THE SCIENCE FILES
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ENVIRONMENTAL SCIENCE

PARTICIPANTS: Richard Zurawski

Dr. Rob Thacker

Dr. Linda Campbell

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RICHARD ZURAWSKI: Good morning. Welcome to August 13th, show number 28 of **The Science Files** with Richard Zurawski.

In the sciences we often speak of the great achievements that we've made, the incredible advances that we've made as a society. And I daresay that without science we would still be huddled in ignorance fearing nature and following superstitious problematic codes. Some people ask why bother with the so-called esoteric questions, why trouble ourselves with the endless stream of inquiry. Well, my response is simple, without science not only would we not have technology but our society, how we interact with each other, how we see the universe around us, all of that would be vastly different. Things like racism, sexism and all the other negative "isms" would run rampant. The sciences have been at the forefront of quality and a egalitarianism right from the beginning. It took time, but without the sciences it's doubtful that our western world would have evolved the way it did.

This is my last **Science Files** for the next eight weeks. We have this thing called the CRTC which says that municipal candidates must be off the air in every capacity eight weeks preceding the election. As a result I will be silent over the airwaves over the next eight weeks in Halifax. Filling in for me will be the fabulous Dr. Rob, who is more than able

to pilot **The Science Files**. And in addition, what makes this particular show even more noteworthy, aside from the fact that I can't speak, is the fact that we have Dr. Linda Campbell, Senior Research Fellow in Environmental Science, and professor at Saint Mary's University as our special in-studio guest. What you should know is that Linda is also Dr. Rob's better half. She was also a top 40 Under 40 **Globe and Mail** recipient. Today we're going to speak with her about her environmental studies and some toxins like mercury.

In studio as well is Susan Cargill, an interpreter who is working with us with our interview. Linda is deaf, and my signing is awful, no, it's non-existent. So thank you, Susan Cargill for being with us. And in a few minutes we'll proceed with the science of toxicity. Not toxic scientists, but the science of toxicity.

I also have to mention that way back when, Linda was being called Dr. Linda before there ever was a Dr. Rob. And I would also like to mention that Andrew Pinsent is filling in for Leah Batstone, who's taking a well-earned vacation.

So welcome to **The Science Files** and good morning, Dr. Rob. You have been all over the place except in the studio.

DR. ROB THACKER: It's great to be back. Yes, I've just spent a week in Quebec at a family reunion, which was wonderful and seeing the Saguenay River as well, that was great.

RICHARD ZURAWSKI: And you've been ... You're going to

be sitting in for **The Science Files** for the next ...

DR. ROB THACKER: Oh gosh, yes.

RICHARD ZURAWSKI: ... eight weeks.

DR. ROB THACKER: I'm going to be ... have to be inventing new words like you do in your monologue, the egality or what's that word?

RICHARD ZURAWSKI: Yeah, you know, and ... and hopefully you'll be able to say it properly without tripping over your tongue.

DR. ROB THACKER: Well, hopefully, hopefully. Known to stumble every now and again. But so, big thing this week, I guess, was the Perseid meteor shower.

RICHARD ZURAWSKI: Oh, do I have to listen to that again?

DR. ROB THACKER: Well ...

RICHARD ZURAWSKI: You know ...

DR. ROB THACKER: ... yes, you do. Come on, shut up, yes, you do.

RICHARD ZURAWSKI: They come in every year.

DR. ROB THACKER: It's very ... Well, no, we go through them every year, that's how you should think about it.

RICHARD ZURAWSKI: Okay. So they make a visit every year.

DR. ROB THACKER: Yeah, so this ... all the Perseids basically get them every year the same time, and that's

because there's a stream of material in space created by Comet Swift-Tuttle that we go through every year basically the same time. But the interesting ...

RICHARD ZURAWSKI: What happened to Swift-Tuttle?

DR. ROB THACKER: Oh, it's still going around. Right? Last time it went around closest to the sun was 1992, it'll be back in 2126.

RICHARD ZURAWSKI: So it's periodic.

DR. ROB THACKER: It's periodic. 133 years. Yeah. So it's still going around ... zipping around, coming back soon. But the really interesting thing is that everyone thinks, Oh, that's just like a distribution of material, but, no, it's clumped up in certain places. And so this year it's particularly clumped up as we go through it. So there should be more Perseids than ever. So reports are we got up to 200 an hour, which is really pretty spectacular.

RICHARD ZURAWSKI: Yeah.

DR. ROB THACKER: So a lot of the times people go out, you get, like, 40 or 50 an hour, and that's less than one a minute. Right now if you get 200, even up to 250 an hour, which is still possible, maybe tonight, you could see basically a couple a minute, three a minute, which is kind of incredible.

RICHARD ZURAWSKI: Okay. Well, let me put my weather on ... hat on right now.

DR. ROB THACKER: Yeah.

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RICHARD ZURAWSKI: And we've got about a 50/50 chance of ...

DR. ROB THACKER: Oh, you always spoil everything, Zurawski.

RICHARD ZURAWSKI: I know. I know. I know. There you go.

DR. ROB THACKER: Yeah.

