HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament
1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE
No. 1

FRIDAY, FEBRUARY 20, 1953

WEDNESDAY, MARCH 4, 1953

WITNESS:

Dr. C. J. Mackenzie, President, Atomic Energy Control Board and Atomic Energy of Canada Limited.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

72014—1

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Chairman: G. J. McIlraith, Esq.

Messrs.

Bourget	Kirk (*Digby-Yarmouth*)	Pinard
Brooks	Low	Stuart (*Charlotte*)
Coldwell	McCusker	Winkler—14
Gibson	Murphy	
Green	Murray (*Oxford*)	

(Quorum—8)

A. SMALL,
Clerk of the Committee.

ORDER OF REFERENCE

TUESDAY, February 17, 1953.

Resolved,—That a Special Committee be appointed to examine into the operations of the Government in the field of Atomic Energy; that the said Committee be empowered to sit during the sittings of the House and to print such papers and evidence from day to day as may be ordered by the Committee; and to report from time to time; that the said Committee consist of Messrs. Bourget, Brooks, Coldwell, Gibson, Green, Kirk (*Digby-Yarmouth*), Low, McCusker, McIlraith, Murphy, Murray (*Oxford*), Pinard, Stuart (*Charlotte*), Winkler.

Attest.

LÈON J. RAYMOND,
Clerk of the House.

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MINUTES OF PROCEEDINGS

FRIDAY, February 20, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 11.00 a.m. for organization purposes.

Members present: Messrs. Brooks, Green, Kirk (*Digby-Yarmouth*), Low, McIlraith, Murray (*Oxford*), Pinard, and Stuart (*Charlotte*).—(8)

In attendance: C. J. Mackenzie, C.M.G., M.C., D.Sc., F.R.S., President of Atomic Energy Control Board and of Atomic Energy of Canada Limited; G. M. Jarvis, M.B.E., Legal Adviser and Secretary of Atomic Energy Control Board and General Counsel and Secretary of Atomic Energy of Canada Limited; J. L. Gray, B.Sc., M.Sc., General Manager, and T. W. Morison, B.A., Chief of Administration Services, Atomic Energy of Canada Limited.

On motion of Mr. Green, seconded by Mr. Low, Mr. McIlraith was elected Chairman.

Mr. McIlraith took the Chair and thanked the Committee for the honour again conferred on him in being chosen Chairman. After reading the Order of Reference, he submitted, for expression of opinions by members, a proposed outline of future meetings of the Committee.

After discussion on the proposed outline, the Committee agreed:

1. That the next meeting be held at 10.00 a.m., Wednesday, March 4; and, if necessary, again on Monday, March 9. At that time, Dr. Mackenzie would appear before the Committee to review the history and operations in the field of atomic energy since 1949, when he last appeared before a Special Committee on Atomic Energy;

2. That Dr. Mackenzie's evidence be presented in three main parts: (1) General, (2) Isotopes, and (3) Power; the last to be given at Chalk River; and

3. That arrangements be made for an inspection visit to Chalk River, leaving Ottawa early on Friday morning, March 13, and returning from Chalk River Saturday, March 14.

The Chairman brought to the attention of members the broader scope of the Committee's Order of Reference as compared with that of the 1949 Special Committee on Atomic Energy and, in response to their inquiries, submitted:

1. That Mr. W. J. Bennett, President and Managing Director, Eldorado Mining and Refining (1944) Limited, would be available to appear before the Committee possibly on its return from Chalk River;

2. That the National Research Council did not come within the Order of Reference;

3. That, following the practice of the Special Committee on Atomic Energy set up in 1949 (Second Session), papers of interest to the Committee would be brought forward for the information of the members at subsequent meetings; and

4. That the size and nature of this Committee did not appear to warrant a sub-committee on agenda and procedure.

On motion of Mr. Low, seconded by Mr. Pinard,

Ordered,—That, pursuant to its Order of Reference, the Committee print, from day to day, 750 copies in English and 200 copies in French of its Minutes of Proceedings and Evidence.

At 11.35 a.m., on motion of Mr. Low, the Committee adjourned until 10.00 a.m., Wednesday, March 4.

WEDNESDAY, March 4, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 10.00 a.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Bourget, Brooks, Green, Kirk (*Digby-Yarmouth*), Low, McCusker, McIlraith, Murphy, Murray (*Oxford*), Pinard, and Winkler.—(11)

In attendance: Dr. C. J. Mackenzie, President, and Mr. G. M. Jarvis, Legal Adviser and Secretary, both of Atomic Energy Control Board and Atomic Energy of Canada Limited.

Copies of the following documents were tabled and distributed to members of the Committee:

1. *The Atomic Energy Control Act, 1946* (Chap. 37);

2. *The Atomic Energy Regulations of Canada* (Order in Council P.C. 5513 of November 3, 1949); and

3. "Canada's Atomic Energy Project" (March 1953).

The Chairman called and introduced Dr. Mackenzie who read the following briefs into the record, copies of which were also distributed to members:

1. History of the Atomic Energy Program in Canada, the Relationships between the Organizations associated with that Program, and the Changes which have taken place since the last examination by a Special Committee on Atomic Energy (*Second Session—1949*); and

2. Production and Uses of Radioisotopes.

At the conclusion of Dr. Mackenzie's evidence, the Committee agreed to reserve its questioning thereon for the next meeting which was tentatively set for Monday, March 9, at 11.00 a.m.

At 10.55 a.m., on motion of Mr. Green, the Committee adjourned to the call of the Chair.

A. SMALL,
Clerk of the Committee.

EVIDENCE

MARCH 4, 1953, 10.00 a.m.

The CHAIRMAN: Gentlemen, I see a quorum. We have Doctor Mackenzie here to give evidence this morning.

I have copies of the Act and the regulations here—The Atomic Energy Control Act, and the Atomic Energy Regulations of Canada, and with your permission will have them distributed now. I also have a publication titled "Canada's Atomic Energy Project". It is a general description of the project. We will have it distributed, also; we will also distribute Doctor Mackenzie's brief before he reads it.

I will now call on Doctor Mackenzie.

Dr. C. J. Mackenzie, President, Atomic Energy Control Board; President, Atomic Energy of Canada Limited, called:

The CHAIRMAN: I don't think any introduction is necessary. We are all pleased to have him with us again as No. 1 witness.

Some Hon. MEMBERS: Hear, hear!

The WITNESS: Mr. Chairman and gentlemen. At the last meeting of the committe, it was decided they would like a review of the atomic energy program in Canada—its history, and the relationship of the Atomic Energy Control Board to the other organizations. We did present this evidence, you will remember, in 1949 at the November 8 meeting, so I will make my presentation briefer this year. You have this memorandum before you. Would it be satisfactory, Mr. Chairman, if I read it?

The CHAIRMAN: What is the wish of the members?

Agreed.

The WITNESS: Nuclear fission was discovered in Germany in 1939. In 1940 a small experiment was started in Ottawa by Dr. Laurence of the National Research Council, but there was no intensive effort toward the development of atomic energy in Canada until late in 1942, when a joint United Kingdom-Canadian team was established in Montreal under the administration of the National Research Council, to work in co-operation with United Kingdom and the United States toward wartime uses.

In 1944, it was decided that Canada should build a heavy water moderated reactor as a pilot plant for the production of plutonium. A site on the Ottawa river, at Chalk River, was selected, and work began immediately. Defence Industries Limited undertook the engineering design and supervision of construction, and was responsible for operation in the early stages. National Research Council conducted the research programme and supplied the basic scientific information and guidance.

In 1945 the first Chalk River pile, known as ZEEP (Zero Energy Experimental Pile) was brought into operation—the first nuclear reactor to operate outside the United States. ZEEP supplied much of the information necessary for the completion of the design of the larger reactor, NRX, which came into operation in 1947.

Atomic Energy Control Board.

The Atomic Energy Control Act, 1946, established the Atomic Energy Control Board, and gave it wide powers to conduct, supervise and control Canadian atomic energy developments.

Membership of the Board, 1952-1953, is as follows:

Dr. C. J. Mackenzie, President, Atomic Energy of Canada Limited and President of the Board.

George C. Bateman, Mining Consultant, Montreal, Quebec.

William J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited.

Dr. Paul E. Gagnon, Director of the Department of Chemistry and Director of the Graduate School, Laval University, Quebec.

Dr. E. W. R. Steacie, President, National Research Council.

Mode of operation of Board.

The Board considered that if it were to supervise properly a program having so many ramifications it should not become too enmeshed in operating details. Moreover, it believed that it would be more efficient and more economic to make use wherever possible of the experience and facilities of other organizations rather than to set up duplicate facilities within its organization. Consequently, the Board staff has been kept to a minimum and it concerns itself mainly with over-all supervision of the program, security matters, legal questions, and liaison with external atomic energy organizations, particularly those in the United States and the United Kingdom.

Raw Materials Program.

In the raw materials field it was decided that, with proper security provisions, the development of Canadian radio-active mineral deposits could best be carried out under normal exploration and mining practices. Accordingly the Board framed the necessary regulations so that prospectors and mining companies would be encouraged to prospect for and develop uranium deposits. On the advice of the Board, the government offered to purchase acceptable uranium ores and concentrates at guaranteed minimum prices for a number of years, the latest extension of the guarantee period being to 1962. Every prospector and exploration and mining company, therefore, is a potential participant in the Canadian radioactive raw materials program. A great deal of work has been done by private interests, and many promising showings are under exploration and development.

Eldorado Mining and Refining Limited

The most important organization in the raw material field, of course, is the Crown company, Eldorado Mining and Refining Limited, which was organized in 1944, and which reports to Parliament through the Minister of Defence Production. Because of this company's experience in uranium mining and its operation of the only uranium refinery in Canada, it has been designated as the government purchasing agent for ores and concentrates produced by other companies.

The directors of Eldorado Mining and Refining Limited are as follows:

W. J. Bennett, President and Managing Director, Ottawa, Ontario.

R. T. Birks, Q.C., Toronto, Ontario.

Dr. W. F. James, Consulting Geologist, Toronto, Ontario.

F. D. Reid, Mining Executive, Toronto, Ontario.

E. L. Brown, Mining Executive, Toronto, Ontario.

C. G. Williams, formerly Professor of Mining, University of Toronto, Toronto, Ontario.

J. A. MacAulay, Q.C., Winnipeg, Manitoba.

Edorado operates transportation facilities by water and air for its operations at Port Radium, N.W.T. and Beaverlodge, Saskatchewan, through its wholly-owned subsidiary, Northern Transportation Limited. The directors of that company are as follows:

W. J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited, Ottawa, Ontario, President.

F. W. Broderick, General Manager, Edmonton, Alberta.

H. H. Haydon, Treasurer, Eldorado Mining and Refining Limited, Ottawa, Ontario.

S. Bruce Smith, Q.C., Edmonton, Alberta.

Department of Mines and Technical Surveys

In the technical aspects of the raw materials program the Board has made use of the experience and facilities of the Department of Mines and Technical Surveys. The Radio-active Resources Division of the Geological Survey acts for the Board in collating information on the discovery and development of uranium minerals in Canada and gives technical advice and assistance to uranium prospectors. The Mines Branch of the department has set up a special division to investigate the best methods of concentrating ores found by Canadian exploration and mining companies. The Department, therefore, is making a very important contribution to the Canadian raw materials program.

I would also like to add that the Department of Mines and Technical Surveys cooperates in a very effective way with the Chalk River project in connection with the problems of chemical and physical metallurgy. We would like to pay tribute to the extraordinarily effective cooperation we get from Mines and Technical Surveys. We think that is a much wiser way to solve our metallurgical problems than to set up a large metallurgical section within the project. Mines and Technical Surveys have officers at Chalk River working with our scientific officers and they also carry on a great deal of work in Ottawa. We feel that this committee should understand the important work that this metallurgical branch is doing.

Chalk River Project

In the field of research into atomic energy application, Canada's only large scale establishment is the Chalk River project. Shortly after the Board was set up, it was made responsible for the future activities of this establishment. The Board considered that it should be maintained so that large scale research on the production and application of atomic energy could be carried out in Canada. It therefore requested the National Research Council, which since 1942 had directed the Canadian atomic energy research activities, to operate the Chalk River project as a research establishment on its behalf. Under Council operation Chalk River has become known throughout the world as an outstanding atomic energy research establishment.

NRU Reactor

Following the recommendation of the 1949 Special Committee that an additional reactor be constructed, plans were made for a reactor more powerful and with a higher neutron flux density than the NRX pile. Construction of

the new reactor was authorized early in 1951 and actual construction began that year. The new reactor, to be known as NRU, will use heavy water as a moderator, and will be adapted to extend greatly the range of possible research, as well as to increase production of plutonium and radioisotopes. It is expected that the cost of the new reactor and ancillary works will approximate thirty million dollars.

Atomic Energy of Canada Limited

The industrial aspects of the Chalk River establishment have been increasing, and there has been a growing feeling that large-scale industrial application of atomic power is closer at hand than had been expected. For these reasons, it was considered desirable that the project be segregated from other government activities and operated by a staff without outside responsibilities. Accordingly, the Board arranged, on the advice and instructions of the minister, for the incorporation of a Crown company, Atomic Energy of Canada Limited, which took over from the National Research Council on the 1st April 1952 the responsibility for the operation of the Chalk River establishment. The company was incorporated, pursuant to Section 10 (1) (a) of *The Atomic Energy Control Act,* 1946, by Letters Patent under Part I of *The Companies Act,* 1934. All of its issued shares except directors' qualifying shares are held by the Atomic Energy Control Board in trust for the Crown.

The directors of Atomic Energy of Canada Limited are as follows:

Dr. C. J. Mackenzie, President, Atomic Energy Control Board and President of the Company, Ottawa, Ontario.

Mr. W. J. Bennett, Member, Atomic Energy Control Board and President, Eldorado Mining and Refining Limited, Ottawa, Ontario.

Mr. E. R. Birchard, Vice-President (Administration) National Research Council, Ottawa, Ontario.

Mr. Rene Dupuis, Commissioner, Quebec, Hydro-Electric Commission, Montreal, Quebec.

Mr. G. A. Gaherty, President, Calgary Power Limited, Calgary, Alberta.

Dr. A. R. Gordon, Dean of the Graduate School, University of Toronto, Toronto, Ontario.

Mr. R. L. Hearn, General Manager and Chief Engineer, Hydro Electric Power Commission of Ontario, Toronto, Ontario.

Mr. Huet Massue, Manager, Economics and Statistics Department, The Shawinigan Water and Power Company, Montreal, Quebec.

Mr. V. W. Scully, Comptroller, The Steel Company of Canada Limited, Hamilton, Ontario.

University Research

In addition to furthering large-scale research at Chalk River, the Board has encouraged Canadian universities to carry on fundamental atomic energy research through financial grants to those institutions. The first grants were made to help defray the cost of major items of special equipment; e.g., a cyclotron at McGill University, a synchrotron at Queen's, a betatron at the University of Saskatchewan, A Van de Graaff generator and a linear accelerator at the University of British Columbia. Later grants were made for research with this special equipment, for other fundamental research and for work related to the treatment of uranium ores. The Board has arranged for its university grants to be handled through the National Research Council and the operating grants are administered in exactly the same way as the consolidated grants made by the Council from its own funds.

The amounts supplied are determined in relation to the programme of work on related subjects in progress in the particular university department. They are considered to be appropriate amounts for the best use of the equipment and facilities that are available. No major changes are contemplated from year to year. Each consolidated grant is administered by a responsible individual in the university, and the use of funds within the general intention of the grant is left to his discretion. The work in progress under these grants is reviewed once a year by senior scientists who submit written reports to the Council and the Board.

Distribution of Isotopes

At first distribution of radioactive isotopes was handled directly by the National Research Council, the operator at Chalk River, but when industrial applications began to increase it was decided to make special arrangements for their marketing. Under these arrangements, Charles E. Frosst and Company undertook the distribution to Canadian hospitals of certain specially purified radioisotopes intended for application to humans, while the Commercial Products Division of Eldorado, the radium sales organization of that company, took on the marketing of all other isotopes. The Commercial Products Division also carried out important development work on the industrial and medical applications of radioisotopes. That division was responsible for the development of the commercial model of the "cobalt bomb" which has been supplied to several hospitals in Canada and the United States. Because of the growing importance of radioisotopes it was decided last year that the Commercial Products Division should be transferred from Eldorado to Atomic Energy of Canada Limited. This transfer took place on the 1st August, 1952. The increase in the use of radioisotopes is indicated by the number of shipments made in 1952, over 1,100, as compared with about 270 in 1949.

Health Precautions in connection with Radioisotopes.

Radioisotopes, like radium, can cause serious injury if not handled properly. When the distribution of isotopes in Canada was first started the only organization with any experience in the field was the Atomic Energy Project, so that organization formulated the health precautions to be followed by users of radioisotopes and only released these materials to workers qualified and equipped to handle them safely. The Board's view has been that, except as necessitated by security aspects, such health precautions were a matter for enforcement by the appropriate health authorities. Discussions on the subject were opened through the Dominion Council of Health soon after the Board was established and progress is being made toward the settlement of regulations for administration by the health authorities. In the meantime, a special section devoted to this subject has been established in the Department of National Health and Welfare, and the project is co-operating with this section and with officers of the provincial health departments.

Civil Defence

Canada is not engaged in the manufacture of atomic weapons, but the Board is providing technical assistance and advice to those organizations (i.e., the Departments of National Defence and National Health and Welfare) responsible for Canadian atomic defence.

