

Radiation - Friend or Foe?

November 18, 2003

Operator: Good afternoon ladies and gentlemen. Welcome to the Health Care Health and Safety Association radiation safety conference call. I would now like to turn the meeting over to Ms. Fiona Macpate. Please go ahead Ms. Macpate.

Fiona Macpate, Consultant, Halton and Peel Region: Good afternoon. My name is Fiona Macpate and I'm a consultant with the Health Care Health and Safety Association in the region of Peel and Halton. On behalf of the Health Care Health and Safety Association I would like to welcome all participants.

Today our presentation is *Radiation - Friend or Foe?* Following the presentation we invite you stay on the line for a question and answer period. Please note the question and answer period is a finite time so if time runs out and your question is not addressed please stay on the line and the operator will take your contact information. I will get back to you with the speakers e-mail address.

Before introducing our speakers I have a few reminders for the audience. Please eliminate all background noise or discussion during your call since this will affect the audio quality. Come to the microphone if you're conferencing in a large room, turn off all pagers and cell phones. And finally if your building has a PA system turn it down or off if possible.

We are fortunate to have with us today two experts in the field of radiation, Dr. Jerry Cuttler and Mr. Ray Ilson. Each of the presenters will speak for 20 minutes and following this there will be a 10 minute question and answer period.

Our first speaker Mr. Ray Ilson is currently the manager for radiation protection services in the office of Environmental Health and Safety at the University of Toronto. His office is responsible for over 600 laboratories and approximately 800 academic and laboratory staff as well as numerous supervisory and service staff.

For the past several years Mr. Ilson has participated in the commissioning, inspection, audits and decommissioning of hundreds of laboratories. During 2001 he was responsible to the University of Toronto for the safe and successful decommissioning of the slow poke research reactor and the very successful radiation program evaluation conducted by the Canadian Nuclear Safety Commission. He has presented numerous papers to the Canadian Radiation Protection Association.

For several years he participated in the graduate program in occupational health and safety at the University of Toronto and has recently been appointed to the faculty of Ryerson University. We are very pleased that he can be with us today. Welcome Mr. Ray Ilson.

Ray Ilson: Thank you Fiona. And welcome to the healthcare members. I'm going to give an overview of what I believe constitutes a good radiation protection program and hospitals and universities. It's a model which is widely used in institutions with which I'm familiar. Radiation protection management requires precaution of the workers, the staff, the students, the equipment and the environment. We have to consider precautions with the dose of radiation received by the workers and the public and damage to the environment and the possible contamination of workers, public equipment and environment.

Precautions to be considered with dose would include direct radiation from sources, radioactive sources indirect radiation due to patients and including patients and laboratory waste. And the possible contamination of personnel, members of the public, therapy and research equipment, the possibility of radioactive releases including patient [inaudible] into the sewers and the air handling system, landfills, etc.

The question is what is a safe dose of radiation and when I say this I mean non-therapeutic of course. What is, is there a dose below which there will be no harm for example. Is there a dose to which most people can be exposed without significant harm analogous to threshold limit values basically.

How do we know that these doses are safe? Is a safe dose reviewed regularly and assessed by knowledgeable bodies? And what is the minimum dose which can be reasonably achieved?

The International Committee for Radiation Protection offers basic recommendations for radiation protection management. These include justification, optimization and ALARA. Justification we consider that no practice shall be adopted unless its introduction produces a positive net benefit. So therapeutic care for instance includes a net positive benefit for the patient.

The dose equivalent to individuals shall not exceed recommended limits. And there are defined limits for nuclear energy workers and members of the general public. Even given that, that we're going to use radioactive materials for a positive benefit and we're going to put controls on the exposure limits in addition to that all exposures must be kept ALARA, that is *as low as reasonably achievable*, economic and social factors taken into account.

Now I'm going to consider some regulatory information. The government agencies involved, these refer to the Canadian Nuclear Safety Commission and others who are involved in the control of radioactive materials. And then I'll go on to the administration of a radiation safety program, what constitutes a good program, a radiation safety committee for example, authorized radiation safety officers and services.

For most institutions this involves a consolidated license provided by the Canadian Nuclear Safety Commission. And there may be specific licenses for therapy units and other uses.