RICHARD ZURAWSKI: You guys with your ... Now I can truly say I've got my head in the clouds. Sun's run rampant.

DR. ROB THACKER: Yeah.

RICHARD ZURAWSKI: Anything else in astronomy?

DR. ROB THACKER: Oh, yeah, so there's a report that we may have an earth-like planet around the nearest star to us. The nearest star to us is Proxima Centauri, and we had rumours that ... Okay, taking a step back, Proxima Centauri is part of a three-star system where there's Alpha Centauri, Beta Centauri and Proxima Centauri.

RICHARD ZURAWSKI: And this is the closest star.

DR. ROB THACKER: And this is the closest one. It's a bit further out than the other two. And so what's interesting about this star is, is what we call a red dwarf, which is fairly small, fairly dim and there are absolutely millions and millions and millions, there are probably 200-million of these things in the overall Milky Way galaxy. Why is that interesting? Because if there's life around these red dwarf stars that means there's a really, really high

probability of life within the Milky Way.

RICHARD ZURAWSKI: And this ... this ... this planet that's around Proxima Centauri, it's earth similar ... earth like?

DR. ROB THACKER: It ... So ...

RICHARD ZURAWSKI: Earth sized?

DR. ROB THACKER: Here's the thing. There's being reports of it in the media and I can't find any details because they haven't done the press release yet. So my interpretation will be ...

RICHARD ZURAWSKI: That press.

DR. ROB THACKER: It's about earth size and it's going to be in, what we call, the habitable zone, the goldilocks zone, not too hot, not too cold for liquid water. And so this is really interesting because maybe the James Webb Space Telescope flying in a couple of years could start doing really good analysis of this planet, right, if we can see it. So that would be really, really awesome ...

RICHARD ZURAWSKI: So really ...

DR. ROB THACKER: ... if this proves to be true.

RICHARD ZURAWSKI: ... if there's a chance that we could actually travel there within the lifetime of a person but probably not come back.

DR. ROB THACKER: Yeah, so this is what everyone wants to do, but it's really, really hard to go to the stars and it's so far away. Even travelling at a 10th of speed of

light you're looking at 50 years to get there. And, you know, as awesome as it sounds we can't even get to Mars.

RICHARD ZURAWSKI: You can be playing Pokemon Go while you're going there.

DR. ROB THACKER: Oh, scary thought. What if you meet an alien playing Pokemon Go, that would be like, Oh, no, they've already (inaudible - talkover).

RICHARD ZURAWSKI: You can't tell the difference.

DR. ROB THACKER: Yeah. So ...

RICHARD ZURAWSKI: So that's big news. I like this.

DR. ROB THACKER: Yeah, no, this is actually really pretty cool because there was talk of a planet around Beta Centauri, but that was actually shown to be not true in 2015, so finding something around Proxima, I think they found this one via stars wobble that's called radial velocity mechanism and so on. So it'll be fun to, kind of, confirm this follow-up with a little more detail in the future.

RICHARD ZURAWSKI: Interesting stuff going on in the heavens. I want to get closer to earth. One of the ...

DR. ROB THACKER: You're going to get to weather, are you?

RICHARD ZURAWSKI: I'm going to get into climate.

DR. ROB THACKER: Climate. Okay.

RICHARD ZURAWSKI: You know, this is a summer that just blows me away and, you know, it's one thing to talk about the drought in California and Texas and the southwest of the

United States and the incredible heat in through the Middle East and all of that kind of stuff, but this summer in Southern Ontario, Quebec and in through the Maritimes has been one for the ages.

DR. ROB THACKER: Yeah.

RICHARD ZURAWSKI: I mean, the protracted ... I forecast for Ottawa, for our sister station, 1310 ...

DR. ROB THACKER: Um hmm.

RICHARD ZURAWSKI: ... and we have had seven heat ... protracted heat warnings of which the last one was the worst; humidex values approaching 45.

DR. ROB THACKER: So I was away this week, as you know, and then reading in the newspaper about they're actually banning people from walking in forests in ...

RICHARD ZURAWSKI: Here in Halifax.

DR. ROB THACKER: That's incredible.

RICHARD ZURAWSKI: Yeah. That's how dry it is.

DR. ROB THACKER: I mean we're surrounded by water everywhere and yet it's so dry in parts that we have fire risk.

RICHARD ZURAWSKI: Well, it's ... and even so, people are still having fires.

DR. ROB THACKER: Yeah.

RICHARD ZURAWSKI: And violating the rules and figuring that it doesn't apply to them. And this whole climate thing is something that just seems to be off the radar. It's incomprehensible to me that this isn't big news,

that people are not stepping up and saying, My goodness, we've only got two or three or four years to do something.

DR. ROB THACKER: So most people don't think they can do anything about it individually, right? This is the whole problem we have.

RICHARD ZURAWSKI: Well ...

DR. ROB THACKER: It takes collective effort. You know it's got to get going from the government and, in fact, I don't know, I still kind of agree with Silver Donald Campbell was saying, it's got to come from a push from the people to make having a good quality of environment to really have an impact on the government.