International Relations

International discussions of a political character on atomic energy and its control are the responsibility of the Department of External Affairs but the

Atomic Energy Project has provided technical advice and assistance when required. The Board maintains direct relations with the atomic energy organizations of the United Kingdom and the United States on such matters as the interchange and declassification of scientific and technical information.

Changes since 1949

As will be seen from the foregoing, the major developments since the Special Committee of 1949 held its sittings are:

(a) the authorization and commencement of construction of the new NRU reactor;

(b) the taking over by Atomic Energy of Canada Limited of operation of the Chalk River project;

(c) the expansion in the production and use of radioisotopes;

(d) the taking over by Atomic Energy of Canada Limited of the Commercial Products Division of Eldorado;

(e) the growth of interest in atomic energy as a potential source of industrial power.

The CHAIRMAN: Gentlemen, before we start questions, we have further evidence available on the production and use of radioisotopes, and, if it meets with your approval, we could go through that now and then that would make it available for all the members before questioning starts at the next meeting. It is just a matter of procedure. I take it then we can go ahead with the brief, Production and Uses of Radioisotopes.

The WITNESS: The production and use of radioisotopes is something that the committee is particularly interested in. I have this brief which I will read and then be very glad to answer questions. First, the production and uses of radioisotopes.

The large scale production of radioisotopes and their use in research, industry and medicine constitute an important atomic energy application which already has had its effect on the prosperity, comfort and well-being of mankind. These radioisotopes have been hailed by scientists as the most important analytical discovery since the invention of the microscope; they are recognized by industrialists as valuable aids in the measurement and control of many plant operations; and they are looked on by doctors as the treatment of choice for certain diseases. Indeed, the advantages resulting from the use of radioisotopes are already so great that many people are convinced that the ultimate benefits accruing from their use will alone be worth all the money spent on atomic energy developments.

Production

Radioisotopes, of course, are not something entirely new. Certain radioactive materials do occur naturally and a few of these, particularly the element radium, have been in use for a considerable time. A few radioisotopes have also been produced at great expense in large electronuclear machines called cyclotrons but it was not until the development of the nuclear reactor that radioisotopes became readily available in quantity and at a reasonable price.

Radioisotopes are produced in a reactor in two ways. The radioactive "ashes", i.e. the fragments from the fission of Uranium 235, are composed of many different radioisotopes and these can be separated one from the other by chemical methods. The general method of production, however, is to place a quantity of an appropriate substance in a container and expose this

to neutron bombardment in the reactor. The amount of radioactive material formed from this substance depends, among other things, on the number of neutrons per second bombarding it and the time of bombardment. The higher the neutron flux the shorter is the time that the substance has to be bombarded in order to obtain a given concentration of the desired radioisotope. This is much the same principle as that in the cooking of a roast—the hotter the oven the shorter is the time required to cook the roast. This oven analogy may be used to explain the important advantage that the NRX reactor possesses in the production of radioisotopes. As NRX is the "hottest" reactor (i.e. it has the highest neutron flux) of any known reactor engaged in isotope production, the time required to "cook" a particular sample is much less in NRX than in other reactors, sometimes only one tenth or one twentieth as much. A sample which would require say 6 month's "cooking" in NRX therefore would require a period of five or ten years in other reactors, and this is usually too long to wait for a particular sample.

Use of radioisotopes as tracers

Probably the best developed use of radioisotopes is their employment as tracers to indicate the course of particular chemical, biological or industrial processes. Most people are familiar with the military use of tracer bullets and they know that the luminous track left by these bullets indicates the course of ordinary bullets of the same calibre. Radioisotope tracer work is based on the same principle but here the bullets are sub-microscopic particles and they do not leave any visible track. They do, however, give off bursts of radiation which can be detected by means of sensitive, very sensitive electronic instruments called counters. So penetrating is this radiation that the presence of isotopes can be detected even through considerable thicknesses of material.

The quantity of these sub-microscopic bullets required for detection purposes is often extremely minute. For example it has been calculated that, if we were to take a teaspoonful of Carbon 14, a radioactive isotope of carbon, and mix this thoroughly with all the water in Lake Ontario, the amount of the isotope then present in one teaspoonful of this water could still be detected. This gives you some idea of the tremendous sensitivity of the tracer method. Sometimes, however, considerable quantities of radioisotopes are required, particularly where the radiation is to be detected through considerable thicknesses of material.

A few examples of tracers in agricultural research

By incorporating a small amount of radioactive phosphorus in a fertilizer and applying this fertilizer at various rates and times and then analyzing individual plants for total phosphorus and for radioactive phosphorus, agricultural scientists are able to determine the amount of phosphorus taken up by the plant from the fertilizer and from the soil. By such experiments they can determine the optimum amount of fertilizer required for a particular crop of a particular soil and the best time of application. By a similar procedure forestry scientists can determine the absorption of chemicals by roots of trees. Again, by placing a drop of a weak solution of Cobalt 60 on the hard shell wing of a pine weevil, entomologists are able to trace this insect and find out where it hibernates.

Tracers in medical research

In medical research by injecting radioactive sodium into the blood, doctors are able to follow the blood circulation in the human body and can locate spots where there is any restriction or impairment of circulation. Then again, since

some types of inflammation and tumours are known to absorb certain dyes, these dyes can be labelled with radioactive isotopes so that their presence can be detected externally with electronic detectors.

Tracers in industrial research and operations

Radioisotope tracers are also finding increasing use in industrial research and operations. For instance, by incorporating small amounts of radioisotopes in metal test pieces and checking any material abraded off for radioactivity, the automobile industry is able to determine very quickly the amount of wear in machine parts and to study the effect of lubricants of various kinds. Not long ago a large Canadian newsprint mill tagged a particular type of pulp fibre with radioactive iodine and thereby was able to determine the distribution of this fibre in a sheet of paper while the paper was running through the newsprint machine at a speed of 1,700 feet per minute. Radioisotopes have also been used to good effect to locate obstructions in underground oil pipe lines being built across Canada. To scrape away any deposits occurring inside such pipes it is customary to force through them a tight-fitting scraper called a "pig". If a strong radioisotope source is attached to this pig, then if the pig is stopped by some obstruction or deposit which it cannot remove, the position of the obstruction can be located on the surface of the ground by instruments capable of detecting the radiation emitted by the radioisotope. This technique may obviate the necessity of tearing up miles of pipe to find an obstruction.

Radioisotopes in measuring and controlling devices

Another use of radioisotopes which is finding increasing application, particularly in industry, is their employment in measuring devices of various kinds. As mentioned earlier, the radiation from certain radioisotopes can penetrate considerable thickness of material. However, the percentage of radiation penetrating a particular material depends on the thickness of this material. By using a specially calibrated detector, therefore, it is possible to determine the thickness of material placed between the radioactive source and the detector. Such thickness gauges are finding increasing use in the paper making industry, for the continuous measurement of paper thickness even when the paper is moving through the device at great speed. Indeed, arrangements can be made so that the device not only measures but also controls the thickness of the paper, thus ensuring a greater degree of uniformity in the product. Similarly, radioactive isotopes can be used to indicate the level of oil in refinery tanks, and to make other measurements such as the progress of corrosion on the inside of tanks which otherwise would not be available for inspection.

Radiography

Another example of the use of radioisotopes for measurement purposes is industrial radiography, the inspection of welds and castings for flaws. The technique used is just the same as that used in the taking of an x-ray photograph. The source of radioactive material is placed on one side of the casting and a special photographic film is placed on the opposite side. Any flaws in the casting will permit a greater percentage of radiation to reach the film and this will show up clearly when the film is subsequently developed. This inspection work can be carried out more quickly with radioisotopes than with x-ray machines and it is possible to use these materials in places where x-ray machines cannot be used because of their size.

Medical uses of radioisotopes

Radioisotopes also have important value as therapeutic agents. This is based on the fact that though the radiations given off by radioactive materials are injurious, they are usually more injurious to diseased tissue than to normal

healthy tissue. Consequently with proper safeguards the radiations from such materials can be used to kill diseased tissue without causing serious injury to neighbouring healthy tissue at the same time. This, of course, is the theory on which the use of radium for medical purposes is based. Radioisotopes, however, for example radioactive cobalt, can provide a much more intense beam of radiation at much less cost. Consequently radioactive cobalt is beginning to replace radium and high voltage x-ray machines, particularly in the treatment of deep seated tumours which cannot be treated satisfactorily by the other methods.

Some radioisotopes—they are very few—can be taken internally for the treatment of certain diseases. For example, since iodine tends to concentrate in the thyroid a small amount of radioiodine taken internally will tend to concentrate in the thyroid and the radiation from this iodine will be effective in the treatment of certain thyroid disorders.

The above examples by no means exhaust the possible uses of radioisotopes in research, industry and medicine, but may give some idea of the benefits that they can bring to mankind.

Isotope shipments

Shipments of isotopes through the Commercial Products Division of Atomic Energy of Canada Limited were being made in the last quarter of 1952 at the rate of about 50 per month, or 600 per year. In addition, some 500 shipments per year are being made through Charles E. Frosst & Company, and for project purposes. The average amount of active material per shipment is now much higher than it was a few years ago. (3)

I think that is very important. You remember that in 1949 we shipped 249 per year. We are shipping now over 1,100 per year, and the shipments are larger than the previous ones.

Canadian recipients of isotope shipments include:

Hospitals	14
Industrial Laboratories	39
Universities and Colleges	19
Research Centres	6
Government Laboratories	20
Miscellaneous	4

Making a total of 102.

It is thus apparent that many more hospitals, colleges and industries in Canada are now using isotopes in their work, as compared with the number using them a few years ago. A further increase is expected in the number of users as well as the number of isotopes used, resulting from the A.E.C.L. policy of assisting customers to find applications for isotopes in the simplification of their operations and in the development of new techniques.

Many shipments are routine, others illustrate special and interesting applications, some of which will be mentioned in succeeding paragraphs.

Cobalt Beam Therapy Program

A.E.C.L. makes available a complete equipment, including radioactive source, operating equipment and installation service. The source is in the 1,000 to 2,000 curie range whereas ordinary shipments are usually in the millicurie range—that is a thousandth of a curie. Such units are now in use at London, Ontario; Saskatoon, Saskatchewan (source only supplied by A.E.C.L.); Vancouver, B.C.; New York, U.S.A.; others will shortly be installed at Chicago, Winnipeg and Minneapolis, and there are many others.

A detailed list is appended to this memorandum.

Cobalt Source for Sterilization

A large source of low specific activity Cobalt^{60} has recently been supplied to the University of Michigan. This is believed to be the largest source of radioactive material ever put to commercial use. A total activity of about 10,000 curies was shipped in a single container.

I might say that 10,000 curies is equal to 10,000 grams of radium in its radiating effect. A hospital that has two or three grams has quite a lot of radium. In this one source we have 10,000 curies which is the equivalent of 10,000 grams of radium in its radiating effect. This source will be used to further studies on sterilization of food stuffs, drugs and in other experimental work.

I might say that this is something we are extraordinarily interested in because we are constantly looking for a use for the radioactive isotopes or fission products which we have in such large numbers. To find some use for the bulk of fission products will be to our great advantage.

The next two pages contain a description of some of the short-lived isotopes. Do you think I should read it?

Hon. MEMBERS: Yes.

The WITNESS: This is an example of some of them to give you an idea of what they are used for.

Short Lived Isotopes

Sodium^{24} (half life 14·8 hours) has found application in the radiography of very thick sections because of its very penetrating gamma radiation (Aluminum Company of Canada, Kingston).

One example of the application is that of a large casting costing many thousands of dollars which needed to be inspected and could be inspected in no other way.

Sodium^{24} is short-lived and must be transported very quickly and used before its life has gone.

Palladium^{109} (half life 13 hours) has been shipped from A.E.C.L. to University of Michigan for studies in the effect of ionisation within cylinders of combustion engines.

That is a study of what takes place in the cylinder of an internal combustion engine.

Mr. GREEN: What does that term "half-life" mean?

The WITNESS: All radioisotopes decay. They decay because they are unstable, and as they decay they give off radiation and in order to get an idea of how long they are going to last, one must have some yardstick and the yardstick used is the length of time in which half of the existing life will decay. If you start with 100 units then the activity of this at the end of seven days will be 50.

Mr. PINARD: Why half?

The WITNESS: At the end of the next week there would be 25 and in the next seven days it would be 12½. It just gives you an idea of how rapidly it decays and the reason you cannot make it absolute is because you never know where the end is. You have to stop somewhere. That is the way we have of measuring the lifetime.

Some, for instance, radium is around 1,000 years. Plutonium is around 2,000 years, and Carbon^{14} is 5,000 years and you can have isotopes with only a few seconds. If you were to treat a person with radium—you would not want to treat them with an isotope that was going to be in their body for a long time, but with a short half-life it would die off, whereas if you treated them with Carbon^{14}, it would stay there. Does that answer the question?

Mr. GREEN: Yes.

Copper^{64} (half life 12·8 hours) has been shipped to University of Utah for metabolism tests.

All of these short-lived isotopes naturally require special shipping arrangements to minimize decay in transit.
Other uses of radioisotopes

(1) Medical Therapy—Cobalt^{60} in beam therapy units; in needles, tubes & special applications.
Iodine ^{131} for intravenous injections.
Gold^{198} for intravenous injections and to replace radon.

(2) Chemical Tracers and Process Control—
Silver^{110} for pulp and paper research
Iodine^{131} for biological studies
Phosphorus^{32} for dermatology, agricultural research (fertilizer uptake and tracing of animal food uptake).
Sulphur^{35} has uses similar to phosphorus.
Carbon^{14} has very diverse uses.

You can say that long lived Carbon^{14} is useful in experiments where you wish to carry on experiments for a long time.

(3) Luminous Compounds—Strontium^{90} and Thallium^{204} are now used extensively as a radium substitute.

They have reasonably long lives.

(4) Static Eliminators—Strontium^{90} and Thallium^{204} are used as a radium substitute and as a substitute for electronic static eliminators.

(5) Industrial Radiography—Cobalt^{60}, Iridium^{192}, Tantalum^{108} are widely used in radiography of castings and pipeline weldments.

(6) Neutron Sources —Polonium^{210} and Antimony^{124} produce useful sources of neutrons for many research applications.

(7) Liquid Level Gauges and Thickness Gauges—Beta emitters such as Strontium^{90} and Thallium^{204} are finding many uses in the control and measurement of sheet material such as paper and metal foil.

(8) Tagging of Animals and insects—Useful information on the habits of certain insects has been obtained by tagging them with active material and subsequently locating them in their natural surroundings; e.g. pine weevil and mosquotes. A program is under way for the large scale tagging of fish to determine migration and spawning habits.

Mr. GREEN: How do you locate the mosquitoes after they have been tagged?

The WITNESS: By radioactive counters; you can gather them and pick them out and find the ones which are radioactive and the ones which are not.

(9) Sterilization—Gamma or beta radiation may be used in the sterilization of drugs where heat sterilization would produce a deterioration in the product. Food sterilization by radiation is in the experimental stage.

As I have said before, that is one of the projects in which we are particularly interested because, if it succeeds, it will be one of the projects in which a large quantity of fission products might be used. We have large quantities, and they are now a source of expense to us; but we hope to turn them into something which will bring us in revenue.

In the appendix there are listed the Cobalt 60 therapeutic units already installed.

The CHAIRMAN: We can either start the questioning now or leave it until the next meeting. We have about five minutes more time.

Mr. MURPHY: Why not leave the questioning to the next meeting, Mr. Chairman?

The CHAIRMAN: Yes, we can leave the questioning to the next meeting; and if we could start with page one of the evidence, it would perhaps produce a more systematic way of conducting the questioning.

(At this time discussion continued off the record.)

The CHAIRMAN: A motion for adjournment is now in order.

The meeting adjourned.

APPENDIX

LIST OF "COBALT BOMBS" ALREADY INSTALLED

(NOTE: All bombs supplied with high activity radioactive cobalt from NRX reactor. Bombs designed by Commercial Products Division of Atomic Energy of Canada Limited (formerly Commercial Products Division of Eldorado Mining and Refining Limited) except where noted.)

1. University Hospital, Saskatoon, Saskatchewan.*
2. Victoria Hospital, London, Ontario.
3. Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.**
4. British Columbia Cancer Institute, Vancouver, B.C.
5. Montefiore Hospital, New York, N. Y.

* Unit designed by scientists of University of Satkatchewan.

** Unit designed by American engineers and scientists.

List of "Cobalt Bombs" expected to be installed in the next few weeks.

(NOTE: All bombs designed by Commercial Products Division, Atomic Energy of Canada Limited and supplied with high activity radioactive cobalt from NRX reactor.)

1. Cook County Hospital, Chicago, Ill.
2. Manitoba Cancer Relief and Research Institute, Winnipeg, Manitoba.
3. University of Minnesota Hospitals, Minneapolis 14, Minnesota.

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament
1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE

No. 2

MONDAY, MARCH 9, 1953

WITNESS:

Dr. C. J. Mackenzie, President, Atomic Energy Control Board, and Atomic Energy of Canada, Limited.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

MINUTES OF PROCEEDINGS

MONDAY, March 9, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 11.00 a.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Bourget, Coldwell, Gibson, Green, Kirk (*Digby-Yarmouth*), Low, McIlraith, and Murray (*Oxford*). (8).

In attendance: Dr. C. J. Mackenzie, President, and Mr. G. M. Jarvis, Legal Adviser and Secretary, both of Atomic Energy Control Board and Atomic Energy of Canada Limited.