In addition to this we issue internal permits to individual researchers and supervisors of their locations. This requires an application process, the consideration of qualifications and review and approval by the appropriate authorities.

The internal permit may be authorized for research, education, it will depend upon the past members experience. It controls the types of isotopes and the quantities that they can use and this must all be approved by the central radiation safety committee and authority.

The permit assigns responsibilities onto the permit holder and their staff who are the active users of radiation. This is analogous to the Ministry of Labour industrial regulations and the health and safety act. It was implemented many years prior however.

Consider regulations and safe work practices, policies and procedures. It will be necessary to establish these practices, policies, and procedures within the institution. This will be delivered in a radiation safety manual and policy manuals. There will be controls for procurement of all

radioactive materials. And this includes purchases but also transfers. We often share radioactive equipment with the teaching hospitals and the university. Gifts from companies, replacement samples, experimental radioactive materials for trial runs and experiments. It's the law that we keep an inventory of all of our radioactive materials and basically sign off on its usage, on the declining balance inventory method.

Personnel monitoring is accomplished by dosimetry with thermal luminescent detectors, most often. There are whole body badges which measure the dose to the whole body including the trunk and the reproductive organs. And there are extremity dosimetry including rings and wrist badges which measure dose to the hands.

Health Canada records these exposure results and stores them in a central inventory.

There are also bioassays particularly for the use of radio iodine. And long lived beta emitters including tritium and carbon 14. Health Canada also has established a quality assurance program for bio acids whereby they, and I'm sure most of the hospitals participate in this, whereby they provide unknown samples of radioiodines, iodine 125 and iodine 131. And the institution must do a test and provide the data to Health Canada explaining what the isotope is and what the quantity is. This is a third party audit of the testing procedure.

In addition Health Canada provides urine samples which include long lived beta particles, for instance tritium and carbon 14 and the institution must tell Health Canada what the isotope is and what their quantity is. Health Canada then provides feedback on the numbers and tells you if your system is adequate.

You also have to consider the disposal of radioactive materials by waste types and the procedures for safely doing so. At the University of Toronto we decay our radioactive materials by half life so that we can reduce the cost of waste. If the material is decayed sufficiently and we audit this program very carefully there will be no releases of radioactive material to the environment.

Any safety program should be followed up with inspections and audits to determine its success including the training and the practices in the laboratories and the health unit. You would want to establish compliance, we know there is a check list to determine the requirements and the success of the program to document the inspections and analyze trends and if necessary provide disciplinary policies.

The federal regulator, the Canadian Nuclear Safety Commission provides for audits of healthcare institutions and universities as well as nuclear power generating stations on a regular basis. For the universities and hospitals this is approximately every five years. But the new practice apparently is to do mini audits annually rather than the laboratory inspection. That is Canadian Nuclear Safety Commission will simply look at your programs and audit it and you will be expected to show them your trend and analysis and inspections.

The federal regulator, the Canadian Nuclear Safety Commission functions by issuing licenses which govern the receipt, possession, use and disposal of open and sealed sources of radioactive material. It includes all locations owned and controlled by the licensee. Wherever the licensee has control and authority that is. It defines reporting requirements, it sets regulatory standards and establishes the need to perform inspections and audits and this is done by the federal agency as well on a regular basis. And they provide enforcement and penalties including jail terms and fines.

So the Canadian Nuclear Safety Commission administers and enforces the general nuclear safety and control regulations, nuclear facilities and described equipment regulation etc [inaudible] you have the handout.

For healthcare this would include the general nuclear safety rights, the nuclear substances and radiation devices regs, nuclear security regulations will be included, in particular these days after 9/11.

Other federal agencies include Transport Canada which is responsible for control of shipping and signage of radioactive materials. Health Canada I mentioned the dot symmetry program, there is a registry for exposure results for all Canadians. And the [inaudible] quality assurance program with the radioiodines and the urine samples.

Environment Canada is responsible for environmental impacts, particularly waste management. Provincial agencies come into play include the Ministry of Health for our medical x-ray safety and the Ontario Ministry of Labour for non medical x-rays and general laboratory safety. And as well the Ontario Ministry of the Environment for waste management. There are also local agencies such as the city of Toronto which will look at releases into the environment in particular.