RICHARD ZURAWSKI: Let me slag the media here for a second though. Most people listen to the everyday ...

DR. ROB THACKER: You're slagging yourself.

RICHARD ZURAWSKI: I'm slagging myself, yes. Yeah. This comes under self-flagellize- ...

DR. ROB THACKER: Self-flagellation.

RICHARD ZURAWSKI: There you go. The flagellization ... no, flagellation. The media I view as culpable. We don't see the news reports, we don't see the crisis reports, we are so busy running around doing so many other things that this falls off the radar in the public's mind, precisely because we don't have scientists in the media.

DR. ROB THACKER: I honestly think it's down to the fact that people hear this so much they're kind of tuning it

out now.

RICHARD ZURAWSKI: All right. Well, okay, that's our introduction to the show. Dr. Rob and I will mud wrestle afterwards to decide who is right and who is wrong on various topics.

DR. ROB THACKER: Not with each other.

RICHARD ZURAWSKI: Not with each other. Anyway, you're listening to **The Science Files**. We will be back with Dr. Linda Campbell right after these messages.

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RICHARD ZURAWSKI: Good morning. Welcome to **The Science Files**. We have a very special show today. Dr. Linda Campbell, who is Senior Research Fellow in Environmental Science and professor at Saint Mary's University is our special guest.

As I mentioned, Linda is deaf and her interpreter is Susan Cargill. So it's going to be a bit unusual today in that there may be delays in questions and answers and the dialogue may be slightly different, but the science is going to be great.

So I'd like to welcome Dr. Linda. Welcome to **The Science Files**.

My first question for you, and the voice you're going to be hearing is that of Susan Cargill. The first question

I have, what got you into the sciences to begin with?

INTERPRETER: Thank you, Richard and Rob, for having me here, and it's really cool to see you working in action and chatting back and forth, I've been interested to see this. And I got involved in my research, I ... really I love being outside. The more I got outside, the more I realized that there were issues around. And I wanted to keep the beauty of our planet and the health of our planet forever. So that's how I got immersed in research, was understanding the issues and how to improve the world for everyone.

RICHARD ZURAWSKI: Okay. So ...

INTERPRETER: Those are the big ideas. The big ideas were what (inaudible - talkover).

RICHARD ZURAWSKI: Okay. So the big ideas are that you love science, you love the outdoors. Tell me about your specific research, what your area of interest is.

INTERPRETER: Thank you, Richard. I focus on environmental contaminants; pollution, chemistry, chemicals, how things move through the environment and how they impact the health of the people, the wildlife and the ecosystems.

Currently I'm focussed on mercury.

DR. ROB THACKER: Can you give us an example of how it impacts people?

INTERPRETER: Yeah, okay. Well, right now I'm focussed on mercury and that's an element. I'm sure you're

familiar with the old thermometers that have mercury in them and there's that silver that would move up and down as the temperature was changing and measuring the temperature, and in the old days kids would break the thermometers and actually play with that little silver ball that would roll around in their hand.

DR. ROB THACKER: Well, I used to do that.

RICHARD ZURAWSKI: I did that. I did that when I was in Grade 9. We had ... We made a barometer and my Grade 9 teacher actually had cupped the mercury in his hand and we didn't think anything of it.

DR. ROB THACKER: You seriously don't do that now.

RICHARD ZURAWSKI: Seriously.

INTERPRETER: Well, it's beautiful, right? Mercury is very beautiful, it's silver, it's bright, it rolls around, it's an amazing element, and it's a metal, it's still liquid at room temperature. So that's a pretty amazing characteristic. But it can also be toxic. And there are different types of mercury compounds. Some are more toxic than others.

RICHARD ZURAWSKI: How toxic is it?

INTERPRETER: Elemental mercury, the kind that you were describing that you have ... that would roll around in your hand is toxic. I mean, it's not too bad, long- term exposure it would be toxic. But that mercury can combine with methane and then that would become Methylmercury, and

Methylmercury is very toxic. It ...

RICHARD ZURAWSKI: Ah.

INTERPRETER: ... effects brain functioning, it effects developmental delays and so forth.

RICHARD ZURAWSKI: The expression "mad as a hatter" ...

DR. ROB THACKER: You nailed it.

RICHARD ZURAWSKI: Is ... Is ...

INTERPRETER: Yes.

RICHARD ZURAWSKI: Does that have anything ...

INTERPRETER: Yeah.

RICHARD ZURAWSKI: ... to do with mercury?

INTERPRETER: That's a different type of mercury though. I'm sure with Johnny Depp you've seen the movie, yeah, it was a famous movie ... I don't know about the movie itself, **Alice in Wonderland**, the accuracy of it, but it's based on a true story, people who were working with beaver felt and beaver fur, they were making the felt from the fur and they were using mercury to do that, they ... and they would use that in the fur to make a beautiful felt and they were actually inhaling mercury. And it was awful. And their brain functioning went down and so forth, they just deteriorated.

RICHARD ZURAWSKI: But is mercury still an issue? I mean, we don't make hats anymore out of beaver pelts by and large. I can't remember the last one I saw. Is mercury

still an issue today?