Dr. Mackenzie was questioned by the Committee on the evidence given at the preceding meeting held on March 4.

The Committee agreed that witnesses be called from Eldorado Mining and Refining Limited and from the Department of Mines and Technical Surveys to give evidence at a later meeting.

At 12.50 p.m., the Committee adjourned to meet again at the call of the Chair following its inspection visit to Chalk River.

A. Small,
Clerk of the Committee.

72029—1½

EVIDENCE

MONDAY, March 9, 1953
11.00 a.m.

The CHAIRMAN: Gentlemen, I see a quorum. We have Dr. Mackenzie with us today to answer questions with respect to the briefs which were given in evidence at the last meeting. I now call on Dr. Mackenzie.

Dr. C. J. Mackenzie, President, Atomic Energy Control Board, President, Atomic Energy of Canada Limited, called:

The CHAIRMAN: Dr. Mackenzie, is there anything you want to say?

The WITNESS: No, I do not think there is anything.

By Mr. Kirk:

Q. Dr. Mackenzie, may I pass on a question which was passed to me. It referred to reports which appeared in American newspapers and magazines and which seemed to indicate that private industry in the United States was spending money in the field of atomic energy—with or without the approval of the American government, I do not know—and the question was, if this is the case, would you anticipate that such a movement would in any way affect the program for the development of atomic energy upon which we have embarked in this country?—A. I do not think it would have any effect at all.

Q. Do you think there is anything in these rumours?—A. Yes. This is the situation: Up until, let us say, two years ago, the operation of reactors had for its object the production of fissile material for the bombs, run entirely by the government. The management of certain of the production plants had been under certain companies the research was always done by the government direct. The use of isotopes, and the equipment and instruments for their utilization was done by private industry.

The government supplied the isotopes and let whoever was to use them, use them. Mining activity was always done by private companies; and the manufacture of instruments was done largely by private companies. That left the reactor field entirely in the hands of the government.

But about a year and a half ago it seemed to everyone, I think, in all countries, that the possibilities of employing nuclear power which involved the use of reactors were probably closer than we had thought. At that time, in all countries, people began to think of how you might develop that power if and when it came; and it seemed apparent, without any decision being taken that I know of, that the people who should be interested in power are the people who are experienced in the operation of power plants, whether it be private industry, public controlled industry, or what not.

As far as scientific and technical study are concerned, they felt that the people who must come into the picture are the people who are interested and experienced in power matters. And in the United States, of their own initiative, four groups of companies were set up, or rather set themselves up, and the commission agreed to put information at their disposal so that they could study the feasibility of building commercial power reactors.

These four groups have been set up. They have reported. The reports I do not think are public in their entirety, although there have been many releases of a general nature; and as far as I know they are still studying the feasibility of some program whereby they could, in cooperation with the gov-

ernment or alone, or in some other way, obtain the necessary funds to build prototype power plants. So that is the picture, and I cannot see that it effects our program at all.

We are looking forward to power, and I think we feel the same way, that we must bring into the picture those organizations which are experienced in the production of power; and that would depend on who did it, and it would depend upon the set-up of the country. I think that is the feeling in Britain, in the United States and here. Does that answer your question?

Q. That is very nice. When we go to Chalk River we will go into this power development project more fully, I take it?—A. Yes.

Q. I am greatly interested in the power problem since I come from the Maritimes.—A. I see.

By Mr. Green:

Q. What use could be made of atomic energy for power? For example, could it be taken to the Maritimes or to any other part of Canada where there was a lack of hydro power and used there for the production of electric power?—A. Yes. That, I think, constitutes its great advantage, that it can be located in places where it would not be feasible to locate hydro power or perhaps steam plants. You see, the fundamental thing is this: You have in fissile material a situation where one pound of fissile material is the equivalent of 1200 to 1500 tons of coal in its heat value. Therefore, in very distant plants, where there would be no hydro facilities and where freight rates on coal would be prohibitive, it might very well be that atomic energy would become very advantageous. I think that is the answer.

Q. Could it be exported, for example?—A. Oh, yes.

Q. Could we export atomic energy for power purposes, let us say, to India or to Pakistan?—A. Yes, yes. And we could export fissile material.

By Mr. Low:

Q. You have used the term "fissile"?—A. Yes.

Q. I have heard the term "fissionable" used too. What is the difference? —A. They are exactly the same thing. The discovery was called "fission", as you will recall.

Q. Yes.—A. When an atom of uranium 245 is hit by a neutron, it breaks in two, with a great deal of energy being given off.

Q. Yes.—A. And that phenomenon was called "fission"; so that the words "fissionable", or fissile" material are synonymous.

By Mr. Coldwell:

Q. From your reply to Mr. Green I take it that where there is ample hydro power, or where coal can be used economically, that this fissile material could not be used advantageously? Is that what I take from your reply?— A. You ask if it is economic?

Q. Yes.—A. Mind you, we are just in the period when we are studying these things and one cannot speak with authority. But I think that the best opinion today would feel that atomic energy is not going to compete economically with central station power of the hydro type or the coal type, where coal is cheaper; and that it will be probably faced with its greatest use in an area of power scarcity, or to implement these other sources when they run low.

As you know, the world picture today is very serious; the world demand for power, speaking world-wise, is going up at a terrific rate, and known sources are diminishing. Therefore within not too long a period of time a scarcity of power, from a world point of view, is going to occur.

Q. And you think this would be supplementary to those sources of power? —A. That is my opinion.

Q. You say that is your opinion?—A. Yes.

By Mr. Low:

Q. Are you speaking, Dr. Mackenzie, from presently known sources of fissile material? You are speaking of plutonium, I suppose?—A. Yes.

Q. And if research work in the next several years should reveal some other substance that was fissionable or fissile, you might change your mind later?—A. I would not change my mind on the proposition that atomic energy will be an important thing to supplement the world supplies of power.

Q. I see.—A. Coal, oil, and hydro are fairly well known as being not unlimited, and if the world demand for power continues as it is at the present time, it will mean that there must be a supplementary source of power provided. If, according to your question, other means besides uranium should be obtainable, that would merely add to our ressources of potential energy.

Q. But it would not change materially the economics of the picture?—A. One has to hesitate about prophesying economics because history has shown pretty definitely that the rates go down as development goes up. For instance, aluminum at one time was an impossibly expensive material until development came along and now it is something wonderful.

Q. That is what I had in mind in asking my question.

By Mr. Gibson:

Q. Are we short of any necessary material to convert uranium power into the present type? I was thinking of mercury, or vapour, or whatever you are thinking of. Do we seem to have ample resources of it?—A. Yes.

Q. I was wondering if there was any other critical material of which we would run short?—A. The economic aspect is one of developing a satisfactory material. There are technical and scientific problems yet and until we can say what we want, we cannot say whether it is short or not; but it is one of the points on which there has been a lot of scientific and technical work done.

By Mr. Green:

Q. In what parts of Canada would you say that atomic energy would be most useful for power development?—A. I could not say that.

Q. Would it be, for example, in the Maritimes or in Newfoundland?—A. As a matter of fact, I am not well enough informed on the power situation in the various parts of Canada to say. I have never made a study of it. But I would say that it would be useful wherever there was a scarcity of power or wherever there were high areas, areas where the rates were very high.

My own feeling is—and it is purely a personal matter—that atomic energy will develop probably something in the way that internal combustion power developed and that it will open up new areas. The internal combustion engine in its infancy was thought of as a substitute for coal, but it never was. It opened up the whole field of automobiles, and aircraft, and changed the whole complexion of the world. I cannot document this opinion, but I think there is a general feeling that when we get into a new form of energy, it is likely to be used in areas where there are special requirements or special advantages. It is the sort of thing I feel that we must just take on faith. I think that is a sounder way to take it than to try to document it when you do not know the actual answer.

By Mr. Gibson:

Q. Have we had any luck in getting down from the size of the critical mass? Have we made progress in that direction, so that we might not have the whole world blown up in one explosion?—A. I do not think there is much danger of blowing up the world from one reactor.

Q. Have we got it down smaller than it was originally?—A. There are various types of reactors. You may use a reactor with raw material, or use a reactor with pure fissile material. The reactor for pure material becomes very much smaller in physical terms, but not smaller with respect to the use of fissile material.

In natural uranium, there is only one fissile atom of 140, and if you just take that one atom out and you have a body either of metal or in solution in which you only have fissile material, then the bulk of it becomes very much smaller for the same amount of power.

Q. But you still have to have an immense explosion before you can make it pure?—A. You never get what I think of as an explosion at all. If you just take that one fissile atom out and have a body either metal or solution in which you only have the fissile material, then the bulk of that becomes very much smaller for the same amount of power.

Q. But you still have to have a monster explosion before you can make it possible?—A. You never get what I would think of as an explosion at all.

Q. I was wondering if we can develop anything that would make the atomic explosion smaller?—A. That is a difficult question to answer because we refuse to think of a reactor as an explosion. The concept of explosion is tied up with the time so that the liberation of energy which takes place from material in say five minutes is just ordinary combustion. If you put that in the thousands of millionths of a second it is so rapid that it has the effect of what we would call an explosion but in reactors we do not get to that point.

Q. We are developing artillery shells now for instance. They will not make an explosion the size of the Hiroshima bomb?—A. I know nothing about that.

Q. Perhaps I am on the wrong track.

The CHAIRMAN: We are getting into the whole subject of power and that subject was indicated for examination at Chalk River. Perhaps we would be better to go on with examination of the evidence given the first day and revert to this evidence with respect to power after the brief is given at Chalk River.

Mr. GREEN: There is some information in Dr. Mackenzie's statement made the other day.

The CHAIRMAN: It occurred to me it would be better to reserve our examination on the subject of power until we have had the whole evidence given on the subject as proposed at the meeting at Chalk River. I do not want to cut off the discussion but it seems to me it would be a more orderly method of proceeding.

By Mr. Low:

Q. There was one line of thought I had. That is, when we were at Chalk River the last time, the scientists told us one of the problems they faced was to find some material for building the power developing reactors that would withstand the terrific heat that would be generated, and I think they indicated at the time they were carrying their research into the field of ceramics, and I was wondering if Dr. Mackenzie had something to say about the results of their research in that field?—A. I think generally speaking one can say the researches over the last three years have led the scientists to be more hopeful about the possibilities of obtaining material, but to say specifically what the materials are going to be at the moment is not possible.

The CHAIRMAN: I am wondering if we can go through the evidence page by page.

By Mr. Coldwell:

Q. I was going to skip the history and ask a question. "The Board considered that if it were to supervise properly a program having so many ramifications it should not become too enmeshed in operating details." Then you go on to say: "It would be more efficient and more economic to make use wherever possible of the experience and facilities of other organizations." I was going to ask what cooperation there is now among the three countries, the United Kingdom, the United States and Canada which would enable us to carry out this particular subject. Is there any closer understanding with the United States, for example?—A. May I just make one preliminary observation? We were referring to the cooperation within the Canadian picture. We were thinking of cooperation with the Department of Mines and Technical Surveys, the Geological Survey, and Eldorado Mining and Refining Company which does the mining internally.

Mr. GREEN: The other reference is on page 7.

The WITNESS: Externally the situation is not very different from what it was in 1949. Our exchange with Great Britain is very free and very useful. The cooperation we get from the United States is as free as they can give it under the McMahon Act. I think that we do get a great deal of use out of it but not as much as if there were no McMahon Act.

Q. There has been no freeing of information since 1949?—A. There was one amendment to the McMahon Act which was very limited and has not been very useful. The amendment was in effect that if it could be proven that there was a field in which it would be of mutual advantage—may I amend that—that it was of primary use to the United States defence projects, there could be exchanges with certain restrictions. It had to go before a number of bodies in the United States. It looked as if it might be of value, but practically it has not affected our project at all.

Q. Is Canada making application to the United States for any freeing of this information?—A. I do not know whether Canada has officially. It is a matter which is being attacked all the time unofficially, but I think in Britain they have attacked it officially. I think the situation is this, that the Americans are very much aware of the fact that both the Canadians and the British would like to have more cooperation. I do not think that the lack of cooperation is due to the fact that the Americans do not know we want it.

Mr. LOW: The Americans still maintain a liaison officer at Chalk River?

The WITNESS: Yes.

By Mr. Green:

Q. Are any other nations in the same position as the United Kingdom and Canada in so far as obtaining information from the United States is concerned?—A. As to their desire to get it, I think all the countries would be interested in getting it, but very few countries have progressed as far as we have in the field; but it is a matter on which many countries are becoming very interested and they naturally would like the information and I think it is fair to say that there is a continuous declassification going on; every year other information is declassified. It is done within the framework of the McMahon Act. Nearly all of the information on the very low power reactors is declassified so that if any country in the world wishes to build a small zero energy pile it will be possible for them to get information from us and the Americans, and that of course is a step. In connection with the reactors of the NRX class, there is quite a lot of material that is declassified, but when it comes to large production reactors any material that affects the knowledge of the production of fissile material or weapons is very rigidly classified.

Q. By the United States?—A. Yes.

Q. There is the position then, that Canada and the United Kingdom have a very free interchange of information?—A. Yes.

Q. And that the United States has a much freer exchange of information with Canada and the United Kingdom than she has with any other nations? —A. I would not like to say just exactly that, because the restriction of the McMahon Act does not single out the United Kingdom and Canada. I think it is true that we have more interchange of personnel and information. We are in better position to take advantage of the unclassified material, but I think legally one could not state that we occupy that position.

By Mr. Low:

Q. Doctor, does the United States stay with the carbon reactor?—A. They are building very large heavy water reactors at Savannah at the cost of $1,400,000,000 and they are building another reactor of the size of NRX in Chicago and the United Kingdom is proposing to build an NRX type of reactor just for experimental purposes. So we will not be the only one in the world.

By Mr. Coldwell:

Q. Are all three countries working along the same lines?—A. The United States is generally speaking covering a very broad comprehensive field and in England they are, as you know, building weapons. I would say that the research program at Harwell in England and the research program in Canada generally cover the same field. In both cases, naturally our fields are narrow because there are so many problems that with our limited facilities it is impossible to embark upon all these various types of reactors that might be developed.

By Mr. Green:

Q. Are any other countries except the United States, Great Britain and Canada very far developed with their atomic energy programs?—A. France has two reactors. There is a reactor in Norway which is a combined project with Holland. Sweden is about to start its first reactor, but has not done so. In many other countries there is a great deal of discussing and preliminary planning going on—in India and South Africa. I do not know, of course, anything about behind the Iron Curtain. And Australia is interested, but there are a number of countries which are doing preliminary work, and as you know there is a European project for a nuclear centre which will be located in Geneva. It is rather an interesting experiment and nearly all the European countries are in it because of the fact that no one European country thought it could undertake the very large expenditures. They are putting up an institute in Switzerland to which all these countries will send their scientists, but it is on accelerators at the moment. They are not contemplating building reactors.

By Mr. Coldwell:

Q. What about South American, Argentina?—A. Argentina had a delegation in North America last year. The delegation was here and I see from the press they are getting certain equipment from the Unitetd States, not a reactor, possibly cyclotrons in order to study nuclear fission and it seems a very wise way to approach it.

Mr. GREEN: The United States, Canada and the United Kingdom are far ahead of the others?

The WITNESS: Very much so.

Mr. COLDWELL: You know nothing about the Soviet Union at all?

The WITNESS: No.

By Mr. Low:

Q. Consolidated Mining & Smelting Company is the main supply of heavy water?—A. We are not in a position to say that. That in the United States is classified information. Certainly it is the only one in Canada.

The CHAIRMAN: Are there any more questions about "operation of the Board". What about the "raw materials Program"—page 2.

By Mr. Coldwell:

Q. To what extent is Canada a source of raw materials in comparison with the Commonwealth and other places?—A. That again is information which is top secret, but I have seen comment in the press and I think it is common knowledge that Canada will be a very substantial though not the main source.

Mr. COLDWELL: I will not pursue that. I was going to ask another question.

By Mr. Low:

Q. What concentration of ore is considered necessary before an ore body is considered economic to work?—A. I would not like to answer that question. I may say, if the committee is interested in the details, that they might hear from Mr. Bennett of the Eldorado Company, because that is an economic matter.

The CHAIRMAN: We will hear from Mr. Bennett on the whole subject of the operation of Eldorado, and the raw materials price program, but the only point here is the question of policy with relation to the Atomic Energy Control Board.

By Mr. Green:

Q. The policy at the present time is that the Board merely guarantees a price for the ore and the purchase of the uranium that is produced, is that correct?—A. It is not quite that. The Board's responsibilities are very general in character. The Board, I think you could say—the fundamental responsibility that the Board has is to see that the flow of this prescribed material goes in the proper way having regard to the security and health of the people. It has no responsibility for development. As you know, historically, the situation developed in Canada something like this. Eldorado was taken over by the government when the matter developed rapidly in the United States and it became wise to do so and they were the only mining company. Now, the Board would give permission for Eldorado to dispose of these materials in a way that was satisfactory to the government. Then when it came to a matter of other people getting it there had to be some funneling of the negotiations and I think that was probably a government decision rather than the Board's decision entered into with the commission that the most effective way would be for the Eldorado to become the purchasing agent for all the other companies and as there is only one purchaser, that is, the United States, the United States I fancy would prefer that, and so the Eldorado was set up by the government, not by the Board, as the purchasing agent, and the price, as I understand it, is a matter for negotiation. It has nothing to do with the Board or even Eldorado. There would be negotiations with the purchaser on what he would pay. The government would then guarantee to purchase for a period of time so that it would be an internal Canadian arrangement with the individual companies.