Within the institution there will be, there must be a radiation safety committee or central authority. This should be represented by users and effected staff with management reps, representatives. They're responsible for all aspects of radiation safety including permits, facility commissionings and decommissionings and for providing training. They set standards internal to the institution based on the federal license. They establish polices and procedures which must meet or exceed the regulatory requirements. They must ensure compliance, do inspections and provide disciplinary actions if required and this committee will report to senior management and to the regulatory authorities. At the University of Toronto the radiation protection authority meets three to four times annually. But there are numerous business meetings for signature of revised permits, issuing of new permits, disciplinary policies, etc.

The licensing procedure describes the requirements for training, leak testing of sealed sources, facility approvals, record keeping, exposure and monitoring and reporting, action levels for contamination criteria for example. The supervisor assumes the duties of a supervisor under the Canadian Nuclear Safety Act which is very similar to the industrial regulations. In other words they're responsible for their staff, for the safe use, handling, storage and disposal of materials. They must comply with the federal and the institutional policies and procedures, in other words obey the law. They must ensure competent supervision of radioactive work. So they must be competent supervisor. They must be available to supervise the daily operations. They must provide the workplace with personal protective equipment, dosimetry equipment and shielding for example. In other words provide the protective equipment, analogous to the Ministry of Labour requirement. In our case they must retain the required records for three years and they must report incidents.

Radioisotope users assume the duties of workers. They must comply with the regulations, use the personal protective equipment provided and the dosimetry, register in the bioassays program if required. Perform contamination checks as required and this is by law every seven, within seven days of using the radioactive material. They must maintain the inventory so that they know what amounts of radioactive material they have on hand at any given time. Follow the correct waste disposal procedures. Again analogous to the industrial regs report any defective

equipment or situation that may endanger others and reduce the hazard. And as well do not create a hazard to themselves or others.

The radiation safety officers role is to execute the mandate of the radiation authority. They usually provide a liaison between the regulator and the institution and the users. They classify users and locations per risk. They control the procurement, transfers, inventory of radioactive materials and disposal procedures. They provide the training for safe use of radioactive materials. They administer and review the exposure control programs and bioassays and they conduct compliance inspections in for instance, for example radiology, nuclear medicine and research laboratories. And their role may be expanded beyond ionizing radiation to include lasers and other non ionizing radiation, for example electromagnetic fields.

Radiation safety program will provide engineering controls, administer the controls and personal protection, engineering controls for example would be ventilation, exhaust from the rooms, fume hoods. They must provide access controls particularly for security and traffic patterns. By that I mean pedestrian traffic patterns so that exposures are minimized. Provide containment of the radioactive materials through the isolation of work areas and equipment and the containment of radioactive sources and radioactive waste. Providing monitoring instrumentation for dose rates and contamination control, good communications, appropriate shielding and contamination and discharge controls.

Administered controls would include qualification of the staff and the workers and training. That includes initial training, follow up training and refreshers. Management oversight program. We always try to place the responsibility at the highest level of the institutional authority. The radiation safety committee of course will oversee this. Establish policies and procedures, establish dose assessment and contamination control procedures. And again follow up on inspections, audit and disciplinary policies if required.

In the event of loss of control of the program there must be an emergency response system for assessing radiation fields, contamination controls and for controlling releases into the environment.

In terms of basic personal protection radiation is an insidious hazard, that is you cannot see it or smell it or hear it. There is very little warning signs. So in general we want to use universal precautions, lab coats, gowns, ventilation systems, gloves, boot covers, hair covers, masks, etc. Hand protection, syringe shields, protective creams for the skin, face and eye protection and in general the separation of clean facilities for eating and rest areas from the areas of radioactive use.

You want to keep this material out of you. This can be assured by general and local exhaust ventilation to prevent inhalation, general sharp safety policy to prevent injection and stabs. And the prohibition of food and drink in areas of radioactive use to prevent accidental ingestion.

Any program must be followed up with some method of assessing the adequacy of the controls. This is done in radiation through dosimetry as I mentioned. The radiation badges, both whole body and extremity rings to measure dose and so you can follow up on any potential, any possible exposure. To the bioassay program which assessed thyroid contamination or whole body uptake. Contamination control programs and again compliance audit internally within the institution by the radiation safety authority and externally by the federal regulator. Thank you very much.