INTERPRETER: Well, I'm thinking about beaver hats I've seen in a museum, there are a few and they are gorgeous.

RICHARD ZURAWSKI: Yeah.

INTERPRETER: But anyway. We still use mercury. It's naturally occurring in the environmental, for example, with coal, there's several parts of the world that are burning coal and mercury is released to the atmosphere through the burning of that and then it's deposited back down.

DR. ROB THACKER: But it's not just mercury that we're using now. We used mercury a lot in the past, right, and so I'm well aware that Linda, and she can talk about it, is looking at how mercury was used in the past and how honestly it may have been disposed of, that's a huge issue in the environment.

INTERPRETER: Um hmm. Well, mercury is very useful. It's a very useful substance. For thermometers, you can use it for paint, you can use it for batteries, for electricity, lots of different things. So humans have been using mercuries since Roman times and on an ongoing basis. And there's a huge mercury mine in Spain that is still producing mercury. So it's a very useful substance. But in the ... about 50 years, we've been reducing how much mercury we're using, so there's been some improvements made.

But for over 2000 years we've been using mercury, and that means there's a lot of mercury on our planet, and that's

what we have to handle. For example, with gold production, you know, with the Olympics we win gold medals, the Olympians themselves. But we have to think, where is all the gold that we're using coming from.

RICHARD ZURAWSKI: I see. Now what about in the old days we used to use amalgams for our teeth, are they an issue? I understood there's mercury in them as well. Is that an issue?

INTERPRETER: Well, my understanding of the mercury amalgam for the first few days there is some being released but after that it just ... that exposure would go right down, it wouldn't be being released anymore it would be stable. So if you have an amalgam, my recommendation is just keep it, don't disturb it, oh, and ... and ask for a different type of filling when you go to the dentist, don't ask for one that would have mercury.

DR. ROB THACKER: So I want to go closer to home and I'm going to ask a really straightforward question, right? Is there a mercury issue in Nova Scotia anywhere?

INTERPRETER: Well, there's several. Unfortunately, Nova Scotia has the perfect storm for mercury. I've spoken about different types of mercury and the toxic potential of those different types. Methylmercury is more toxic, and I had mentioned that. And it's how mercury becomes Methylmercury that is the problem and that is environmentally dependent. Acidic water, the chemistry of the area and so

forth, and sources of mercury would all play part in that. And we have one important source of mercury in the province here in Nova Scotia and that would be gold mining. We have 64 gold regioned and over 306 mines and that covers, you know, that would be about half the province.

RICHARD ZURAWSKI: Well, thank you. That's the first half of **The Science Files**. You're listening to Richard Zurawski, our special guest in addition to Dr. Rob is Dr. Linda, and the voice you've been hearing is Susan Cargill, our interpreter.

We'll be back in about three or four minutes. We're going to listen to some news and some commercials, so stay tuned to **The Science Files**.

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RICHARD ZURAWSKI: Good morning. This is a special edition of **The Science Files** for a number of reasons. Firstly, I'm going to be off air for the next eight weeks.

DR. ROB THACKER: Ooh.

RICHARD ZURAWSKI: Ooh, yes. I even turned your microphone on. You know, Show 28 and I remember to turn your microphone on, Rob. There you go. Maybe that's ... There's a good reason for me being off air for the next eight weeks.

DR. ROB THACKER: You're going out with a high.

RICHARD ZURAWSKI: Yeah, there you go. And behind

the glass we have Andrew Pinsent, who's filling in for Leah Batstone and, of course, Dr. Rob is going to be filling on **The Science Files** with Rick Howe. He's going to have to make ...

DR. ROB THACKER: On Mondays.

RICHARD ZURAWSKI: On Mondays, yes. You're going to have to have a special tinfoil hat made for Rick.

DR. ROB THACKER: Oh, I get to tease Rick live.

RICHARD ZURAWSKI: Yes, you do. And so you're going to be doing double duty for me while I'm gone, running in the ... I was going to say provincial ... in the municipal election for District 12, I'm vying for councillor. And for another reason, our special guest is Dr. Linda Campbell who is a Senior Research Fellow in Environmental Science and professor at Saint Mary's University, but she's famous for being Dr. Rob's wife.

How did you guys meet? I want to do this one. How do ... How do scientists meet? Like, people must understand that scientists do get together and they do socialize so how did this happen? Both of you jump in whenever you want. Okay, great silence here.

INTERPRETER: Well, we met at a party. It was a party, that's it, that's the story.

RICHARD ZURAWSKI: So scientists do go to parties and socialize.

DR. ROB THACKER: Okay, I will jump in and I'm going

to expand just a little bit, and I'm going to say that Linda is not famous for being my wife, Linda is particularly unfamous for being my wife because no one really knew that, we kept it quiet. So ...

RICHARD ZURAWSKI: So there isn't a cult of celebrity in the family then.

DR. ROB THACKER: Oh, no, no, no. Good heavens. But we actually met at a party and we were ... I was a little bit nervous, like, boy meets girl kind of thing, and so we just started writing notes to one another, because I couldn't understand Linda that well. I do now obviously, no problem at all, and we just, kind of, wrote notes for about three hours and Linda was, like, really interested in what I was doing and I was really interested in what she was doing and it kind of went from there.