Q. Then the only market for uranium ore in Canada is the Eldorado Company?—A. The Eldorado is the only agency; I mean, that a man with a mine producing uranium ore cannot sell to anyone other than the Eldorado?—A. Yes, I think that is true; but I do not think anybody else would buy it.

Q. Then the eventual purchaser from the Eldorado Mining Company is the U.S. government?—A. That is correct—the Atomic Energy Commission.

By Mr. Bourget:

Q. Is the Eldorado selling outside Canada?—A. Just to the Atomic Energy Commission in the United States.

Q. That is the only country we are dealing with?—A. Yes. I think one might modify that statement. There is a very small amount of uranium oxide which they have for a number of years sold to the chemical industry which is insignificant in amount. I think that is true that some was being used for gas mantles and some paints. It is however insignificant.

(Discussion continued off the record).

By Mr. Green:

Q. Apparently there is plenty of incentive to prospectors and mining companies to go out and look for uranium under the present plans?—A. That is apparently so, it has developed very rapidly.

The CHAIRMAN: I presume the committee is interested in this whole matter of price for the concentrates from the mines and so on. It is quite involved and I think the one to give that evidence would be Mr. Bennett.

The WITNESS: I think Mr. Bennett would be very willing.

By Mr. Green:

Q. On this paragraph on page 2:

> On the advice of the Board the Government offered to purchase acceptable uranium ores and concentrates at guaranteed minimum prices for a number of years, the latest extension of the guarantee period being to 1962.

Q. Is that on the basis of a guaranteed price offered by the United States for that length of time?—A. It is a matter of negotiation. The government would find out what United States feeling would be. The government feel they have to give these companies some guarantee perhaps beyond the years the Americans would guarantee.

Mr. GREEN: There is a guarantee for a period of nine years from the present time.

The CHAIRMAN: It was ten years from the date of announcement, which was 1952, and the change in the date of guaranteed prices was to April, 1962.

Mr. COLDWELL: That is the minimum price. It may go higher.

The CHAIRMAN: Yes, but it involves an undertaking to take concentrates that minimum price.

By Mr. Green:

Q. Are you in a position to say the length of time for which the United States government has given a guarantee?—A. I do not know that. I am not familiar with any of the negotiations between the Atomic Energy Commission and Eldorado.

Mr. COLDWELL: It is a question for Mr. Bennett.

By Mr. Green:

Q. Is the government doing any actual exploration work itself?—A. Well the Eldorado company is a Crown company and I presume they are doing something. Apart from that I do not think the government has any interest.

The CHAIRMAN: "Eldorado Mining and Refining Company". I presume there are no questions on that unless in relation to the Atomic Energy Control Board.

"Department of Mines and Technical Surveys". In relation to their activities are there any questions you want to ask Dr. Mackenzie about that subject.

By Mr. Green:

Q. The Department of Mines and Technical Surveys seems to be filling quite an important need in this whole programme?—A. I would certainly endorse that. I would like to pay my tribute to the work they have done. It is very important work—the geological survey, receiving reports and integrating the work. They do a terrific amount of assaying and examination. For instance, in 1952-53 the Geological Survey and the Mines Branch—have examined a total of 11,700 samples. They are operating very effectively. That department always has been in the mining field, and in addition in the metallurgical area they are assisting us in Chalk River. It has nothing to do with mining but has a great deal to do with materials that go into the pile and we have found the cooperation excellent.

Q. They have representatives at Chalk River?—A. Yes.

By Mr. Coldwell:

Q. They do field work in making geological surveys of various ores and prospectors go in afterwards?—A. Yes.

By Mr. Green:

Q. Had they anything to do with finding deposits in northern Saskatchewan?—A. I do not know just how they work in the Geological Survey, but there is very close cooperation. Prospectors and mining people receive reports from the Geological Survey. As I understand it, the Geological Survey takes a very comprehensive view of the broad geological formations and are in a position to give some advice as to what would be a promising area, but I do not think they go into prospecting.

Q. Did they play any part in the discovery of uranium ore in northern Saskatchewan, at Beaverlodge?

The CHAIRMAN: How can you tell how much part they played in any discovery in mining in Canada. All prospectors use the data compiled by the Geological Survey Branch.

Mr. COLDWELL: They actually do not do prospecting.

The CHAIRMAN: No, not as I understand it.

Could I ask the committee if it is their wish to have a witness from that department here at a later stage of proceedings?

Mr. LOW: I think he could come at the time Mr. Bennett comes.

The CHAIRMAN: I should think he might follow after Mr. Bennett's evidence.

Mr. LOW: I was just thinking we might not want to give over a whole meeting to each.

The CHAIRMAN: I could have him here at the same time. I am rather inclined to think when you get into it, it probably will turn out that there is quite a bit of evidence there. If it is your wish then I will make arrangements. I have not made arrangements yet.

Mr. COLDWELL: It is a good idea.

The CHAIRMAN: It completes the information and it is quite important.

Mr. LOW: I would certainly like him to come.

The CHAIRMAN: Now, the "Chalk River Project".

By Mr. Green:

Q. Dr. Mackenzie, has the fact that the main reactor is no longer functioning in Chalk River given you any difficulty in holding your staff?—A. No, we have so much work and so very much interesting work that we can hardly find the men to do the work. The repairs and the work of putting the reactor back is quite a fascinating challenge and everybody is working very hard, and I would say that 90 per cent of the people are working very, very vigorously on the component parts.

By Mr. Coldwell:

Q. I was going to say at the present time you have no difficulty in holding your staff.—A. I do not think so. We can get you the information on that. These days there is a shortage of staff everywhere in all companies. We know that. But I just looked over the list of our top scientific people who were present in 1949 and then noted the ones who have left as of today. A considerable number have left, but in considering this question it is important to know where they go. For instance, we lost one dean of engineering to the University of Toronto. We have lost the head of the physics division in the University of Toronto, and in Queen's, and the head of the engineering division at McGill. We have lost two to professorships in the university. To industry we lost the biggest group, four went to Isotopes Products Limited. It is not a loss to the atomic energy field. Four young chaps went to form that company. Two others went to senior positions in industry, and there were two who went to government.

By Mr. Low:

Q. All within Canada?—A. Yes, and when you think of the very large organization it is more of a compliment than something to weep about.

Q. They are hardly losses to you?—A. They are not lost at all in the Canadian sense, and, in fact, in a real sense Isotopes Products is a gain to the overall picture in Canada. They are doing good work. The university people are really training men and some are acting as consultants. So, all in all, I would not think that our situation in that regard is more difficult than even the universities or government services. I think you will find that young people are naturally mobile. Young people do move around. I do not want to say we have no problems, but I do not think we could establish a particular problem more acute than exists in similar organizations in Canada today.

Mr. GREEN: For instance, by comparison with the National Research Council, what is the situation?

The WITNESS: My own feeling is that there is no difference at all.

By Mr. Gibson:

Q. Is this the first time in the atomic field that we have an opportunity to look at an atomic reactor after it has been working this long?—A. Yes, and it is the first time you will ever be able to look down into the centre. You will be able to look down on the top of the calandria which is down about 10 feet from the opening, and I think you will find it a very interesting experience because you will see how difficult the circumstances are under which we have to work with this new factor of radiation, which nobody has ever had to work with before. We are pioneering in that field of operating in the presence of this agency.

Q. You will be able to get some very interesting metallurgical ideas, I suppose?—A. A very great deal of interest. While one does not want to boast about accidents, I think we can feel that this is the type of thing which makes progress. We have got to have these experiences before we can detail and

new designs and deal with their operation. If we do put this pile back into operation, as we have every hope of doing—you will remember when the committee met last time I think I suggested that this was a declining asset and that it had an expectancy of perhaps five years and we could not do anything about it—in doing that we will really recover a five or 10 million dollar facility we were all prepared to write off. If you look at it in that way, if we can do this I think it is a great tribute to the ingenuity of those engaged in the operation.

Q. Have any of the carbon plants had any accidents of this kind, Doctor?—A. We just do not know. That is a top secret. We do not know of the experiences that the Americans have had.

Mr. Low: I suppose you share freely, though, with the United States any information you gather from this experience?

The WITNESS: Oh, yes, we do, and we think it is a very useful thing to do, and they have been very cooperative and very helpful. Immediately this happened, I had a telephone message from Mr. Dean, Chairman of the Atomic Energy Commission of the United States, to the effect that anything that was in their power to do, they were anxious and willing to do it. They have been very helpful. The people who are actually operating those plants are operating under laws of the land which they have to obey, but personnally they are very, very friendly and very anxious to cooperate in every way they can, and I think that we have been very fortunate and that our policy of giving information to them has paid off very handsomely. We will tell you, when we get up to Chalk River, some of the experiences which we don't want to make public now.

By Mr. Green:

Q. Have you made the Chalk River project available to students coming here from India and Pakistan under the Colombo Plan?—A. Well, we have to clear people. I mean, that is one of the important thing. We are under agreement to do that because we have other people's secrets. When we get people from distant lands, it takes an awful lot of time to clear them and it is almost impossible to clear on a casual basis. We have people from Great Britain, some from Australia, and we have people from other countries, but it is pretty difficult in certain countries to get the necessary clearances.

Q. You have to clear with the United States?—A. Oh, no, no.

By Mr. Coldwell:

Q. Security clearances?—A. You see, we have an agreement that we use each other's clearance systems, and it has been agreed that our security system is as good as theirs so that we do the clearing internally, but we agree on what we will clear for. For instance, people are to be given classified information and we agree that they must be cleared, but they are cleared according to the agencies in the countries we have agreed with.

Q. Have you students from India or Pakistan?—A. I do not think so. We have them in the National Research Council, though.

Q. You have not got them at Chalk River?—A. No, we have to limit the number of students we take there. We are not like the Research Council. We are a little more rigid in our programs than they are; we have definitely fixed programs of work and the students coming in there in the summer are there for training. We have another disadvantage in limited housing facilities, so we are not in the same position as the National Research Council is.

Mr. Low: Is there any special significance at all in the letter designations of those reactors? You have the NRU reactor and the NRX reactor.

The WITNESS: It is very difficult to get an exact answer to that. To me there is not, but probably somebody did conceive the word. We studied, before

we accepted this, about eight tentative code designations. They had to be given some code letters so that we could talk about them. I do not think there is much significance. I think NRX was a code name just for the purposes of hiding the meaning of it.

By Mr. Green:

Q. Are you still using your first reactor?—A. Yes, and it is very busy.

Q. That is the small one?—A. Yes, the small one. It is very busy.

Mr. COLDWELL: Does the so-called accident delay the production of the cobalt bomb?

The WITNESS: Yes, it will delay it, but it is like any manufacturing plant, you do not have a uniform production. You can store isotopes. You can build up a supply. And then when you shut down you are obviously going to feel that some day, but we propose when we start up again to give preference to the production of cobalt isotopes, so that we hope it is not going to be a very serious thing.

Mr. GREEN: When will the NRX reactor be back in operation?

The WITNESS: We have studiously refused to give that data on account of the pressure up there. We just say X months. We told them it had been down three months before. You see, the difficulty of an appointed date is that it is not in our hands. There are deliveries to consider, and as soon as you appoint a date it creates an embarrassment. However, it is a matter of months, and not weeks. Perhaps you will be able to get more information by talking to some of the people there, but I would not set a date. You can see the progress chart there, but I do not want to give any publicity to that. If I told the press that, they would put a date on the calendar and when that date came along they would want to know. I would be very glad to show you our estimates, provided you will realize we do not want to have people saying "you said you were going to do this". We know now that the time is not in our control because it depends on the delivery of equipment, which is beyond our control. That is a very interesting feature. We felt for a long time that the work we would have to do in a case like this would be the controlling factor, but the work is progressing very well indeed as far as we are concerned.

By Mr. Low:

Q. I suppose you have had to design a lot of equipment before it could be manufactured, did you not?—A. Well, we are putting the material back pretty much as it was, but we have to design equipment to do the tearing down.

Q. That is what I thought.—A. They are manufacturing that and that is the difficulty, and when we have to work slowly, deliberately, in the presence of this radiation. In some of these areas you can only work people perhaps an hour a day because you have a tolerance that you must not exceed, which is a safe tolerance as long as they live, and if they get their daily tolerance in 15 minutes you have to withdraw that man from these projects. We do an awful lot of preparation. If a man goes into an area where the radiation is high, then he is trained before he goes in there. He rushes in and he does his operation. He has his protection films on and they are read when he goes in and they are read when he comes out, so that he is under no danger at all. But that means a lot of staff work. If we did not have to worry about the health hazard, it would be quite a simple operation. The whole delay, the whole expense, is due in a major part to this health hazard. If you were not careful about your people's health, you could make very fast progress, but we cannot take any chances, at least we feel we do not take any chance at all.

Q. It is commendable that you are taking as great care as you are.—A. I think it is a unique precaution we are taking in the long term operation of the industry.

Mr. COLDWELL: It has paid off?

The WITNESS: It costs money, but I think everyone agrees we should not take chances, and we feel very definitely we are working under conditions that will be advantageous to the industry and we are refusing to take any risks whatever.

The CHAIRMAN: "Atomic Energy of Canada Limited." Any questions on that?

By Mr. Green:

Q. The NRU reactor is the new one?—A. Yes, that is the new one.

Q. When will it be completed?—A. That, again, is something that depends on how the construction proceeds—it also depends on materials from the United States. We would say, plus or minus, somewhere in the middle of 1955.

Q. That is another two years?—A. Yes. If we put NRX back in operation, you see we will not be so concerned about the early completion of NRU, it will not be so significant. We are not slowing it down but, again, if you hurry these things too much in design you are liable to pay for it. During the war all these reactors were built under a crash program, but as you go along in these very intricate projects, you are continually finding problems on which you want a little more information. You can compromise or you can do something you are not quite sure of, or you can delay it a bit. We feel we will not get some material from the United States before 1955, and I might say their programs are delayed also.

The CHAIRMAN: Are there any more questions?

By Mr. Green:

Q. But the cost is still expected to be about $30 million?—A. Yes; well, that is the order of magnitude. We made our estimates in 1949 or something like that, and I am quite sure that it would not be under that. I feel quite sure that it will go over a certain amount because everything has gone up. The price level has gone up and the experience of everybody with these things is that it is the order of magnitude.

Q. You mean it will be quite a lot more than $30 million?—A. I think it will be more than $30 million, but I do not think it will be very much more. I am merely guessing, but I am saying that was everybody's experience of the last ten years. Consider that period of 1948 to 1949, with its increasing cost levels. You may estimate as of 1948 to 1949. Everybody at that time was thinking that the situation was going to peter off, and that there would be a lot freer competition. But with Korea prices have gone up as well as wage rates and all that, and it seems to me to be reasonable to expect an increase.

Q. You will have estimates as the work proceeds?—A. Yes.

Q. What is the estimate of the total cost now?—A. We have not got an exact estimate. We are going to get one within a short time. The difficulty is that you have to have development contracts and you cannot estimate until you get the final plans worked out. The plans and the control devices are not designed yet. As to the building, and the bricks and the stone, you can do that; but nobody likes to go out on a limb and estimate if he is going to be held to it, until he can see the thing clearing up. For instance, material is going up very rapidly. The price we pay for uranium is going up terrifically and we have no control over that.

Q. Who does have control over the price of uranium? Is it the United States?—A. Yes.

Mr. COLDWELL: You are entirely dependent on the United States as far as the price goes?

The WITNESS: Yes; and it in turn is a reflection of other prices. The Canadian price has gone up. When we went into it, do you remember what it was?

Mr. JARVIS (Secretary of the Atomic Energy Control Board): It started out at two seventy-five.

The WITNESS: And it is now?

Mr. JARVIS: The maximum is seven twenty-five.

By Mr. Low:

Q. Is the Canadian price parallel with that of the United States?—A. We do not know. The United States buy uranium all over the world. I do not know what the prices are. The prices are not uniform; they go according to the expense of getting it.

Q. Would Eldorado pay the producers in Canada the price which the United States would offer Eldorado?—A. They would be negotiated. That is the sort of thing that happens.

Q. Yes?—A. And we have not got any control over that.

Q. I see.—A. And the firms are tied up with war contracts and that makes your costs go up.

The CHAIRMAN: Are there any more questions on "NRU reactor"? Are there any questions in connection with "Atomic Energy of Canada Limited"?

Mr. LOW: The minister of that department is the Minister of Trade and Commerce. Is that correct?

The CHAIRMAN: Atomic Energy of Canada Limited is responsible to the Atomic Energy Control Board, and it, in turn, is answerable to—what is the full name of that committee of the Privy Council?

The WITNESS: The Privy Council Committee on Scientific and Industrial Research.

The CHAIRMAN: And the chairman of that committee of the Privy Council is the Minister of Trade and Commerce.

Mr. LOW: That is rather a complicated relationship?

The CHAIRMAN: So what it amounts to is that all the boards and crown companies concerned with this program are answerable to the Minister of Trade and Commerce with the exception of Eldorado, which is answerable to the Minister of Defence Production. I think that is the legal position.

Mr. LOW: You must have a terrible time in getting together.

Mr. GREEN: I guess there is no doubt about who is the boss. Then Atomic Energy of Canada Limited is a Crown company. That is correct, is it not?

The CHAIRMAN: Yes, that is correct.

By Mr. Green:

Q. It is set up to carry on, or to direct the business activities in connection with atomic energy?—A. Of the Chalk River establishment.