Fiona Macpate: Thank you Mr. Ilson for sharing your area of expertise with us. And I think we probably also found it very helpful that you showed the analogies with other health and safety legislation and programs.

At this time I'm pleased to introduce you to our next speaker, Dr. Jerry Cuttler. Dr. Jerry Cuttler is the president of Cuttler and Associates Incorporated providing consulting services to Ontario Power Generation to help bring the Pickering A generation station back to service.

Dr. Jerry Cuttler graduated from engineering physics at the University of Toronto. Following 10 years of nuclear engineering and research and development in Israel he joined Atomic Energy of Canada Limited and headed the branch which designed the reactor control safety system and radiation instrumentation for the Candu 6 Pickering B and Bruce B electricity generating station.

Dr. Jerry Cuttler brings many years of working experience with him including project engineer, engineering manager for Bruce B Nuclear Generating Station, resident engineering manager in Romania and engineering manager for the slow poke heating reactor.

Dr. Cuttler served on the council of the Canadian Nuclear Society for 10 years and was president in 1995 to 1996. He was pointed fellow of the Canadian Nuclear Society in June of 2000. After 26 years of service with Atomic Energy of Canada Limited he left to pursue his interest in therapeutic applications of low doses of radiation.

During the past eight years he has been assessing the effects of ionizing radiation on health. We welcome Dr. Jerry Cuttler at this time to share his area of expertise with us. Welcome Dr. Cuttler.

Dr. Jerry Cuttler: Thank you Fiona. Thanks for inviting me to speak with the healthcare workers of Ontario. I'm not going to speak for a full 20 minutes because I want to allow the listeners a lot of time to ask questions. That was the main purpose I think of this teleconference. We did send out some material, overhead slides, I think there was approximately 50 of them and there were a number of papers. So I hope people have looked at them and formulated some ideas and questions. And so I look forward to listening to those and trying to answer them.

My feeling is and everyone I worked with in the area of science is that we live in a radioactive world. Many scientists believe the universe was created 14 billion years ago. And the planet earth was formed four and a half billion years ago from the debris of the sun. Pieces of radioactivity that was released, matter that formed into a ball and later became the earth.

And living organisms started to appear in a sea of radioactivity. And primitive humans evolved from this and I think they found evidence back to 2 million years ago. The earliest evidence of humans. So our genes have been exposed to radiation long, long, long before x-rays were discovered in 1895 by Roentgen and before radioactivity was discovered in 1896 by Becquerel. It's over 100 years ago we've known about it.

Now all living organisms have defence mechanisms against many hazards of life including radiation. Otherwise they would not have survived long enough to have offspring to start the next generation. There's another important characteristic of biological organisms and that is they adapt to changes in their environment. And that includes changes in the intensity of ionization that they receive.

The average person in an average background receives 15,000 hits of ionizing radiation on their body every second just from natural background. And there are areas where this is 100 times higher. And we are accustomed to this natural exposure, this continual stress on our body. Our defenses repair and replace almost all of the cells that are damaged by this natural radiation.

In the scientific material that I gave you earlier I identified the natural phenomenon of radiation hormesis. This is an adaptive response of all living organisms to low doses of radiation stress or damage. Leading to a modest overcompensation to this disruption and resulting in improved fitness.

What does this mean, improved fitness? Well it's like the exercise we do or should do every day that makes us stronger and healthier than we would be if we did not exercise, if we did not stress our bodies. The cells in our bodies are continually subjected to a high rate of damage also and mainly by reactive oxygen species. This comes about from the oxygen that we breathe and use in our bodies to generate energy from the food.

Our defense mechanisms produce anti-oxidants to prevent most of the cell damage that would otherwise occur from these reactive oxygen species. And our defense, our defenses repair the damaged cells to eliminate most of the DNA ulcerations that were caused by these reactive oxygen species. And we have defenses that destroy most of the altered cells that our defenses could not repair. The mutated cells, most of them are destroyed.

It's the buildup of mutations over 10's of years that causes cells to become cancerous or cause a congenital malformation. And we have very capable immune systems that destroys most of the cells that start to form cancer.

