agree in terms of the general public that it used to be expected of science and the scientist, the doctor and all these professional people, that there was an implicit trust in them? That this has been eroded and that now the public tends to mistrust authority figures from the scientific establishment and certainly from industry?

JM: You mention the medical field. As a good example, if you are a physician today [he] tells you that you have this particular illness, I'm sure you will go on the Internet and go on the Web and read 50 articles and then you'll go to your physician and say, "But you're not doing this test, you're not doing this test, you're not doing this test." Right? I don't mean to do that at all, but now we have information blow-up almost. And because we don't give the whole truth, then the public doesn't trust. Probably people do it on purpose, I'm not sure, but I don't think anybody wants to misguide you; because they are telling you the truth, but not the whole truth. I know that I'm mentioning that often, because I see that on both sides. It does bother me.

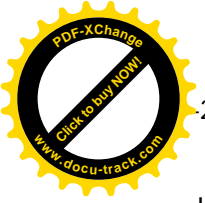
AD: What's next for you, because your emeritus appointment is coming to an end?

JM: This month. Will you believe it?

AD: So what do you see yourself doing next?



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JM: I tell you what. Two days ago I said to myself, "What shall I do today?" I had to make a list, because I knew I had to do a lot of work by that particular date. And the list was really full – it was all black from ink. And I said, "Jacob, are you retiring?" And the answer is, "Of course not." I still have students in the lab. The university has been tremendously supportive; the environment is tremendously supportive. I still have a lab; I still have an office; I still have students; I still have a research grant from NSERC; and I still collaborate with the industry on issues of importance and I give my advice for whatever it is worth. So I'm really very much involved. I don't see ... actually I hate the word retirement to tell you the truth. I truly do.

AD: So you're easy now, and so long as you can be useful you will be useful. Now, in terms of any of your documents, your records and research. Have you thought about where these might reside? I mention this because this whole project [Petroleum History Society Oil Sands Oral History Project] is an archival project and that the oral history audio and video tapes are going to be residing in the Glenbow Archives. Having done work on Karl Clark, some of his tapes, letters, etc., are in the University Archives [University of Alberta], and some Research Council materials are in the University Archives. So I just wanted to raise this question of where your personal materials might reside?

JM: Unfortunately we are downsizing our living quarters, so I started to throw things away. But now, after starting to talk with you last week, two weeks ago, some of the important documents I am keeping them for a while. In fact, I've discovered some documents from my student days which I feel are very important to have around.

AD: Because your research is so significant, it is important that it goes to a public repository. Is there anything else that you would like to add?

JM: No, not really, except that I have to keep the good work going.

AD: Thank you so much for agreeing to the interview.



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