Q. May we see the balance sheet for that company?—A. We could certainly show you the balance sheet that we took over, when the company took over from Atomic Energy Control Board, or National Research Council, in April 1952. We have a prepared balance sheet which you could see.

The CHAIRMAN: There is no objection that I can think of to your seeing the balance sheet, except that one year has yet to elapse.

Mr. GREEN: One year?

The WITNESS: You can see the starting balance sheet.

The CHAIRMAN: Yes, you can see the starting balance sheet and there will be no objection except that one year has not yet elapsed.

Mr. GREEN: What about the salaries; can we see them too?

The CHAIRMAN: I will see about that.

By Mr. Coldwell:

Q. If they are commensurate with the salaries paid in other government departments, they would not be at all terrifying, when compared with industry. —A. Yes.

Q. They are relatively lower.

Mr. GREEN: How is the Board made up?

The CHAIRMAN: What is that again?

By Mr. Green:

Q. How is the Board of the Crown company made up? What was the set-up for the Board?—A. The Board has nine directors.

Q. They are listed on page 5?—A. Yes.

Mr. LOW: Did you mean in your question: how did they select them?

By Mr. Green:

Q. Yes. How did they select them? What was the plan in setting up the Board?—A. They are really appointed by the stockholders, by the government of Canada.

Q. Which minister appoints them, the Minister of Trade and Commerce or the Minister of Defence Production?—A. It would be done by the Committee of the Privy Council.

Q. There appear to be power men on the Board.—A. That is right.

Q. And production men as well?—A. Yes.

Q. Just what was the plan in setting up the Board?—A. I cannot speak for the minister, but as I mentioned some time ago, it became obvious that if you are going to move into the power field, you want some one with power operating technique. That seems to be the way to open up all the technical facilities of Canada. For instance, when the Hydro Electric Development took place, it did not take place on the initiative of the men who manufacture electrical equipment. The initiative was in the operating people who, in turn, looked into the picture and then wrote specifications of what equipment they wanted; and then the manufacturers manufactured that equipment. That led to the opening up of the entire resources of the country. And it seemed that that was the reasonable way to do it.

We have power people, and the people who also have had a great deal of experience and initiative in the original power work. I cannot say that is the reason, but that certainly justifies the establishment of the Board.

We have Dr. Gordon who is a university man and who has had experience as a member of the National Research Council for many years, and who understands these different projects. Then we have Mr. Scully who has been Deputy Minister of Income Tax and is now comptroller of the Steel Company of Canada, Limited. He has knowledge of the set-up and the general accounting set-up. And we have in the scientific end along with Dr. Gordon, Mr. Birchard who, as vice-president of the National Research Council, understands its administration and the general set-up. I do not think this policy was ever laid down, but that is the way it seems to work out.

Q. You have no representatives from either the far west or the far east on the Board. Should there not be some representatives from those parts of the country?—A. Well, you have a very serious problem in getting these groups together quickly, and there is a terrific expense. You have people whose interests are pretty wide.

The CHAIRMAN: The major part of Mr. Bennett's operations are in the west and in the northwest.

Mr. GREEN: Mr. Bennett has farther to come than someone from British Columbia.

Mr. COLDWELL: Is it wise to consider representation on a geographic basis rather than on a basis of competence and efficiency? I suppose that is the reason?

The WITNESS: These people are all chosen on a personal basis, but we are trying to get a spread. For instance, Mr. Gaherty is president of the Calgary Power Limited, and is also president of the biggest power company in Nova Scotia; and he certainly does cover in his interests a very wide territory. I think the only argument you could put up is that British Columbia Electric is not in it. But we do more than this. We have adopted a policy of conferences with people who are interested, and it serves the same purpose of keeping in touch with developments. And we will take in British Columbia interests in that way.

By Mr. Green:

Q. Does this Board meet every week or ten days?—A. It has met that often. Sometimes once a month; but during the formative stage we met very frequently; and in cases of necessity, we would have group meetings. Our meetings would not be uniform like that over the year, but there might be times when we would have three or four meetings.

Q. In view of the fact that atomic energy would appear to be of more use to such areas as the Maritimes and Saskatchewan, in so far as power development is concerned, it would appear to be worth while to have more representatives on the Board directly from the Maritimes and also from British Columbia?

The CHAIRMAN: Would you knock out the general manager and the chief engineer of Hydro Electric of Ontario in order to give geographical representation to an area where you are going to use power? Is it not better to have representatives from areas where they have power developed than from areas which have not now got it? If you chose your representatives according to a geographic plan, you would be picking most of the men from areas where they have no power.

Mr. GREEN: I do not suggest that any should be taken off, but I do think the Board should be enlarged to take in some representatives from the Maritimes.

The CHAIRMAN: But would you not then get an unwieldly Board, just as was the experience of this Committee?

Mr. COLDWELL: It seems to me that the Board now is composed pretty much of power people, and if you appointed power men from British Columbia—

The CHAIRMAN: They would have a majority.

Mr. COLDWELL: Yes. You would have an overloaded Board, I would think.

The CHAIRMAN: Of the nine directors, four have power experience; and if you increase the number of power representatives, you then give the power representatives majority control of the Board. This would not be desirable with respect to the scientific and research end of such operations.

Mr. GREEN: What about the dean of engineering from Dalhousie, or somebody from there?

The CHAIRMAN: Does the dean of engineering from Dalhousie work on atomic energy in the University research work? The dean of the graduate school of engineering at Toronto does.

Mr. GREEN: This is too big a thing not to have all parts of the country actively tied in with it.

The CHAIRMAN: I think all parts of the country are actively represented in it now. For instance, take our chairman. His early history, I think, was in Saskatchewan. How do you identify any of those men with any part of the country?

Dr. GORDON: I do not know how you identify him with any part of the country. I do not know what part of the country we identify Mr. Scully with.

Mr. LOW: I should think you would want the very best directors you could get, the men best qualified to do the work irrespective of their geographic qualification. We have one from Calgary.

The CHAIRMAN: Is he from Calgary? Do we charge him to Nova Scotia or Alberta?

Mr. LOW: He gets his mail in Calgary anyway.

Mr. COLDWELL: I do not think the geographical situation should be over-riding.

Mr. GREEN: All I ask is that some thought be given to the subject.

The CHAIRMAN: What about "University Research"?

By Mr. Coldwell:

Q. Can you tell us something about that, Dr. Mackenzie?—A. The university research has not changed a great deal since the 1949 meeting. You remember that I indicated at that time that the policy of the Board was to support equipment or accelerators at the universities rather than place that equipment at Chalk River, and that we adopted the practice of accepting for any particular accelerator the first proposal put before us providing the university putting it before us was competent and could make proper use of it. We then supported the capital expenditure to roughly 50 per cent and under that category is the Van de Graff generator in British Columbia, the betatron in Saskatchewan, the synchroton at Queen's and the cyclotron at McGill. There was the Cockcroft-Walton at the University of Montreal, and the chemical laboratory at McMaster. Then, after these were built we have supported them by annual grants according to their needs and the amount of work they were doing. We make an annual grant to these universities to help them operate these plants. That is a very useful arrangement. I think it is much less expensive than if we tried to put the whole thing at Chalk River and it also brings in the universities who are specialists in these fields and all the work they do is open to us. Generally speaking it is unclassified work, but it is very useful to us. We think it is a system that is highly commendable.

Q. Have you expanded it at all?—A. We have not expanded it since 1949.

By Mr. Low:

Q. Will this work continue under the Atomic Energy Control Board or under the National Research Council?—A. This is the Control Board, but we use the National Research Council's machinery. I should have mentioned that since the last meeting we have expanded these grants into two other fields. The metallurgical field was not covered in the other and the isotope development, which we are interested in expediting at the moment.

By Mr. Gibson:

Q. Do you actually get information from them valuable to you, or is it more a training school for young fellows you might use later?—A. Both. For instance, might I explain it this way. Radioactive isotopes, certain isotopes are made by putting in extra neutrons which we could put in the Chalk River pile. You can make isotopes by putting extra protons in as well which we cannot do in a pile but you can in an accelerator and with certain of the devices you get quantitative results which you cannot get with a pile. So all these are useful to fill in the technical information. At the same time they are training personnel.

By Mr. Green:

Q. Do we make use of the provincial research councils?—A. No.

Q. Are all universities in Canada participating in the plan?—A. No.

Q. Which ones?—A. Just these six.

Q. Which ones?—A. I mentioned the six, British Columbia, Saskatchewan, Queen's, McGill, Montreal, McMaster.

Q. The University of Toronto?—A. No. It would be a great mistake, if I may say so, for all the universities to concentrate in one field. There would be no sense in everybody allowing universities to go into the field because there are so many other activities and we would only support those universities which were in that field to start with and had special teams. For instance, Dr. Thode of McMaster University was an international authority and obviously it is an extension of his work; at McGill, Dr. Foster had his cyclotron plans drawn up in 1938 and he had been a nuclear physicist in good standing; at Queen's, Dr. Gray was a distinguished physicist and he had done a lot of nuclear work; and at Saskatchewan there is a very effective group. They have a combination of chemists and physicists and medical work and it is one of the really first class groups. We did not think it was our job to go in and say to the universities you should do this and that, and we also felt we could not afford to support more than one of these groups. We have one cyclotron in Canada at the moment and that is adequate.

Q. Would it not be helpful if the other universities were taking a part as well, both for the scientific end and the training?—A. It is not by any means the only scientific activity in Canada and it would be very wrong to take all the universities of the country and put them all on atomic energy. For instance, there are very broad fields that the University of Toronto is attacking, and other universities. Among them is the low-temperature field which is very important and they are getting help from the National Research Council. I think it is a pretty good picture speaking generally and I think most universities would agree. In the metallurgical field we are supporting metallurgical work at B.C. and Alberta, on the same basis.

The CHAIRMAN: Any more questions as to "University Research"? "Distribution of Isotopes".

By Mr. Gibson:

Q. Doctor, I see you sent some to Ann Arbor—this Cobalt 60 for the sterilization of foods. I was wondering how much repercussion it is going to have on the economic field if we could sterilize meat. Would it have any effect on closing butcher shops or things of that kind?—A. I would not think so. I think the main field would be to sterilize products which are sterilized in some other more expensive way.

Q. You mean by heat?—A. By radiation—instead of boiling you do it by radiation. Our main interest is in the economics of production. If we could find out some mass use of those things it would be very satisfactory. This is

something a lot of people are interested in. And everything of that sort that was successful would mean that our project would be able to make material out of waste.

Q. Is it conceivable things might remain fresh and yet be sterilized?—A. I think that that is what you would have to aim at. If you deteriorated them, it would not be adequate.

Q. They would be packed, but you would not have to cook them, is that it?—A. I am speaking from general knowledge only, but that would be my feeling that you would be able to sterilize material from the outside and without boiling or whatever agency they put in. But I do think there are a number of fundamental problems to be attacked before it is solved. I understand some of the preliminary tests have changed the taste of certain things and if you change the taste or colour or odour it would be something that might not be acceptable. It is merely in the experimental stage, but it does interest people.

Q. It has tremendous economic possibilities I think?—A. Yes.

Mr. GREEN: You couldn't make an Atlantic salmon look like a Pacific coast salmon?

Q. What is the basis used in providing a cobalt bomb, who pays for it?—A. It is a commercial proposition.

Q. You sell it?—A. We sell it. Before we became a company the commercial products division of Eldorado was the chief agency for our isotopes and they developed the application of the therapy unit and carried it on as a commercial proposition. We took that division over and it is carrying on as a commercial division.

By Mr. Gibson:

Q. How do you figure out the cost of getting a pound of cobalt 60?—A. We are getting at the point where we do know or at least where we can appraise it. You see, if you can establish a price of plutonium then you can go one step further and establish the value of the neutron that made the plutonium. Now, cobalt 59 bombarded with neutrons makes cobalt 60. So, if you can place a value on the neutron, you can place a value on the cobalt 60. While it is not mathematical, it is getting to a point—at one time you could not price anything.

By Mr. Green:

Q. The hospitals have to pay you for the cobalt bombs?—A. Yes.

By Mr. Coldwell:

Q. How did they run across this?—A. It is merely a natural sequence from radiation. You treat people with radition and x-ray machines come in and do the same thing and when the piles came into operation it became obvious we could make cobalt 60 which had many advantages over radium or x-ray machines and we could get more in concentrated form and move it around to the patients. The whole thing is a very small physical unit and it is movable. Our project was interested in radioactive cobalt and the Eldorado Commercial Products Division conceived the idea of making the whole equipment; so did Saskatchewan. We provided a source to the University of Saskatchewan and they made the assembly.

Mr. COLDWELL: I saw it in operation and very effective it is indeed.

The WITNESS: Various people in parts of the world get interested in it. It is not a completely novel idea. It flows I think out of radium and x-ray machines. And it is possible something else someday will be found better than cobalt, but the fundamental thing is getting these high rays so you can treat the growth inside, the deep growth, without affecting the skin.

By Mr. Coldwell:

Q. It is more powerful than anything else?—A. It is per unit size.

By Mr. Green:

Q. What is the cost of a cobalt bomb?—A. You mean the whole assembly?

Q. Yes.—A. $60,000 or something like that.

Q. How do you decide to which centers they will go?—A. It starts on a commercial basis. You start out and nobody wants them and then you get orders. It is not quite so simple as we have to modify our decision by the use it can be made of in safety, and we have an advisory committee of medical men to determine or advise us whether or not it is safe to ship any isotopes for clinical use. Obviously, when it is dangerous to humans we are not, as a civilian organization, going to take that responsibility and we have this advisory committee which is made up of a panel of first-class radiologists. There is one from B.C. I might say.

Mr. GREEN: Good.

The WITNESS: They might say to us, it is not safe to let one of these units go to hospital "Z" because there is no one there competent to handle it and it will be more dangerous to patients and they might also say you will only treat one patient there whereas in another center you could treat 1,000 a year.

By Mr. Coldwell:

Q. Is the apparatus designed on the same principle as the one at Saskatchewan? Was it designed there?—A. No, it was designed in the Eldorado.

Q. But they are all on the same principle, are they?—A. Yes, though they do not necessarily look alike, but what you have to do is to play this beam on various parts of the body and move the beam around like this. If they are treating a thyroid they want it to go in here and here and here and on all sides, so they can get a very intense radiation inside without hurting the skin. That means we have to get the machines going in three directions in rotation. It is not the same in all its physical configuration, but the actual ultimate purpose it the same.

Mr. COLDWELL: It is interesting to see a patient marked with little crosses on the body for this tiny, tiny ray.

The WITNESS: I saw two of them treated the other day and I was quite impressed.

(Discussion took place off the record.)

The CHAIRMAN: Any more questions?

By Mr. Green:

Q. Do you have much demand for the cobalt bomb?—A. Yes, there is quite an order list.

Q. More than you can supply?—A. Well, more than we could supply instantaneously. There is a very healthy situation in the relationship between what we can produce and the demand. An institution might have to build a building for the bomb and they might not want it for 18 months or two years.

Q. You mentioned using isotopes to tag fish the other day. Is that a practical application?—A. Yes.

Q. How do they do that?—A. —You have some of the food that the fish would take normally and you substitute or put in a radioactive atom in the compounds. They eat it just as an individual takes iodine. You could take iodine salt and put in a radioactive isotope, swallow it, and then follow it through the body with a geiger.

Q. Do isotopes lose their potency after a certain time?—A. Yes.

Mr. Low: That means some of us who are fishermen have to take a geiger counter?

The WITNESS: You just put the salt on the tail and catch the fish.

By Mr. Green:

Q. How about testing the fish with a geiger counter? What do you hope to find in one of these fellows who has been injected?—A. It would just merely identify the fish or identify his food source. We find some very interesting things on some of the theories on how the steps went from the very lowest forms of life up through the smaller plant forms, then to fish and then to humans and they found through isotopes that some of the radioactive material is blocked along the line. If you do not have bacteria the fish could not take it directly and it is a theoretical thing, but for the scientists it illuminates the step which is very interesting.

The CHAIRMAN: "Health precautions in connection with Radioisotopes". Any questions?

The WITNESS: May I interject a remark here. I think one of the interesting things is the growth in the use of isotopes. You remember at the previous committee sittings there was a lot of discussion about the lack of industrial use of isotopes. You will remember I said in commenting on it that the actual orders showed an indication of the interest and I listed about 47 to 49 examples of requests and inquiries we knew about at that time. This year the latest information is that—as against those in 1949 our shipments have gone up from 207 to 1,100 and the number of users has gone up from 20 or 30 to 102. In the States they have about 1,000 users and we have 100 to their 1,000, and that is very good, and I think they supply about 470 industrial organizations according to their last report, and we are supplying, we have somewhere around 40 to 50. So the picture is changing very much. I think we are safe in saying that the Canadian universities, Canadian hospitals and industries are making very full use of isotopes in comparison with other countries.

By Mr. Coldwell:

Q. What types of industries use isotopes?—A. It is pretty well spread all over the place and usually wherever there is any scientific laboratory you find users. We do not follow all these users because it is more or less on a commercial pattern and the Isotopes Products, this new company, purchase a lot of isotopes and then pass them into equipment and work with other commercial companies. We have a right to inquire and I suppose some of our technical officers know but we do not think it is the proper thing to do but generally speaking it is used in radiography.

Mr. LOW: We saw a very interesting application of it down at the Massey-Harris plant where they were using it for the surface tempering of steel—just the surface alone.

The WITNESS: I feel personally that the picture has completely changed from what it looked like in 1949. There is participation in this which also means it is a going concern now and it is increasing every year.