We know from a century of research and observation that small doses of radiation stimulate these defenses to work harder and more efficiently, reducing the incidents of cancer and other diseases. And we know that large doses of radiation slow down the activity of these defenses allowing more cancers and more disease to occur. So low doses are beneficial, high doses are harmful. It's a biphasic response of our, of living organisms.

So we now have the biological model that can tell us how much the effect is. It can actually be calculated. The damage caused by low doses of radiation to our cells directly is negligible compared with the damage caused by reactive oxygen species. It's the effect of the radiation on our natural defenses that's the most important consideration. The stimulation reduces the damage of the reactive oxygen species. And that's an important biological phenomenon that we can take advantage of.

We could use low doses of whole body radiation in medicine to cure cancer and prevent metastases by stimulating our defenses with no symptomatic side effects. We could use low doses of radiation to cure infection such as gas gangrene and avoid amputations and death.

Our defenses play the major role in the cure of all diseases so we ought to explore where and how low doses of radiation can be employed as part of a treatment of these diseases.

Now there was a political problem in the 1950's and 60's, scientists created a scare about low doses of radiation to stop atom bomb testing. This scare was about more cancers and more genetic defects due to small doses from radioactive fallout. The truth is the complete opposite. We should not be afraid of low doses of radiation.

Now I can read a letter which is an example of what went on in that time. I have a letter that was written by Professor Linus Pauling, received the Nobel Prize in chemistry in 1953. And he writes to President Kennedy in the White House in March the 1st, 1962. "Are you going to give an order that will cause you to go down in history as one of the most immoral man of all time and one of the greatest enemies of the human race? In a letter to the New York Times I state that nuclear tests duplicating the Soviet 1961 test would seriously damage over 20 million unborn children including those caused to have gross physical and mental defect. And also stillbirths and embryonic neonatal and childhood deaths from the radioactive fission products and carbon 14. Are you going to be guilty of this monstrous immorality matching that of the Soviet leaders for political purpose of increasing the still imposing lead of the United States over the Soviet Union in nuclear weapons technology?" Signed, Linus Pauling.

Well this is the sort of scare that was used in those days to stop atmospheric atom bomb testing. And it certainly scared a lot of people and they did stop testing. And he got a Nobel Prize. The Peace Prize. So that man got two Nobel Prizes.

So this information that he sent and that Telexed to the President was incorrect, it's not true. But he used it, he created a scare for political purpose. So this is the background that we have and this is the fear that's out there and people are terrified and we've created a lot of regulations as a result of those scares to protect people from small doses of radiation that are even smaller than what people receive from background radiation and nature, that our bodies are easily capable of coping with.

And we even have evidence that it's beneficial, these low doses. There's no question that high doses are harmful. We're talking about low doses.

Now I must inform you and as Ray has very carefully spelled out here that we have regulators in Canada and in every country that enforce strict regulations to keep radiation exposures as low as reasonably achievable. Until these regulations are changed healthcare workers must comply with these regulations or the regulators will shut down your hospital and your clinic. So by all means you must follow the regulations even if you have information to the contrary that low doses are beneficial. Because the regulators will not pay attention to that. They will follow the laws and regulations we have in place.

The thing I'd like you to know is that there is no basis for fear. We have to follow these regulations. We have them and we're stuck with them and this whole issue is a medical issue. And it's up to physicians and medical scientists to take the lead, to change what is to what should be. It's going to be very difficult to turn around the perceptions that have been created for the past 50 years to give us the best medicine. So that's all I have to say. I'll, perhaps we can take questions.

Fiona Macpate: Thank you Dr. Jerry Cuttler. I think that Dr. Cuttler has opened up this area of radiation for some very interesting discussion. And I'd like to welcome the audience to either enter into a discussion with either of our speakers or if you have any questions please address those to the speakers at this time.

Operator: Thank you Ms. Macpate. Thank you gentlemen. We will now take questions from the telephone line. If you have any question please press star one on your telephone keypad. If you're using a speakerphone please lift the handset then press star one. If at any time you would like to cancel your question please press the pound key. So please press star one at this time if you have a question. There will be a brief pause while the participants register and we thank you

for your patience. Once again please do not hesitate to press star one if you have a question or comment. Ms. Macpate at this time there are no questions registered. I'd like to turn the meeting back over to you.