RICHARD ZURAWSKI: Well, it's ... You know, people tend not to think that scientists are anything other than clinical, that they're awkward, that they're not able to socialize; obviously, they are.

DR. ROB THACKER: Well, you can still be awkward and socialize.

RICHARD ZURAWSKI: Well ...

DR. ROB THACKER: I mean, that goes without saying.

RICHARD ZURAWSKI: Or you can socialize and not be awkward and all that kind of stuff, so ...

DR. ROB THACKER: Yeah, I mean, parties are pretty

much parties. There's a whole spectrum of different ...

RICHARD ZURAWSKI: Yeah.

DR. ROB THACKER: ... personalities in science.

RICHARD ZURAWSKI: Yeah. Yeah. I want to jump in with Linda. I have a little anecdote ... Oh, Linda wants to jump in.

INTERPRETER: Yes, a lot of people think of scientists that they work in isolation just in their lab or on a computer, however, scientists do a lot of teamwork. They work with ... in a team with a diverse group of people, with, you know, varying backgrounds and communities from all over the world. So the social skills are actually important to being a successful scientist.

DR. ROB THACKER: And, in fact, I would argue that teamwork in science is more important now than it's ever been.

RICHARD ZURAWSKI: Yeah, I'd have to agree.

INTERPRETER: Yeah. Yeah, collaboration.

RICHARD ZURAWSKI: And I find it's great that you can point that out and the fact that you can have a glass of wine and let your hair down, so to speak, and that you're not always talking about Proxima Centauri and planets ...

DR. ROB THACKER: Oh, give it a rest. Come on.

RICHARD ZURAWSKI: That having been said, I wanted to ask Linda a question about lead poisoning versus mercury poisoning, the toxicity of it. When I was growing up we had a neighbour, and this was a long time ago, who was cleaning

out some lead-based paint in a boiler of a ship and he got acute lead poisoning and awful things happened to him. He lost his teeth, his hair, and ...

DR. ROB THACKER: That sounds horrible.

RICHARD ZURAWSKI: Yeah, it was horrible. He withered away. He was a strapping, young, healthy man before he got the job and we didn't know much about that or maybe we should have. Could you comment on that, the similarity? Is there a similarity between lead poisoning and mercury poisoning?

INTERPRETER: Mercury and lead are very different and they have different mechanisms of toxicity. With lead it tends to (bond?) with calcium structure in the body and it competes with the calcium in the body. So everything in the body that depends on calcium would be impacted by that lead exposure. So that would mean with the bones, with the nerves, all of the systems of the body and it accumulates as well. So the more exposed ... more exposure you get to lead, then the more that would accumulate within the body and it can be very severe. And the story that you're describing within a boiler room, and I'm imagining that being quite hot, you know, it was painted there and you're in a small confined space, so that would be a huge ... that would be massive exposure and the lead would be ... you know, being released from the paint during the job that individual is doing. So I feel terrible about that incident. Comparing it with

mercury may be a little different. Mercury binds with protein, and it accumulates within that, and how it impacts the body is how it would affect the nerve response, someone's development, so it really connects with the nerve so you'd see tremors or brain functioning difference. They're both similar in the sense that it would affect the brain functioning of an individual, but how the lead impacts the body compared to mercury would be different.

DR. ROB THACKER: So how do you know what the overall levels of mercury are in an animal or a person or a plant or whatever? How do you do that analysis?

INTERPRETER: Well, there are many ways to do the analysis. I mean, I can go on for a whole course actually on this, but I won't do that today.

DR. ROB THACKER: No, please don't.

RICHARD ZURAWSKI: Well, I'm thinking please do. I like this.

INTERPRETER: Oh, maybe one day.

So what we do is we collect samples from the environment; fish, let's use that as an example, fish is fun so we bring that back to the lab and then we would, you know, cut out the different parts of the animals. For example, we may look at protein or muscle of a fish and then we dry those samples and grind them and run them through an instrument that we would use to measure it. I have a clean room lab, which means that the lab really reduces how much mercury is in that lab

environment. It would make sure that there's no mercury in that clean room environment, so that when we are analyzing a sample that analysis would be more accurate.

DR. ROB THACKER: Because as I understand it, you can have problems with things like mercury-vapour lights polluting samples and things like that.

INTERPRETER: Yeah, absolutely. And we're making some improvements. Mercury in florescent tubes, for example, as you mentioned. And it's quite a mechanism in action. The mercury actually binds with the powder; There's white powder that you can actually see within a florescent lightbulb. And then that is how the light, it runs through the mercury and then that sends signals, and there's phosphor powder and that's what's emitting the light that we would see when we look at the bulb. So if you break one of those lightbulbs the mercury is being released. So it is an issue here in Nova Scotia because if we just throw them in the garbage it's terrible, it's not a good situation.