Mr. GREEN: It is very encouraging.

The WITNESS: Yes, it is encouraging.

The CHAIRMAN: Page 7. Any questions on "Civil Defence"?

By Mr. Green:

Q. Is there anything extensive being done in that field?—A. We have nothing to do with civil defence. We merely provide them with any information they ask us about and we assist them, but we have no responsibility or connection with the actual work.

Q. You have had extensive experience as the result of the accident at Chalk River in the way to handle radioactivity? Are you taking any steps to spread that information to the civil defence organizations across the country? —A. We would not do it through the country. We would pass our information around to the headquarters whoever was responsible for doing it. I suppose they have been up to Chalk River—the Department of Defence has been there.

Mr. GREEN: That comes under the Department of National Health and Welfare. Civil Defence is under National Health and Welfare. I would think your experience there would be invaluable to civil defence organizations across the country.

The WITNESS: It is, but that will all be available to them. Our experts have gone through this. They would not individually be of much value to us there, because the people that we want at Chalk River, mechanics and pipefitters, people who come in and work, are the ones we look after, but undoubtedly this information will become available to them. I am sorry I cannot say definitely whether they have been up there. The army had decontamination teams there right after the accident, and they are in close touch with the situation all the time.

The CHAIRMAN: Any more questions on that point?

"International Relations"—we dealt with that earlier.

"Changes since 1949"—I think we dealt with that.

Now, "Production and Uses of Radioisotopes". Are there any questions on that?

By Mr. Murray:

Q. Is the Charles E. Frosst Company manufacturing isotopes for commercial use, or are they simply pioneering this field?—A. They take the isotopes from Chalk River and incorporate them into medicinal compounds, and the reason we have to use a pharmaceutical company is that the ultimate product has to be certified for human use. One can do work experimentally in a chemical laboratory with our products, but when the products are to be used for human consumption they must be sterilized, and so forth, and we must have behind us the certificate of a pharmaceutical company experienced in this type of work.

Q. Are they the only firm, Doctor, at the moment who are doing that?—A. They are the only firm. In 1948 we asked for bids from all of the pharmaceutical companies, on the advice of the medical people, who said we must have this available in Canada, and the Frosst tender was the best. Actually, most of the companies wanted money to do this and the Frosst Company said they would do it for nothing, which means they had to put up money; they had no profit in this for a number of years, but they did it on the basis that eventually it might be profitable.

The CHAIRMAN: Any more questions?

Mr. COLDWELL: I move we adjourn.

The CHAIRMAN: The meeting is adjourned.

The meeting adjourned.

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament
1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE

No. 3

WEDNESDAY, MARCH 25, 1953

including

Chairman's Summary of Chalk River Visit on March 13-14.

WITNESS:

Mr. William J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited, and President, Northern Transportation Company Limited.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

ERRATA

Evidence No. 1, March 4, 1953

Page 15: In the sixth last line, delete *"1,000"* and substitute *"1,600"*. In the fifth last line, delete *"2,000"* and substitute *"24,000"*.

Evidence No. 2, March 9, 1953

Page 24: In line 33, delete *"245"* and substitute *"235"*. In the sixth last line, delete *"implement"* and substitute *"supplement"*.

Page 35: In the thirteenth last line, delete *"peter"* and substitute *"level"*.

Page 39: Delete the fifth paragraph beginning with "Dr. Gordon:" and add to the fourth paragraph the following words: *"Take Dr. Gordon: I do not know how you identify him with any part of the country. I do not know what part of the country we identify Mr. Scully with."*

MINUTES OF PROCEEDINGS

WEDNESDAY, March 25, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 10.00 a.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Brooks, Coldwell, Gibson, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Murphy, Murray (*Oxford*), Pinard, Stuart (*Charlotte*), and Winkler.—(12).

In attendance: W. J. Bennett, Esq., O.B.E., B.A., President and Managing Director, Eldorado Mining and Refining Limited, and President, Northern Transportation Company Limited.

The Chairman tabled a list of corrections for the record (See *Errata*).

Mr. McIlraith informed the Committee he was supplying to the Clerk of the Committee his summary of the visit to Chalk River on March 13, and 14, for incorporation into the record, which is as follows:

Members present: Messrs. Brooks, Coldwell, Gibson, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Murphy, Murray (*Oxford*), and Stuart (*Charlotte*).—(10).

On March 13, the above members of the Committee made an inspection tour of the plant and, following introductory remarks by Dr. C. J. Mackenzie, heard classified evidence given "off the record" by the following officials:

Dr. David A. Keys, Chairman of the Co-ordinating Committee, Atomic Energy of Canada Limited;

Dr. A. J. Cipriani, Director of the Biology and Radiation Hazards Control Division;

Dr. R. M. Taylor, Director of the Medical Division;

Dr. L. G. Cook, Assistant Director and Head of the Chemistry Research Branch;

Dr. W. B. Lewis, Vice-President in Charge of Research and Development; and

Dr. C. J. Mackenzie, President, Atomic Energy Control Board, and Atomic Energy of Canada Limited.

On March 14, an inspection of the village of Deep River was made.

Mr. Bennett was called and read into the record briefs on the history and operations of Eldorado Mining and Refining Limited and of Northern Transportation Company Limited.

At the conclusion of Mr. Bennett's evidence, it was agreed to reserve questioning thereon until the next meeting of the Committee.

At 11.30 a.m. the Committee adjourned until 10.00 a.m., Monday, March 30.

A. SMALL,
Clerk of the Committee.

72235—1½

EVIDENCE

MARCH 25, 1953.
10.00 a.m.

The CHAIRMAN: I see a quorum. There are some errata which I want to put on the record. They are very short and non-technical.

(See Errata).

I propose to put in a short summary of the meeting at Chalk River, just a summary of the fact that there was a trip there. I presume that will be agreeable.

Mr. MURPHY: The gentleman who spoke in the afternoon was?

The CHAIRMAN: Dr. Cook.

Mr. MURPHY: I suppose he had a prepared speech. Could you make that available?

The CHAIRMAN: I shall check that, and if it is in a form capable of being published, we will distribute it.

Mr. MURPHY: I think he said that he had some extra copies. I thought we would like to have it because we have his former speech.

The CHAIRMAN: I shall check that.

This morning, we have with us Mr. W. J. Bennett, President and Managing Director of Eldorado Mining and Refining Limited. I asked Mr. Bennett to prepare a brief dealing with the Eldorado operations. If it is your wish, I shall now ask Mr. Bennett to speak.

Mr. W. J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited, Ottawa, called:

Mr. MURPHY: Have you got copies of your brief?

The WITNESS: I can get copies for you later in the day. I have been operating on a rather tight time-table and I did not get my brief into final shape until late yesterday. My secretary did not have enough time to make copies.

Mr. MURPHY: We can get our *Hansard* copy about as soon as we could get them.

The WITNESS: Yes. We could get out copies for you, but it would take the rest of the day.

Mr. MURPHY: That will be all right.

The CHAIRMAN: Mr. Bennett.

The WITNESS: Since this is the first occasion on which I have had the privilege of appearing before your committee, I have thought that it might be helpful if I were to tell you something of the History of Eldorado Mining and Refining Limited, its Organization and Current Activities, its Financial Affairs, and its Purchasing Policy. While these subjects are interrelated, I think it may be useful to an understanding of our work if I discuss them under separate headings.

History

The present company, Eldorado Mining and Refining Limited, is the successor to Eldorado Gold Mines Limited. The latter company was incorporated in 1926 for the development of a gold property in the province of

Manitoba. This property was closed in 1929. The surplus funds then in the company's treasury were used to carry out an exploration program in the Northwest Territories. The result is now a part of the mining history of Canada. Pitchblende was discovered in May 1930 on the southeast shore of Great Bear lake at a point now known as Port Radium. Mining at Port Radium began in 1932. In 1933 a plant was built at Port Hope, Ontario, to refine the concentrates produced at the mine.

I think it important to note that the company's principal product in the years prior to the war was radium for use in therapy and in luminous compounds. There was some production of uranium for the ceramic industry, but this was of little consequence. Before the discovery of the Great Bear lake deposit, the Belgian Congo was the major source of radium. The Congo is still the most important single source of both uranium and radium, although there is now every indication that production elsewhere will equal and perhaps surpass that of the Congo. Radium produced from the new source in Canada, both because of the location of the property and because of the difference in the grade of the ore, was never seriously competitive with radium produced in the Congo. However, the entrance to the field of a new producer did have the effect of destroying a monopoly position with the expected result—reduced prices. This reduction, while undoubtedly beneficial to mankind, was not particularly helpful to the treasury of Eldorado. The company at no time earned a dividend during the years when radium was its principal product.

With the dislocation of markets which followed the invasion of western Europe by Germany in 1940, it was decided to close the mine at Port Radium, and to confine the company's activities to the sale of radium then in inventory.

The rest of Eldorado story is a part of that remarkable achievement, the atomic bomb. We are told in the fourth volume of Mr. Churchill's memoirs of his meeting with President Roosevelt at Hyde Park in June of 1942 and the decision which emerged from that meeting that the United States would embark on this vast, costly, and highly speculative undertaking. The work was entrusted to the United States army engineers and given the name of the Manhattan Project. Canada was a partner in this enterprise from its inception. Our possession of the most readily available source of uranium and of the only plant on this continent capable of refining uranium would have brought this about, apart from other considerations. In 1942, Eldorado Gold Mines Limited was given a contract to produce uranium for the Manhattan Project. The mine was re-opened in the summer of 1942 and production began in August of that year. Before concentrates from Port Radium were available for refining, The Eldorado Refinery at Port Hope accepted a contract for the refining of uranium from the first shipment of Belgian concentrates to reach this continent. In July 1943, the name of the company was changed to Eldorado Mining and Refining Limited, since the old name was hardly descriptive of the company's new activities. The new company, like its predecessor, had a provincial charter. On January 28, 1944, the Government of Canada expropriated the shares of Eldorado Mining and Refining Limited. Some months later application was made for Dominion charter. The new company was given the name of Eldorado Mining and Refining (1944) Limited. During the past year, the "1944" has been eliminated from the company's title.

Throughout the war years, the company continued to supply uranium to the Manhattan Project. With the end of the war, there was some reason to believe that the atomic weapon program would be reduced in line with the then prevailing policy of the United States government of cutting back arms production. As it happened, the program was expanded. I do not pretend to know all the reasons for the adoption of a policy which on surface, at least, appeared to run counter to the common policy. Possibly the most important

single factor was the complete failure of the western nations to reach agreement with the U.S.S.R. and her satellites as to the future control of fissionable materials and atomic weapons. In this connection, you will recall the Baruch proposals and the protracted and acrimonious discussions which followed their submission to the United Nations in 1946. In any event, it is sufficient for our purposes that the decision of the United States government was a most prudent one, having in mind subsequent international developments. The Government of Canada in its turn decided that the wartime partnership should be continued. In terms of raw materials, this meant that we would not only continue to supply uranium to the United States Atomic Energy Commission, the successor to the Manhattan Project, from our existing sources, but that we would make a vigorous attempt to find new sources. This brings me to my second heading.

Organization and Current Activities

At the time of the expropriation of the company's shares, there was no disturbance of management or change in operating practice, and to this day the company has continued to operate as does any other mining company. Its shares are held in trust for Her Majesty by the Minister of Defence Production to whom its board of directors reports.

The directors of the company are:

Dr. W. F. James, Consulting Geologist, Toronto.

R. T. Birks, Q.C., Barrister & Solicitor, Briggs, Frost, Birks & Langdon, Toronto, President of Consolidated Howey Gold Mines Ltd., and East Malartic Gold Mines Ltd.

Eldon L. Brown, B.A.Sc., Mining Engineer, President and Managing Director, Sherritt Gordon Mines Ltd., Toronto.

J. A. MacAulay, Q.C., Barrister & Solicitor, Aikins, MacAulay, Thompson & Hinch, Winnipeg.

Fraser D. Reid, B.Sc., L.L.D., Consulting Engineer, Toronto.

C. G. Williams, Mining Engineer, formerly Professor Mining, University of Toronto.

W. J. Bennett, President and Managing Director, Eldorado Mining & Refining Ltd., Ottawa.

It will be noted that all of these directors, with one exception, are either by profession or association, in close touch with the mining industry.

The head office of the company is located in Ottawa. The head office organization comprises the president and managing director, the treasurer, the secretary, and their respective staffs.

I said a moment ago that the company operates as does any other mining company. This being so, its organization is similar to that of other mining companies. It has three principal divisions—exploration, mining, and refining, which I shall discuss in that order.

The Exploration Division is responsible for prospecting, the staking of claims, the surface exploration of claims by diamond drilling, trenching, etc., the underground exploration of claims, aerial surveying, geological mapping, and all the other types of activity which are embraced by the word "exploration". The division has a general manager, who reports to the president and managing director. This officer is assisted by the company's consulting geologist, Dr. B. S. W. Buffam, and by a competent staff of geologists. Prospectors are engaged on a seasonal basis in accordance with the usual practice. The terms of payment and reward are covered in a prospector's agreement which provides, in addition to salary, a reward of $1,000 for the discovery of a pitchblende occurrence and for the payment of a further bonus of $20,000 and of royalties up to $150,000 as, if, and when, there is production from a deposit.

The Mining Division is responsible for the operation of the company's two producing properties at Port Radium, N.W.T., and Beaverlodge, Saskatchewan. Because of the distances involved, these two operations are separate establishments, each with its own manager reporting to the president and managing director. I shall have something to say at a later point of the nature and scope of these two operations. For the present, I shall say simply that they are similar in most respects to other mining operations in remote areas.

The Refining Division is responsible for the operation of the refinery at Port Hope, Ontario. This division also has a manager who reports to the president and managing director. The word "refinery" is something of a misnomer. Actually, the refinery is an extension of the concentrating or milling process, which is normally undertaken at a mine. For example, in most gold mines, the concentrator or mill is able to bring the product to the purity required by the purchaser. In the case of uranium, the large quantity of chemical reagents involved in the final concentration has made it more economic to bring the rough concentrate to the source of reagent supply rather than to bring the reagents to the mine site. This will explain the present location of the company's refinery. The product of the Port Hope refinery is a uranium black oxide. The refinery is also producing radium and a smelter product containing cobalt.

In addition to these operating divisions, the company has two service divisions—the Aviation Division and the Northern Transportation Company Limited, which is a wholly-owned subsidiary.

The Aviation Division is responsible for handling the transportation of personnel, perishables, and emergency freight to the company's various operations north of Edmonton. The division is now operating a DC-3 aircraft and a C-46 aircraft in its transport service, and a Norseman aircraft and a Fairchild aircraft for the Exploration Division. The operation is based at Edmonton where hangar facilities are maintained for maintenance and general overhaul. The company has constructed and maintains airport facilities at Port Radium and at Beaverlodge. Perhaps a few figures may indicate the scope of the air operation. During 1952, 854,000 miles were flown for a total of 4,900 flying hours.

The Northern Transportation Company Limited operates a water transportation service over the entire Mackenzie watershed. Since this company is a subsidiary, I will deal with its history, and its organization and activities in a separate section at the conclusion of my remarks on the parent company.

With this brief comment on Eldorado's organization, I come to a description of its activities, particularly in recent years.

I have mentioned the decision of the government of Canada that Canada would continue the wartime partnership with the United States in the field of atomic energy. What have we done in implementation of this policy in the field of raw materials? More specifically, what have we done about increasing production from existing sources, and what have we done about finding new sources of production?

At the end of the war, the Eldorado mine at Port Radium faced two problems—depleted ore reserves and an inadequate ore dressing process. Both of these conditions were the result of the mining practice followed during the war years when the objective was to obtain as much production as possible in as short a time as possible, regardless of the effect on the mine's postwar fortunes.

A large-scale underground development program was launched in 1947 in the hope that ore reserves could be restored to a normal level, and if possible, increased. I am glad to be able to report that this program proved successful. The ore reserve position at Port Radium is today healthier than it has been at any time since the opening of the mines. The mine has now been developed at

eleven levels to a depth of 1,300 feet. An internal shaft is being sunk from the 1,100-foot level which will permit development in the area northeast of the main shaft at five levels to a depth of 1,925 feet. The nature of the deposit at Port Radium is such that it appears unlikely that it will ever be possible to block out ore reserves beyond a four or five-year period. However, this is of no particular concern, providing it is possible to maintain a four or five-year reserve which has been the case thus far.

In 1946, the Mines Branch of the Department of Mines and Technical Surveys began an intensive research program in an effort to improve mill recoveries at Port Radium. The objective was to improve the existing process or to develop a new process which would increase mill recoveries. The ore dressing process in use prior to the war and during the war involved concentration by gravity or mechanical methods. As indicated above, this method proved inadequate during the post-war years because of the nature of the ore then available for mining. The mines branch was able to develop a leaching process which would permit the recovery of a large part of the uranium in the residues from the gravity concentrator. Fortunately, the residues from the gravity mill had been impounded since the re-opening of the mine in 1942. Last May, a new leaching plant, built at a cost of $2 million, was brought into operation. This plant will treat both current and stored residues. Its operation, together with the operation of the gravity plant, will increase production at Port Radium by approximately 75 per cent. The average payroll at Port Radium is 250. Its annual operating budget is approximately $4 million.