Fiona Macpate: Okay thank you. Ray would you like to potentially comment on...

Ray Ison: Oh I appreciate Jerry's view. And tend to agree. I wonder if Jerry we know there's considerable support for radiation hormesis. I wonder if you could give us some examples of models and the analogy to vaccination, that is to support the pieces that small doses are actually beneficial?

Dr. Jerry Cuttler: Well there are scientific papers I have here. This one by Myron Pollycove and Ludwig Feinendegen it was published just this year in fact in Human and Experimental Toxicology and I'll give you a copy of this so you don't have to go search for it.

And the title of the paper is "Radiation-Induced Versus Endogenous DNA Damage." Endogenous is what [we call] stuff produced by our own bodies. And here he explains in very careful detail this model, the tremendous damage that's done by our own metabolism in a process of producing energy that powers our cells, our muscles, our organisms that a lot of reactive oxygen species created. And our bodies produce antioxidants.

But still even though the reduction that's produced by our bodies there's still a tremendous amount of ulcerations that are produced in our bodies. And we have repair systems that bring it down by a factor of 10 to the 4th, that's 10,000. And there's calculation and tables here of how all these numbers are calculated.

For example we have 10 to the 6th, that's a million DNA alterations per cell per day, in our bodies from the reactive oxygen species. And the repair systems bring it down to 100 persistent DNA alternations per cell per day.

And then we have removal systems that bring it down by a factor of 100 to one mutation per cell per day. Now you say, "My God, one mutation per cell, we're going to be falling apart!" But it's not really the case. You need thousands of mutations before cells become cancerous. And even when they do become cancerous we have our immune system which hunts down these cells and attacks them and destroys them.

Now the radiation effect is remarkable. It stimulates the antioxidants 10 times background. That's one milliGray, one ... sorry, background is one milliGray per year, 10 times that is 10 milliGray per year. It's one rad per year. That will stimulate the reactive, the antioxidant production. It will stimulate the repair, it will stimulate the removal. And you can get easily a 20 percent reduction just from a dose of one rad per year, in the number of persistent mutations.

And we've done, scientists have done, medical scientists have done experiments, tests on patients where they've given them whole dose radiation treatments with 10 rad several times a week, 20 or well 30 rad a week for five weeks, a total of 150 rad which is quite a large dose considering what sort of things we're trying to protect people against.

This is still a very small fraction of what radiation is given to cancer patients locally. They give fractionated doses adding up to 4,000 or to 5,000 rad. And here we're talking 150 rad over a period of five weeks, fractionated. And this is given to the entire body. And this results in cancers being stopped, non Hodgkin's Lymphoma and other cancers. It also stops metastases

from forming. If the cancer already exists and it's starting to create metastases the stimulation on defence mechanisms will stop the metastases. So persons being treated for prostate cancer or breast cancer and they're concerned about metastases low dose radiation will stop those.

And so I've just well there's going to be a paper published in the Journal of American Physicians and Surgeons later this year. That's probably later November or December. The title is *Can Cancer Be Treated With Low Doses Of Radiation*, and its ... I'm an author and my [inaudible] medical doctor is an author and this is gone through peer review, several, three or four reviewers. At least three reviewers have gone through this. And all the comments have been addressed satisfactorily and they are publishing this. So look out for this paper.

I'd like to tell you another interesting incident that happened in Taiwan. It's quite remarkable. They didn't exercise adequate control on cobalt 60 sources that were used in therapeutic treatments. And these machines were scrapped and melted into steel vats, blast furnaces and they formed rebar, reinforcing steel that was used to make apartments, apartment buildings.

They built 180 apartment buildings, 1,700 apartments. And this was populated, people moved in. 10,000 people moved in. Moved in in 1983 and they lived there till well right till up to the present, they're still living there. They didn't know about this. Unknowingly they received very large doses of cobalt 60 gamma radiation.

And so that's 10,000 people for 20 years of exposure: that's – what? - four half lives of cobalt 60. And they were very concerned about what would happen to these people when they started, they discovered this contamination. So they started to look for cancer mortality and they started to look for hereditary defects, congenital malformations.