However, there are improvements. The federal government and here our provincial government are looking at how they can protect exposure from those compact florescent bulbs that we tend to use and now when we dispose of them we put them in a plastic bag. And we're lucky that we have a business right here in Dartmouth that can actually recycle the mercury found in those.

RICHARD ZURAWSKI: Thank you. When we first met this

morning you were coming up the elevator you were kind of excited about the fact that you had seen some ... And this is a little off the beaten path of the toxicity conversation, you were talking about milkweed. Now I haven't seen much milkweed here. Why is this significant? Why were you excited about this?

INTERPRETER: Okay, yeah, nice topic. Milkweed is a native plant here in Nova Scotia called Swamp Milkweed, and it's native to the plant and it's great for monarch butterflies. It encourages the population to increase here in our area, and the butterflies are an amazing creature, they migrate from Mexico and they migrate all the way to Canada, but they need food to do this, and caterpillars need food, as we know, and they prefer milkweed. And currently when we see milkweed we see it as a weed, that would be our general, you know, opinion of this plant, we would just pull it out of our gardens and so forth. However, you know, we're taking that food from the monarchs.

RICHARD ZURAWSKI: Where can I get milk- ... Can I plant milkweed in my garden?

INTERPRETER: Oh, yes, absolutely. I would recommend Swamp Milkweed, the native species, not the Common Milkweed, and the reason for that is, I think that the Common Milkweed is actually not available to buy, but Swamp Milkweed is native and you can buy it. And the Mersey Tobeatic Research Institute would have those available.

RICHARD ZURAWSKI: Oh, terrific.

INTERPRETER: And they have a butterfly club. And I would recommend them. They have a wonderful program and service, they've done their research and so forth.

RICHARD ZURAWSKI: I'm going to do that.

INTERPRETER: Yeah, and they have a website, you can just Google them.

RICHARD ZURAWSKI: Terrific. Terrific. Because I already have lots of plants and I've got bumblebees and ...

INTERPRETER: And I'll just add to that too, they're actually selling them at the Farmer's Market right now, and they close at 1. So if you want to get there, I suggest getting there soon.

RICHARD ZURAWSKI: Farmer's Market down at the waterfront?

INTERPRETER: Actually, there's one here just around the corner, over on Windsor Street there.

RICHARD ZURAWSKI: Ah, terrific. So I'm going to, on my way home, I'm going to pick up some milkweed.

INTERPRETER: Ten dollars for two, good deal.

RICHARD ZURAWSKI: Yeah, great. Great. I saw a hand go up and there's a guy in the corner here who wants to talk.

DR. ROB THACKER: (Inaudible) something. I've got to ask my wife if I'm gardening this afternoon.

INTERPRETER: Tomorrow morning, yes. I'll help you dig.

DR. ROB THACKER: Okay.

RICHARD ZURAWSKI: You're listening to **The Science Files**. I'm Richard Zurawski in studio. Of course, we have Dr. Rob and we have Dr. Linda. If you have a question you can call in, it's 405-6000, or if you're calling long distance, it's 1-877-801-8255. And **The Science Files** is sponsored by Saint Mary's University. And we're talking about the science of toxicity, not toxic scientists, that's a distinctive difference here.

So let's continue on with the toxicity of mercury. So if you ... you're done ... if you're ... And I have a mercury-vapour florescent tube downstairs that is ...

DR. ROB THACKER: Don't sniff it.

RICHARD ZURAWSKI: ... has broken. What should I do with it? How do I dispose of it properly? Where ... And what process is there in Nova Scotia to dispose of our mercury-vapour bulbs?

INTERPRETER: First of all, don't use a vacuum. If you use a vacuum it actually disperses the mercury through the air. What you do is if you have a bulb, put it in a plastic bag and find the right place to dispose of it. Please don't put it in the garbage. And you're making more work for me, absolutely. And I don't mind, you know, keeping my job, but it's not a good idea to just throw it in the garbage. So if you've broken the bulb, if you have a damp cloth with some gloves to protect your hands you'd cover over the broken

glass, you need to be very careful with that, and sweep it using that damp cloth to gather up them broken materials and put them in a bag. And if it's more severe, unfortunately right now we just don't have the resources but you can purchase a mercury sponge and you can actually use that ...

RICHARD ZURAWSKI: Um hmm.

INTERPRETER: ... to help absorb the mercury.

RICHARD ZURAWSKI: Oh, yeah. So what is it specifically that you do in your lab, like, on a daily basis?

INTERPRETER: Yeah, really, it's very repetitive. The students are so excited on the first day, they come into the lab, and then after about four months, you know, they're more happy to get out. But it is very interesting, many interesting processes.

DR. ROB THACKER: Lab work is hard work.

INTERPRETER: Well, yes, you have to think all the time, you have to be, yeah, careful, you have to have a plan that you follow, and you have to make sure that the processes don't cross-contaminate each other. We have many projects happening simultaneously. We work with very contaminated samples from gold mines, for example, all the way to very lowly trace level uncontaminants, so in human hair, for example. And we're doing ... you know, analyzing them at the same time so we work together as a team to communicate to make sure we keep those projects separate.