Eldorado began to look for new sources of uranium late in 1944, but it was not until 1947 that the exploration program reached major proportions. In that year, a large number of radioactive occurrences were located and staked in the vicinity of Beaverlodge Lake in northwestern Saskatchewan. One of the claims, at Martin Lake, was explored from an adit driven during the latter half of 1948 and the early months of 1949. During this same period, two other groups of claims, the Ace and the Eagle, were explored with surface diamond drilling. On the basis of the results of these diamond drilling programs, it was decided to sink prospect shafts on the Ace and Eagle claims. This work got under way late in 1949. By April of 1951, it was possible to establish a provisional estimate of ore reserves on the Ace property of sufficient size to justify a mining operation of 500 tons per day. It is expected that production from the Ace mine will begin in April of this year. Milling will commence at the rate of 500 tons per day, but the mining plant is designed to handle an ultimate capacity of 2,000 tons per day. At this point I should like to quote certain excerpts from the company's annual report for 1951 which deal with some aspects of the Beaverlodge operation.

"In the annual report of 1950, an outline was presented of the program to be undertaken during 1951. This comprised the sinking of the Ace shaft to the sixth level and the development of both the east and west ore bodies at six levels, the sinking of a five-compartment production shaft on the Fay zone, and the driving of a haulage-way on the sixth level of the Ace mine to connect with the production shaft. In addition, it was anticipated that the development program on the Eagle property would have reached the stage by June 1, 1951, when possible ore reserves could be estimated.

Some statement of the policy underlying this program seems appropriate at this time. Under the best of conditions, the development of mineral deposits is both speculative and costly. The normal risks have been aggravated in the present instance by two factors. First, the great urgency of demand for uranium and second, the inaccessability of the Beaverlodge property, except by air, for almost eight months of the year. It is in the national interest that every possible effort should be made to speed up and increase the deliveries

of uranium. Therefore, the saving of time has a greater significance in uranium mining than in the mining of other minerals. This situation, difficult enough in itself, has been complicated further by the fact that a four months' navigation season makes it imperative that the planning of a program be completed twelve months in advance of its execution. Otherwise, orders for equipment and supplies cannot be placed in time to ensure delivery. The combination of these two factors—the pressure for production and geographic location—cannot help but increase the risks, and in some cases, the cost, involved in the development of the company's Beaverlodge properties.

In April 1951, the company's consultant, Dr. B. S. W. Buffam, presented to the directors a provisional estimate of ore reserves on the first two levels of the Ace mine. This report showed sufficient reserves to warrant a mining operation of 500 tons per day. At the same time, there was made available the results of a surface diamond drilling program carried out in the winter months of 1950-51 on the Fay zone. This zone is located in the footwall of the St. Louis Fault approximately 4,000 feet southwest of the Ace shaft."

If I may just break off from the brief for a moment. I have maps of this area and so on which I will be glad to produce if it will make the brief more intelligible.

"Subsequently, a surface diamond drilling program located a third zone, the Ura zone, lying in the hanging wall of the St. Louis Fault some 400 feet south of the Fay shaft. The results of these drilling programs were most encouraging, having in mind the location of the zones in relation to the St. Louis Fault. The directors were faced with these alternatives—the choice of a program involving the separate development of the Ace property and the Fay and Ura zones, or the choice of a program combining the two developments. The first choice required the fitting-out of the Ace shaft for production and the erection of a mining plant and concentrator at the Ace mine with a daily capacity of 500 tons and, in addition, the sinking of a shaft to explore and develop the Fay and Ura zones. The second choice involved the sinking of a single shaft at a site which would permit its dual use as a production shaft for the Ace mine and as a base of development for the Fay and Ura zones. In selecting the second alternative, the directors were governed by several considerations. First, the separate programs offered no advantage from the standpoint of early production—a requirement of paramount importance. On the contrary, there was some reason to believe that the adoption of the combined program might guarantee earlier production since it would allow the exclusive use of the present Ace mining plant for the completion of development and mine preparation without interruption which would occur if a new mining plant had to be installed. Second, while the sinking of one production shaft and the erection of a mining plant with a capacity capable of serving three zones, for example 2,000 tons per day, would require a larger immediate expenditure than a program involving the erection of a mining plant for the Ace property only and the sinking of a prospect shaft on the Fay zone, there would be an ultimate saving of substantial proportions since there would be no need to provide duplicate facilities when production from the Fay and Ura zones became available".

I am still quoting from the annual report.

"Reference was made in the 1950 annual report to research on the dressing of ores from the Ace mine. This program was undertaken jointly by the mines branch in Ottawa, an ore dressing group at the company's Port Hope refinery, and a research team at the University of British Columbia. The objective was to permit the choice of a satisfactory ore dressing process not later than October 1, since, unless this deadline could be met, it would be impossible to begin the construction of the mill building and the installation of its equipment during 1952. Following the completion of laboratory tests, it became possible

to undertake pilot plant operations with a minimum of delay because of the availability of suitable facilities in the Ottawa plant of Sherritt Gordon Mines Limited. The company was able to obtain the services of C. S. Parsons as consultant on metallurgy and ore dressing shortly after his retirement as director of the mines branch of the Department of Mines and Technical Surveys. The pilot plant operations in Ottawa were under his general direction. In mid-September, Mr. Parsons, after reviewing the results of the several research programs, recommended the choice of a process employing a carbonate or basic leach. In his report, Mr. Parsons stated that while the chemistry of the process had been proven, the engineering of the flowsheet was incomplete. He suggested that under normal conditions, consideration would be given to further pilot plant work at the Ace mine. However, since this would involve a delay of from twelve to eighteen months in bringing the property into production, it was his recommendation that the design of a concentrator with a daily capacity of 500 tons should be proceeded with immediately. The decision as to capacity was influenced by two factors. First, the ore now available for mining will only support a 500-ton-per-day operation. Second, there is some expectation that improvements may be made in the ore dressing process as a result of the intensive research program which is now being carried out by the mines branch of the Department of Mines and Technical Surveys. These improvements could affect both the chemistry and the engineering of the flowsheet. It seemed unwise, therefore, to provide milling capacity beyond the immediate requirements in view of the possibility that an improved process might be available when the mine tonnage is increased."

That is the end of the quotation from the annual report.

By way of comment on these excerpts from the annual report of 1951, I should like to emphasize that the risk inherent in all exploration programs is increased greatly when time becomes the dominant factor.

The production of uranium from the Ace mine will be approximately 40% greater than the present rate of production at Port Radium. If, as we have reason to hope, the underground development program on the Fay and Ura zones is fruitful, the ultimate production may be two or three times the initial rate of production.

The total investment in the property at the commencement of operations will be $19 million. This includes the cost of preliminary exploration, diamond drilling, underground development, mine preparation, production buildings and equipment, housing, roads, and an airport. The average payroll is expected to be 400, and the estimated annual operating budget is $4 million.

The exploration division is carrying out exploratory work of the company's other claims in the Beaverlodge area. This consists of geological mapping and surface diamond drilling. In December last, a large block of claims was staked in the Foster Lake area of Saskatchewan. This ground will also be explored thoroughly during 1953. It is proposed to supplement ground exploration with the use of an airborne detector, a method of prospecting which Eldorado developed in 1950 and 1951.

This recital of the facts of Eldorado's exploration and mining activities would not be complete without some mention of the extraordinary conditions with which the company has to contend. The Port Radium mine is located twenty-three miles south of the Arctic circle, 1,000 miles north of Edmonton by air, and 1,400 miles by water from railhead at Waterways, Alberta. The season of open navigation generally lasts from early July until late in September, or something under three months. The mean temperature for the year is 22° with a mean during the months of November to March of 10° below, and frequent temperatures of 50° below. During these same months, there is an average of six hours of daylight with an average of as little as three hours during November, December, and January. By comparison, the Ace mine at

Beaverlodge might be said to enjoy an almost tropical location. However, this property is also remote by any normal standards. It is some 500 miles north from Edmonton by air and 300 miles by water from railhead at Waterways. The season of navigation lasts from June 1st, until October 1st, or four months. The climate, while somewhat warmer in midsummer, is equally severe in the winter months. I mention these conditions in the hope that I may convey to you some appreciation of the operating problems which have to be faced each day and of the special problems which have had to be faced in expanding existing production and developing new production. We have what might be described as a continual problem in logistics. This daily struggle with the hard facts of geography and climate has been aggravated by the increasing demand for more production. The Beaverlodge development is an excellent case in point. When the Ace ore body was located in April, 1951, a production target of April 1, 1953, was established. This meant that the development of an ore dressing process—there was no known process suitable for the treatment of the Ace ores—the preparation of plans and specifications for the mining plant and concentrator, and the ordering of supplies and equipment, all had to be completed in the eight-month period from May 1, 1951, to December 31, 1951; otherwise, deliveries could not be made during the navigation season of 1952. It meant also that construction had to begin in April of 1952 and in order to maintain the construction schedule that some 2,400 tons of building supplies had to be flown to Beaverlodge before the opening of navigation in 1952. Those of you who have some knowledge of the problems incidental to the establishment of new production capacity will recognize at once the problems involved in maintaining a schedule of this kind.

In my previous comment on the Port Hope refinery, I pointed out that this plant was an extension of the mill or concentrator. The plant was designed to refine the product of the Port Radium operation—a gravity concentrate. It will now refine, as well, the product of the leaching plant at Port Radium—a precipitate. The process consists in the main of a roaster and smelter for the preliminary treatment of gravity concentrates and a chemical circuit for the final extraction of uranium black oxide. The refinery has a payroll of 150 and an average annual operating budget of $1,200,000. As you have probably learned from your examination of the Chalk river project, uranium for use in a pile or reactor is in the form of a metal. Canada does not produce uranium metal at the present time. That this should be so is simply a matter of economics. The production of raw materials now available in Canada for processing is not great enough to warrant the production of uranium metal. It is a reasonable expectation that at a relatively early point in the now increasing curve of uranium production, metal production will become economically possible in Canada. Against that day, Eldorado has developed a new and improved refining process and is studying the technique of metal production.

Financial Affairs

In commenting on the financial affairs of the company, I should like to emphasize that it is our constant endeavour to maintain a position of self-sufficiency. In other words, we are trying to operate the company in the black and, in addition, to finance our expansion program from revenues. A perusal of the financial records of the company will indicate the measure of our success in this regard. It will be recalled that the government paid $1.35 a share for the stock of Eldorado at the time of the expropriation in 1944. Since there were 3,905,046 outstanding shares, this represented a total payment of $5,271,812.10. In 1946, the authorized capital of the company was increased from 60,000 shares to 120,000 shares.

I might mention here, at the time of the change in the charter of the company and at the time of the expropriation, the capital structure was revamped. It had previously been 4 million shares and it was revamped to give it a capital of 60,000 shares and in 1946 the authorized capital was increased from 60,000 shares to 120,000 shares.

Mr. BROOKS: How many shareholders were there?

The WITNESS: I can find that out for you.

The government took down 40,500 shares in addition to its original holding of 40,000 shares and paid over to the company $3,975,064.72. This total investment by the government of $9,246,876.82 was reduced in 1950 by $1 million through the redemption of 10,000 shares of capital stock, and by $1,057,500 in 1951 through the payment of a dividend. In the period 1946 to 1951 inclusive, the company has had total gross earnings of $33,801,668, a total net profit of $7,589,580, and has incurred capital expenditures in the amount of $5,408,191.

I might point out that those are the figures at the end of 1951.

The value of the company's fixed assets as at December 31, 1951, was $7,745,861. The estimated value at the end of December 1952, was $17,188,972.04 less a provision for depreciation in the amount of $3,942,373. Working capital as at December 31, 1946, was $2,812,535, and as at December 31, 1951, was $9,694,838. I regret that I am unable to give you the figures for 1952 as our final audit has not been completed. With the heavy expenditures in 1952 and 1953 incidental to the Beaverlodge development, the company was unable to continue the dividend policy established in 1951. If, as is now anticipated, the Beaverlodge operation can be brought into full-scale production by mid-1953, the company should be in a position to resume the payment of dividends at the end of 1954. This statement is made on the assumption that it will not be necessary to embark on large capital expenditures during that year. Should it be decided to proceed with the establishment of new refining facilities or should underground development programs on new properties be undertaken, the company's anticipated surplus would, in all probability, be required for these projects.

Purchasing Policy

A brief review of the situation in the immediate postwar years is essential to an understanding of the present policy.

It will be recalled that during the war years and in the immediate postwar years, title to uranium in Dominion territories was reserved to the Government of Canada, and in certain of the provinces, was reserved to their governments. This reservation came about in the first instance as a result of a joint decision of the three partners in the wartime atomic energy program, Canada, the United Kingdom, and the United States, that a close control should be maintained of all radioactive minerals. Since there was at the time no statute providing for the control of radioactive materials, this seemed to be the most effective method of handling the situation.

Normally, this reservation of title would have been removed at the end of the war. Certainly those of us who were concerned with the raw materials program were convinced that we could only hope to bring about a substantial increase in uranium production by attracting the prospector and the mining industry. Obviously, this could not be done so long as the reservation of title continued. However, there was a complication. I have already referred to the effort made by the United Nations to establish a satisfactory instrument for the international control of atomic energy. These discussions began in 1946 and lasted during most of 1947. In retrospect, it seems clear that the Soviet and her satellites intended to sabotage this effort from the outset. However, so long as there was any hope of reaching agreement, it seemed desirable that no change should be made in the wartime regulations governing

the control of raw materials. This was especially so since one of the proposals contained in the Baruch plan submitted by the United States delegation was that an international agency should be established which would not only control atomic energy at all of its stages but would also control raw materials in situ. When it became evident that agreement was impossible, it was decided by the Government of Canada that the reservation of title to uranium minerals in Dominion territories should be removed. Those of the provinces which had also reserved title took similar action. This created no difficulty since adequate control of raw materials, and especially the export of raw materials, had been provided through the regulations of the Atomic Energy Control Board which was established on August 31, 1946.

On March 16, 1948, the government established a price schedule for uranium for a period of five years and designated Eldorado as its purchasing agent. Revisions have been made, both in the price and the period of the guarantee. With the thought that it may be helpful, I have had prepared a memorandum setting out the several modifications in purchasing policy which have occurred. With your permission, I shall include this memorandum in my evidence.

"The first announcement concerning the purchase of uranium was made by the Right Hon. C. D. Howe, in the House of Commons on March 16, 1948, as follows:

The government will purchase through Eldorado Mining and Refining Limited, or other designated agency, acceptable uranium-bearing ores and concentrates on the following basis:

1. A minimum uranium content equivalent to 10 per cent by weight of uranium oxide (U_3O_8) in the ores or concentrates will normally be required.

2. Price will be based on the uranium content of the ores or concentrates and will be at the minimum rate of $2.75 per pound of contained (U_3O_8) F.O.B. rail and will be guaranteed for a period of five years.

3. This price includes all radioactive elements in the ores or concentrates, but consideration will be given to the commercially recoverable value of non-radioactive constituents by adjustment of price or by the re-delivery of the residues containing such constituents.

4. Under special circumstances, consideration may be given to payment of a higher price or to acceptance of ores or conentrates of lower grade.

5. All operations will be arried on subject to the provisions of the Atomic Energy regulations of Canada."

On December 20, 1948, the Right Hon. C. D. Howe announced in the House of Commons that the period of the guaranteed price had been extended to March 31, 1955.

A further amendment to the purchasing policy was announced by W. J. Bennett on April 18, 1950. This was designed to encourage the development of low grade deposits and efficiency in ore dressing by payment of a milling allowance on ore treated. The formula for determining the price to be paid for the U_3O_8 content of the concentrates is based upon four factors:

(1) $2.75 per pound for the average U_3O_8 content of the ore or mill feed;

(2) A milling allowance of $7.25 a ton of ore milled;

(3) A maximum price based on a mill head of 0·25 per cent U_3O_8;

(4) A minimum extraction of 70 per cent.

Eldorado Mining and Refining (1944) Limited will purchase, f.o.b. rail, acceptable concentrates, which normally will be required to contain a minimum

uranium content equivalent to 10 per cent by weight of uranium oxide (U_3O_8) and will pay for the U_3O_8 content at a price per pound determined in accordance with the following formula:

> The price per pound to be paid for the U_3O_8 content of acceptable concentrates containing 10 per cent or more by weight of U_3O_8 shall be the product obtained by multiplying the average number of pounds of U_3O_8 per ton of mill feed by $2.75 a pound, adding to this a milling allowance of $7.25 a ton of ore milled, and dividing the sum of the two by 70 per cent of the average number of pounds of U_3O_8 per ton of mill feed.

The maximum price per pound for the U_3O_8 content of acceptable concentrates that will be paid under this arrangement is that based upon the formula applied to an ore with an average grade of 0·25 per cent or 5 pounds per ton.

As the price is based upon the average grade, Eldorado reserves the right to adjust the contract from time to time to bring it into conformity with actual operating results.

The formula is designed to encourage efficiency in ore dressing. Although the minimum extraction of 70 per cent is used in the formula, it will be apparent that if recovery exceeds 70 per cent there will be more pounds of U_3O_8 to be purchased. Hence the value per ton of ore mined and milled will be greater.

Although the price includes all radioactive elements in the concentrates, arrangements will be made for valuing other constituents that can be recovered commercially.