And where they expected 230 natural cancer deaths from spontaneous cancer and if you were to add on the ICRP model, another 70 from so called radiation induced cancer they would have expected 300 cancer deaths. Assuming same age distribution between the 10,000 living in these apartments and the general population of Taiwan.

Well they observed only seven cancer deaths after 20 years and believe me they looked at all these people because everyone was lining up to get damage compensation. There was only seven deaths and they said well what, how can this be? And they were looking at congenital malformations. They would expect for that population 46 and another 21 using the ICRP model for radiation caused genetic defects. They expected 67. And all they could find was three.

And there's an interesting graph here and this paper was authored by 14 important scientists in Taiwan. Some of them are professors in the United States as well. And I have here a profile of the 14 authors. Now I helped them with the English in their paper but otherwise it's their work. And they've given 29 references.

This paper is also going to appear in the Journal of American Physicians and Surgeons. It's still undergoing review by the editor. It's gone through three reviewers and all the comments have been dispositioned. And I expected this paper to appear in the spring of 2004.

What this is showing is that people are exposed unknowingly for 20 years to fairly high doses of radiation. And the exposures are all calculated here. And we know that they were exposed because we can go to those apartments today and measure the dose, it's still there. Decaying away but it's still there. And they know who the people are and how long they lived there. And

they worked out what the collective dose is and what the individual doses are. And this is totally surprising.

So it brings into question whether we are using the right approach in radiation protection, creating a lot of fear and some of these methods are not conservative. If we were to give people low doses it would be healthier, it would get less cancer. And so in protecting them and preventing them from getting low dose radiation treatments we may be, the result may be that they'll have precancer mortality.

So this is information that people should be aware of. But again you have to be very careful not to go off and relax the, not follow the regulations we have in place because there's a lot of people employed, it's their job. They have to follow the law and if they don't follow the law they get put in prison. And if they catch people who are not following the regulations they'll close down their hospitals and clinics. So that's the problem we have.

Fiona Macpate: Suzanne I'd like to ask if anyone else is on the line from participants to pose a question?

Operator: Absolutely. We do have one question from Lori Gill-Savoie of Gamma Dynacare Lab. Please go ahead.

Lori Gill-Savoie: Hi. Very interesting discussion. My question actually pertains to the regulations specifically. What I don't understand if you could just clarify for me a little bit better is the difference between the TDG regulations and the difference between the packaging and transport of nuclear substance regulations. What would the differences be?

Ray Ilson: The Canadian Nuclear Safety Commission is responsible for the packaging, the transport and packaging end of it. And I forget the exact reg. But then it becomes under the Minister of Transport for the transport of dangerous goods where radioactive materials are class 7. I can get you the exact information if you like. I'll have to leave my contact information with Fiona.

Lori Gills Savoie, Gamma Dynacare Lab: Sure. Because I do understand the TDG side of it but I wondered whether the Canadian Nuclear Safety packaging instructions adhere to the TDG ones. But if you could provide me additional information on that that would be helpful.

Ray Ilson: Fine, yeah.

Lori Gill-Savoie: Thanks.

Operator: Thank you Ms. Savoie. We'd just like to remind the participants to press star one on their telephone keypad if they have a question or comment. Ms. Macpate at this time there are no longer any questions registered. I'd like to turn the meeting back over to you.

Fiona Macpate: Okay, thank you. I'd probably like to pose a question maybe to Ray. In light of the information that Dr. Jerry Cuttler presented and you may want to provide feedback on this or not but there's a suggestion perhaps then that we should be looking at changing the occupational exposure limits or looking at new occupational exposure limits and I'm just wondering what your comment on that might be and if that's what we would be looking towards what might be a reasonable approach to that?

Ray Ilson: Yes. As Jerry has pointed out there is considerable evidence for radiation hormesis, that is beneficial effects at low doses. But there is some controversial evidence. I didn't bring the papers with me, I can get Jerry a copy of it. There was one that I just saw this week that suggested that there was some harm at doses as low as five milliSieverts a year, which is the nuclear energy worker limit.

Dr. Jerry Cuttler: How much is that in [inaudible]?

Ray Ilson: Well 500 times as much. So 5,000 [inaudible] which I think the health physics side of it is looking at as a...