DR. ROB THACKER: So you have to divide up the lab to

account for the different levels of mercury and different parts of it.

INTERPRETER: Um hmm. Yeah, absolutely. Yeah, the lab is divided in a quadrant. There's four parts. When you come in, you would have the one area ... And so we see a ... Do I see a call coming in?

RICHARD ZURAWSKI: Yeah, we've got a caller in on the phone so we will ... Hello, Rob?

CALLER: Hey. Ron. How are you doing?

RICHARD ZURAWSKI: Ron, how are you. I ...

CALLER: Good, guys.

RICHARD ZURAWSKI: ... got the ... it's not showing up on my board here again, so it looks ...

CALLER: No problem.

RICHARD ZURAWSKI: ... like I'm not connected.

CALLER: No problem.

RICHARD ZURAWSKI: Anyway, you have a question or you have a comment?

CALLER: Well, I just had an interesting story because the topic is on mercury today, and when I was in junior high school in the 80's we had ... our science teacher actually had a mayonnaise jar with mercury in it and it was about half full and he used to get us to put our hand into the mercury to see what it felt like.

RICHARD ZURAWSKI: I can see Linda is cringing.

DR. ROB THACKER: She's grimacing.

RICHARD ZURAWSKI: So are you okay?

CALLER: Yeah, well, I think so. No real adverse effects but I mean, you know, but like I said, it was in the '80s and, I mean, at one point in the same junior high school they were blasting for asbestos because the walls were built, you know, obviously with asbestos. They never closed the school they just taped off rooms, right? So, I mean ...

RICHARD ZURAWSKI: Yeah.

CALLER: ... back in the '80s, you know, I think the knowledge wasn't there, but I just ... I thought it was really interesting after finding out the effects of mercury that our science teacher actually had us doing that.

RICHARD ZURAWSKI: How's your science teacher?

CALLER: I have no idea.

RICHARD ZURAWSKI: Okay. Well, thank you for calling that in. I appreciate that.

There are lots of stories like this, Linda.

INTERPRETER: And thank you for my first call, that was exciting. Yes, and this is a common story though. And the mercury ... the liquid mercury that you would be playing with, you would want to worry about exposure over a long period of time, so more chronic exposure. So if you put your hand in, that's a very short-term exposure. I don't recommend it, however, it's a very short-term exposure. So you wouldn't see many adverse or negative effects from that type of exposure.

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RICHARD ZURAWSKI: You're listening to **The Science Files**. Our special guest is Dr. Linda Campbell, and of course, Dr. Rob is in the studio and behind the glass we have Andrew Pinsent handling the production of the calls, that kind of stuff. We have to take a quick break and then we're going to wrap up **The Science Files** with the last few minutes. Thanks a lot.

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RICHARD ZURAWSKI: Oh, a little Hollywood jumping in here. Thanks, Andrew. He's making his mark.

I'm Richard Zurawski, and, yes, Dr. Rob is in the studio and Dr. Linda, his wife is in studio as well. And in the break we were talking ... Well, before the show began, one of the issues that we wanted to talk about was the Olympics and the green pool, and I just totally forgot all about that, I got sidetracked with mercury and all sorts of other things like that. And I want to ask you, Linda, what is your take on the green pool in Rio?

INTERPRETER: There's many theories out there. One of the theories that's not true, let's take it off the table, well, the people are peeing in the pool. That is not ...

RICHARD ZURAWSKI: They're not peeing in the pool?

INTERPRETER: ... the cause of the green water. Take that off the table.

And another theory is an algae bloom, but the water is actually too clear. And the third would be the water chemistry and the change in the pH, and with the warm sun and the pH change and the effect of the people there, and then there's also the chemistry of the copper that would add to the water to reduce the bacteria. The copper actually becomes that greenish colour. I'm sure you've seen old pennies with that colour change.

RICHARD ZURAWSKI: Yeah. Yeah.

INTERPRETER: The old pennies ...

RICHARD ZURAWSKI: Yeah.

INTERPRETER: ... they become that blue-green. Same idea as oxidation. So there was a joke around it saying, Oh, you know, there's got to be a water biologist around Rio somewhere with a Secchi disk, it's an instrument called a Secchi disk so ...

DR. ROB THACKER: Okay, okay ...

RICHARD ZURAWSKI: A sucky disk, whoa.

DR. ROB THACKER: A Secchi disk. I've got to jump in. I've got to jump in. These are really, really great. They're a round disk with black and white quarters on them and I've worked with Linda in the field with these and you drop them down and you see how far down you can actually see the disk and that tells you ... It's a measure of, basically, how clear the water is.

RICHARD ZURAWSKI: Um hmm.

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DR. ROB THACKER: So the best conference gift I have ever seen was a coffee cup with a Secchi disk in the bottom. All of the scientists ... the environmental scientists were, sort of, like, swilling it around and seeing whether they can see the disk, how much coffee they need to be able to see it or not. It was really awesome.

RICHARD ZURAWSKI: You can take the coffee out of the scientists but you can't take the scientists out of the coffee.

DR. ROB THACKER: It's so ... It was just the best conference gift I have ever seen.