Dr. Jerry Cuttler: I now have a physician paper that there's no evidence of adverse effects below 10 rad or 10 rem. And that's the same position of the Academy of Sciences in France, same position as the American Nuclear Society. And there's also Wing Spread. They had a big conference involving nuclear societies, scientific societies. They came out with the same physician paper that there was no evidence of adverse effects.

They wouldn't say anything about the beneficial effects. But they were, they had a consensus they had no evidence, scientific evidence, statistically valid scientific evidence of any adverse effects below 10 rad or 10 rem. And there will be people publishing a lot of information and this is a controversial subject and people are publishing and you can look at their evidence and try and repeat it. Fortunately people doing research with radiation, with low dose radiation either they measure high dose range and don't look in the low dose range. Or they do look in the low dose range but they don't look for beneficial effects, they only look for adverse effects.

So if you ignore the beneficial effects and look for adverse effects every organism has adverse effects. People get cancer spontaneously and even if you can with low doses reduce it by boosting your immune system and boosting your defenses these defenses are not perfect. People are still going to be ill and still going to die.

And if you look for the negative things you'll find them. If you ignore the positive things or if you design an experiment not to see the positive things then you'll publish a paper saying oh well we saw adverse effects and they won't say anything about the positive effects because they never looked for them.

Ray Ilson: I agree Jerry. And I think we need to always be looking at the exposure limits and what considered safe and what may even be beneficial. You didn't mention it but we know that there are areas on the earth which are much more radioactive than other areas and they have studied the populations there. And have found in fact in many cases healthier populations and would be much healthier populations than would be expected and lower cancer incidents. I wonder if you could mention a few words about this.

Dr. Jerry Cuttler: Well there's a famous place in Ramsar, Iran where they have springs coming out of the ground with fairly high concentrations of radium. And has been happening for well since recorded history. And people have used materials in the grounds to build homes. And they have high levels of radioactivity in their homes. And there are people getting 70 rem or rad of radiation a year. And we're trying to protect people against one millirem. So these people are getting I don't know 100 times what natural background is.

And they're healthy, they've been healthy for many years. And people have been living there. And in fact there's a nice hotel, the Ramsar Hotel in the, you think the landscape would be

devastation desert but it's lush, it's green, people come there for holiday resort. Many of them aren't told about the radioactivity but it's certainly there. And there's beaches in Brazil and in India, monazite sand that's natural radioactivity from thorium, natural thorium. There's three times more thorium in the earth than there is uranium. And there are areas where it's quite high. People live there and there's no evidence of excessive cancers or increased incidents of cancer.

And we have animals living in the Arctic, the elk, the caribou and they live on lichen they dig up under the snow. And that's contaminated with radon daughter products. There's a lot of radon coming out of the ground because uranium and thorium decay and radon gas is released. Radon gives off alpha particles. People feel it's a very strong hazard. These animals eat the lichen, lichen containing the daughter products, the progeny of the radon and they get doses in their body of looking like 100 rad, one Gray a year. And the elk and the caribou have been there for the beginning of, well thousands of years.

Fiona Macpate: Suzanne if you have no other questions from participants?

Operator: At this time there are no other questions.

Fiona Macpate: Okay. Then I'd like to thank both our speakers, Dr. Jerry Cuttler and Mr. Ray Ilson for presenting on their areas of expertise. I think it's really helped for us to gain further information and to be able to make more informed decisions as well as be more informed about how to work with radiation safely in the workplace.

So at this time I'd like to thank Mr. Ray Ilson and Dr. Jerry Cuttler for taking time out of their busy schedule to speak to us today. And I'm sure we'll agree that it was very valuable and current and expert information that we received from these leading professionals in the field.

At this time this concludes our teleconferences for the year for 2003. For more information on our upcoming teleconferences for 2004 please read our Safe Angle newsletter or contact our head office at 416-250-7444. Also if you stay on the line we'll receive your contact information if you have further questions or would like some contacts from our speakers. HCHSA would like to thank you now for joining us and we wish you a safe day. Back to you Suzanne.

Operator: Thank you Ms. Macpate, thank you gentlemen. The conference has now come to an end. Please disconnect your lines at this time. We thank you for your participation and have a great day.