INTERPRETER: Yeah, the Secchi disk, as you know, is down in the ... it's in the bottom of the cup so ... And the Secchi disk for the coffee is not as good as green tea. You know, green tea is very ...

DR. ROB THACKER: Oh, yes.

INTERPRETER: Green tea very transparent and clear so ...

RICHARD ZURAWSKI: Yeah.

INTERPRETER: ... compared to what drink you have ...

RICHARD ZURAWSKI: So could ... Could the ... the pool colour be the green tea that's in the ... in Rio?

DR. ROB THACKER: In their pee. No.

RICHARD ZURAWSKI: Oh. No, then it would be yellow, wouldn't it?

INTERPRETER: I think it's water chemistry itself.

DR. ROB THACKER: Yeah.

RICHARD ZURAWSKI: Okay. So we're finished with the ...

DR. ROB THACKER: Bathroom jokes.

RICHARD ZURAWSKI: ... with the bathroom ... Yeah, you know, one flush away from another pun by Dr. Rob. Okay.

Linda, is there anything you wanted to add about the types of studies that we do in toxicity, the burning of coal, for instance, we continue to mine this stuff. Coal has a substantial amount of mercury in it, does it not?

INTERPRETER: It depends where the coal is mined from and what the region is like. You have to remember that with coal it's really a plant material. So all plants take up material from the soil where they grow, and the coal, you know, is residing there for millions of years and as, you know, breaks down to become more concentrated. So when you're burning coal, what was ever ... whatever you're in ... is in that coal is being burnt and released into the atmosphere.

RICHARD ZURAWSKI: Ah, I see.

INTERPRETER: The coal is from an area where there be more mercury occurring than, indeed, there would be more mercury released. And it ... depending on ...

DR. ROB THACKER: So how far can it go in the air, like, could you be hundreds of miles away facing problems?

INTERPRETER: It depends on the system. If there's no

filters or anything on the smoke stack then it could travel quite a distance, and the lifetime of coal in the atmosphere is about one year half-life that the mercury would reside in the atmosphere. So then, you know, it would stay in the atmosphere travelling around about three or four years, so if you're burning coal in one location, you know, it could travel over to a different country, absolutely.

DR. ROB THACKER: So if ...

INTERPRETER: If your atmosphere ...

DR. ROB THACKER: ... they were burning coal in New York State and so on, could we have a problem with it blowing over us?

INTERPRETER: Oh, yeah. Yeah, in theory. It depends on the weather and the patterns of air.

RICHARD ZURAWSKI: Interesting. In Nova Scotia, where are the hotspots for mercury?

INTERPRETER: Yeah, that's a challenging question. It depends what type of mercury we're discussing. We have several.

RICHARD ZURAWSKI: Yeah, that ... Yeah, I'm interested in the ... sorry to interrupt ... the types of mercury it's not just mercury specifically but how mercury bonds with other things.

INTERPRETER: Correct. Yeah, so if you're looking at the sources of mercury then coal mining, you know, from the 1800s, historical mining here in the province, and then

plants ... power plants from before the filters were set up, those two would be the hotspots for sources of mercury to our province, and then that we'd have accumulation of mercury. And the hotspots for accumulated mercury would be in freshwater lakes here in our province, lakes that are more acidic that have brown water.

DR. ROB THACKER: So with the gold mining we are literally talking about tons of mercury, aren't we?

INTERPRETER: Yeah. Yeah. A while ago we went to a museum and we saw a newspaper ad and we actually saw an advertisement selling, I think it was, 800 pounds of mercury for one mine. And you have to remember there's over 360 mines in the province so ...

DR. ROB THACKER: And there was no disposing thought about ... They just got rid of it, went and dumped it somewhere.

INTERPRETER: Well, at that time there was no environmental legislation.

DR. ROB THACKER: Yeah, okay.

RICHARD ZURAWSKI: Linda, thank you very much for being in the studio. I have to say, when I think about toxicities and pollution I am so glad that you're doing the research that you're doing, that you have your lab here in ... at Saint Mary's University. I'd like to thank you for making time to come in. I would like to thank Susan Cargill for doing such a wonderful job interpreting, and I'd like to

thank Dr. Rob for sitting in as the co-pilot.

DR. ROB THACKER: And I'd like to thank you for hosting all of these shows and we will miss you over the next few weeks.

RICHARD ZURAWSKI: Oh, my goodness. Tears. Tears are coming down my cheeks right now.

DR. ROB THACKER: No tears. No, no, no. Yes, we really will. It's going to be different not to have you around, sir.

RICHARD ZURAWSKI: Well, you know, we've got a number of shows coming up. It's only eight weeks. I'd like to welcome everybody back in again an I'd like to thank our man behind the glass.

DR. ROB THACKER: You think you're getting the chair back?

RICHARD ZURAWSKI: Oh, Andrew Pinsent, will I get the ... Who's my producer just stepping in, I hope I get the chair back, at least it'll be warm. I'd like to thank you all for listening, you've been listening to **The Science Files.** We've had great fun and welcome back next week, because Dr. Rob is in the main chair.

RECORDING ENDS