The following examples show how the formula is applied:

(1) Grade of ore, 0·25 per cent, or 5 pounds a ton		
·5 x $2.75	$ 13.75	
Milling allowance	7.25	
Value of ore per ton	$ 21.00	
Recovery, 70 per cent of 5 pounds=3·5 pounds		
Price to be paid for the U_3O_8 content of concentrates: $21.00 + 3·5	$ 6.00	a pound
(2) Grade of ore, 0·5 per cent, or 10 pounds a ton		
10 x $2.75	$ 27.50	
Milling allowance	7.25	
Value of ore per ton	$ 34.75	
Recovery 70 per cent of 10 pounds = 7 pounds		
Price to be paid for the U_3O_8 content of concentrates: $34.75 + 7 =	4.85	a pound
(3) Grade of ore, 0·75 per cent, or 15 pounds a ton		
15 x $2.75	$ 41.25	
Milling allowance	7.25	
Value of ore per ton	$ 48.50	
Recovery 70 per cent of 15 pounds = 10·5 pounds		
Price to be paid for the U_3O_8 content of concentrates: $48.50 + 10·5 =	$ 4.62	a pound

The Right Honourable C. D. Howe announced in the House of Commons on April 17, 1950, a further extension of the guaranteed price period to March 31, 1958.

On March 6, 1951, Eldorado announced a further revision in the price schedule by which the price paid per pound of U_3O_8 content for mill products produced during the first three years of production, or any part thereof, will be increased by $1.25 a pound. Thus, for example, the U_3O_8 content of a concentrate produced from an ore with an ore with an average grade of 0·25 per cent or lower will be paid for at the rate of $7.25 per pound during the first three years of production. In the case of a concentrate produced from ore of 0·5 per cent average grade, the new price will be $6.20 a pound of U_3O_8 content, for the first three years, and so on.

The period during which these prices are guaranteed was also extended to March 31, 1960.

On May 6, 1952, the Right Honourable C. D. Howe announced in the House of Commons that the period during which these prices are guaranteed would be again extended to March 31, 1962. That is the end of the price memorandum.

I should like to mention several aspects of the current purchasing policy.

First, may I say a word about the reason for Eldorado's selection as the procurement or purchasing agent. The bulk of the uranium being produced in the free world is being used by the United States Atomic Energy Commission for the manufacture of atomic weapons. The selection of Eldorado as the procurement agent was, I believe, influenced by two factors. First, Eldorado had established a pattern of relationship with the buyer which had proved mutually satisfactory. Second, Eldorado was the only company in Canada with facilities for refining uranium to the specifications which the buyer required. So long as uranium is subject to control, that is to say, so long as it cannot be sold in the open market, it seems to me that the use of a single procurement agency is inescapable. Bearing in mind the price fluctuations which affect other base metals, it can be argued that a guaranteed base price is sufficient compensation for any disabilities which are thought to be associated with a single market. A time may come when world conditions will permit a free market for uranium. Whatever advantages this may bring, a guaranteed price is not likely to be one of them.

There has been considerable discussion from time to time as to the adequacy of the prices established in the current price schedule. As a preliminary to my comment on this point, I should like to clear up a common misconception. This is the impression that there is an unlimited demand for uranium at any price. It is difficult to correct this impression with a categorical "Yes" or "No". In either case, the statement must be qualified, as I shall seek to point out. This impression is associated, although rarely in mining circles, with the belief that Canada has some kind of monopoly of uranium supply and is therefore in a position to dictate the world price. What are the facts? At present, the only Canadian export market is the United States Atomic Energy Commission, an agency of the United States government. Canada is one of several existing sources of supply, but by no means the most important. Whether our new finds will change this position, I cannot say. This will depend on the level of production in other countries where important new discoveries have also been made. The conclusion inherent in these facts is, I think obvious. The buyer fixes the price and he does so as nearly as possible on a uniform basis. This means simply that even in the absence of a free market for uranium, the fact that there is one buyer and several sources of supply makes for the establishment of parity in prices.

It will be evident from the memorandum on purchasing policy which I have read to you that some evolution of policy has occurred in Canada. Prior to the establishment of the first price schedule, it was decided to set up an

advisory committee and to seek the advice of this committee as to what the base price should be. On this committee was represented the mining industry, the Canadian Association of Prospectors and Developers, the Department of Mines and Technical Surveys, and Eldorado. During its deliberations, the committee consulted with a similar organization which was acting in an advisory capacity to the United States Atomic Energy Commission. This committee was endeavouring to work out a satisfactory price schedule for production from the Unted States sources. From the inception of the purchasing policy, an attempt was made to maintain some equality of prices as between the two countries. The differences in the two price schedules are differences of form, rather than of substance. The United States price formula is designed primarily to stimulate production from the carnotite deposits of the Colorado plateau where uranium is usually found in association with vanadium. Vanadium has been mined for many years from numerous small deposits readily accessible by highway. It was and still is the practice of the companies engaged in vanadium production to mine their own ores and also to purchase ores from small operators. These ores are trucked to centrally located treatment plants.

When it was decided to encourage the production of uranium in the Colorado plateau, the price formula was accommodated to these conditions. A price schedule was published, with a sliding scale of prices based on the U_3O_8 content of raw ores. Now from what the Canadian committee knew of radioactive occurrences in Canada, it seemed likely that the best chance of finding economic deposits was in the more remote areas of the Precambrian Shield. The development of such deposits would probably require a large amount of capital and would take considerable time. The only Canadian producer in 1948 provided some measure of what could be expected in the way of costs, but because of its very remote location, could hardly be used as the final gauge of what the Canadian price should be. It seemed to the committee that the pattern of development in Canada might be similar to that of gold mines where properties are sometimes isolated, frequently widely separated, and where each property looks after its own milling. The committee therefore recommended a price policy which would enable the prospector to calculate the value per ton at a relatively early stage in a development program, the price to be based on the uranium content of a mill product or a high grade cobbed ore.

I am frank in saying that when the first base price was established, the committee had very little information as to how realistic it might be in relation to production costs in a new area.

Mr. MURPHY: Mr. Chairman, I was wondering how much more there is of this brief.

The WITNESS: About two pages. I could leave Northern Transportation which is separate.

Mr. MURPHY: When you have finished that.

The WITNESS: Consequently, it was made clear that the first price was a base price and that upward revisions would be considered from time to time. The subsequent revisions in price outlined in the price memorandum, while based in part on what is known of probable production costs in the Beaverlodge area, also reflect the continuing attempt to maintain some parity of price with the United States. There have also been several revisions of price in the United States. At the present time, the price schedule in the two countries, while differing in form, give approximately the same net return.

It will be seen that Eldorado has a dual position in the raw materials field, being both a producer and a buyer. This role is analogous in some respects to that of the large base metal companies which mine their own ores and also buy ores for smelting.

We have thought that as the procurement agency, we should do everything possible to encourage the development of promising deposits. Such assistance can be provided most effectively at the technical level. Consequently, it is our practice to make available to reputable persons in the mining industry information on exploration, mining, assaying, and milling techniques.

I think it will be evident from my remarks, and those of Dr. Mackenzie, that the current Canadian program in atomic energy has two distinct parts—the production of raw materials that is, exploration, mining, milling and refining—and the operation of the Chalk River reactor with the double objective of research and production. The first of these activities is the responsibility of Eldorado; the second, the responsibility of Atomic Energy of Canada Limited. While the two programs might appear, at first glance, to have no immediate relationship, on closer scrutiny, it will be clear that they are interdependent. The prime objective of the raw materials program is to increase the supply of uranium for atomic weapons. We may regret that this is so, but at the same time we must be mindful of the fact that the atomic bomb is the most potent means of safeguarding the security of this continent and whatever that may involve in the way of military action elsewhere. I think we may take some consolation from the knowledge that our efforts to increase the supply of uranium for the weapon program, admittedly a short-term objective, will also provide us with a knowledge of our uranium potential which we might not otherwise obtain. The prime objective of the program at Chalk River is to maintain and improve our technology in reactor design and operation in order that we will be able to take full advantage of our uranium resources when the civilian application of atomic energy becomes possible. There is no conflict between these objectives. On the contrary, the attainment of the first is essential to the attainment of the second. If we are to hold the fine position we have gained in atomic energy, we must have both an ample supply of its raw material and the skills so necessary for its application. The current programs of Eldorado and Atomic Energy of Canada Limited reflect this identity of aim.

That is the end gentlemen, of my brief on the Eldorado. The other is the Northern Transportation Company Limited.

Mr. GREEN: Is it very long?

Mr. MCCUSKER: I think we should have it.

The WITNESS: I do not think it will take very long.

The CHAIRMAN: It is eight or nine pages. There were 39 pages of the main brief.

The WITNESS: It will take about 15 minutes.

NORTHERN TRANSPORTATION COMPANY LIMITED

History

You are all familiar with that fascinating story of Alexander Mackenzie's journey to the Arctic in 1789. You may not know that water transportation on the Mackenzie system has continued almost without interruption since that year. Until discovering of uranium at Great Bear Lake and the discovery of gold at Yellowknife, first the York boats and then the wood-burning paddle-wheelers which plied this immense waterways served the missions and the fur-trading posts. Commercial transportation as such began in the early thirties. In 1935 the Northern Transportation Company, now the principal common carrier on the route, received its charter.

Organization and Activities

The Northern Transportation Company has its head office in Edmonton with agencies at Railhead, Waterways, Alberta Bushell, the new port of entry for the Beaverlodge area in Saskatchewan; and Fort Smith, Yellowknife, and Bear River in the northwest territories. The original fleet of the company consisted of several wooden tugs and barges acquired at a cost of $140,000. Today the company's fleet consists of twenty diesel-powered tugs and sixty-three barges, which, together with buildings and equipment, represent a total investment of five and a half million dollars. The company handles approximately 80 per cent of all water-borne freight moving over the Mackenzie system. Of this, approximately 50 per cent is for Eldorado and 50 per cent for other shippers. All water carriers on the Mackenzie system operate under the jurisdiction of the Board of Transport Commissioners. This means that the carrier must obtain an operating licence from the board and must file tariffs with the board. The board has complete jurisdiction over all rates. This is in contrast to its control of rates in the lake and coastal services where bulk cargo is exempt from the board's jurisdiction. The arrangement has both advantages and disadvantages. The obvious advantage, both from the standpoint of the shipper and the carrier, is the availability of a court where rate grievances can be argued and settled. The disadvantage lies in the difficulty of accommodating the requirements and procedures of the Board of Transport Commissioners to rather unique operating conditions. I should like to speak for a moment of these conditions and I will discuss them under the following general headings: Climate, water levels, portages, and the volume of freight.

A glance at the map does not necessarily give one a real grasp of the extent of the area served by the Northern Transportation Company. From the base of operations at Railhead Waterways, Alberta, to Kittigazuit at the mouth of the Mackenzie is approximately 1,700 miles. If there are included the off-route services to Bushell on Lake Athabasca to Yellowknife on Great Slave Lake, and to Port Radium on Great Bear Lake, the total distance operated by the company's fleet is approximately 2,400 miles. As these routes lie between the 56th and the 70th latitudes, climate plays an important part in the operations. As a general rule, shipping out of waterways does not begin until the middle of May. Lake Athabasca cannot be crossed before the first of June, Great Slave Lake before the middle of June, and Great Bear Lake before the middle of July. Similarly, at the end of the season, ice conditions usually force the closing of navigation on Great Bear Lake and the lower Mackenzie late in September and navigation on the Slave and Athabasca Rivers ceases somewhere between the first and the 15th of October. In other words, the longest period of navigation, that is, on the southern part of the route, extends for a period of from four to five months, while the shortest period—on Great Bear Lake—extends for a period of two months.

Water levels are a serious problem. Flood conditions frequently prevail early in the season, due to the run-off from the mountains, but unless the rainfall is heavy in midsummer, and this is rare, low water on the rivers, especially the Athabasca, invariably occurs in the late months of the navigation season. This has several effects—all of them bad. First, floating equipment must be designed to meet two very different and conflicting requirements —shallow draft for the rivers—in the case of the Athabasca 2 feet 6 inches—and deep draft for the large lakes. The compromise, as is usually the case with compromises, results in a design which is not entirely satisfactory for either condition. Second, the inevitable low water which prevails in August and September reduces the carrying capacity of the barges sometimes by as much as 65 per cent. Both of these factors, design and partial loading, increase the cost of operation. Finally, the margin of water in the Athabasca is such

that an abnormally dry season can shorten the period of navigation and sometimes with unfortunate results. Such a thing occurred in the season of 1951. As I mentioned a moment ago, April 1953 was fixed as the production date for the Beaverlodge operation. This made it necessary that site preparations and foundations for the mining plant and the concentrator be underway not later than March of 1952. While we did not have detailed plans of either plant until late in 1951, sufficient design data were available by late August to permit us to order the bulk of the building supplies, principally cement and form lumber. Normally, all of these supplies would have been delivered during the period between September 1st and October 15th. A very dry season, plus an early freeze-up forced the close of navigation on the first of October with the result that a large part of the building supplies could not be delivered.

We commonly think of portages in connection with canoe trips and even then they have an association which is not entirely pleasant. The same may be said of the two portages on the Mackenzie river system. They add greatly to the cost and to the time which is involved in the movement of freight. The first portage bypasses a series of three rapids on the Slave river extending for sixteen miles between Fort Fitzgerald and Fort Smith. All northbound freight must be unloaded at Fort Fitzgerald, transported by truck across the portage, and reloaded at Bellrock, the terminal of the Northern Transportation Company, some eight miles north of Fort Smith. The second portage is on the Bear river which empties out of Great Bear Lake into the Mackenzie river. This portage bypasses a series of rapids which extend for approximately ten miles. Again, it is necessary to unload and truck around the rapids all incoming and outgoing freight. Not so long ago the handling of freight at these points of trans-shipment was done by hand. It was estimated that an article of freight received nineteen handlings from the time it left the box car at Waterways until it reached the warehouse at Port Radium. Since local labour was not available, the stevedoring crews had to be flown in and housed and fed. Beginning in 1949, the company undertook a program of mechanization employing, in the main, the pallet-board technique. A ton of freight is loaded on a board which is so designed that it can be lifted and moved by a forklift. This method of freight handling is in use throughout the entire system. An article of freight is now handled manually only twice—once when it is placed on the pallet-board at Waterways and again when it is taken off the pallet-board at its destination. The resulting saving in cost will be obvious. However, the use of the pallet-board method is at best a very partial solution of the portage problem. So long as the need for trans-shipment exists, some equipment and crews must be maintained at both portages. Those solutions which would eliminate the need for trans-shipment, for example, a canal, involve very large capital expenditures. The cost of amortizing such expenditures would have to be charged into the freight rate. On the basis of the present level of tonnage this cost of amortization when added to the rate would more than offset the savings in operating cost. In other words, the volume of freight does not now warrant expenditures of this kind. The portages, because of their location, do not affect the movement of freight to the new uranium field at the east end of Lake Athabasca. Because of this, it is possible to make relatively quick deliveries and at a very reasonable rate. The Yellowknife area is affected by the Fitzgerald-Smith portage on the Slave river, and Port Radium is affected both by this portage and by the Bear river portage. The fact that a minimum period of five weeks is required to complete a shipment by water to Port Radium as against two or three days for shipment to Beaverlodge, is due in part to the Fitzgerald-Smith portage and the Bear river portage.

Volume is basic to the operation of any transportation system. Moreover, the successful planning of a transportation operation depends on the regularity

of the flow of freight and the extent to which full utilization of equipment can be obtained. Unfortunately, there is no stability with respect to any of these three factors in water transportation on the Mackenzie system. First, a word about volume. The gross tonnage carried in the ten-year period, 1942 to 1952 inclusive, was 383,475 tons for an average of 34,806 tons per year. The tonnage carried during 1952 was approximately 69,500 tons, the highest in the history of the company. When one considers the distances involved and the amount of equipment required, these are not large figures. For example, one vessel operating on the Great Lakes can handle in the neighbourhood of 225,000 tons in a single navigation season. To make matters worse, there is no consistency of volume from year to year. The following are tonnage figures for the years 1944 to 1952 inclusive: 1944, 28,739; 1945, 14,252; 1946, 27,055; 1947, 35,401; 1948, 49,473; 1949, 38,482; 1950, 42,593; 1951, 53,360; 1952, 69,500.

What is probably more serious, the movement of freight is largely one-way. Over the period, 1942 to 1952, inclusive, the ratio has been about 9 to 1, that is, one ton of freight has been brought out for every 9 tons moved in. In the season just past, the ratio was even more disproportionate, 22 to 1, because of the very heavy movement to the Beaverlodge area. Both the quantity of freight moved and the direction in which it is moved make for a very low load factor. The average for the period, 1942 to 1952, was 45 per cent. One may ask why the company does not tie up equipment with such a low load factor. Unquestionably this would reduce operating costs. On the other hand, it would impair frequency of service. In an operating season of such short duration, frequency of service is imperative. As it is, the company is often hard-pressed to complete deliveries in a single season.

The CHAIRMAN: Gentlemen, that is the end of the brief. Is it your wish that we adjourn now, or shall we start the examination?

Mr. MURPHY: When do we propose to meet again?

The CHAIRMAN: I would suggest Monday forenoon.

The committee adjourned.

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament
1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE
No. 4

MONDAY, MARCH 30, 1953

WITNESSES:

Mr. William J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited, and President, Northern Transportation Company Limited;

Mr. Marc Boyer, Deputy Minister, and Dr. John Convey, Director, Mines Branch, Department of Mines and Technical Surveys.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

72988—1

MINUTES OF PROCEEDINGS

MONDAY, March 30, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 10.00 a.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Coldwell, Gibson, Green, McCusker, McIlraith, Murphy, Murray (*Oxford*), Stuart (*Charlotte*), and Winkler.—(9).

In attendance: W. J. Bennett, Esq., President and Managing Director, Eldorado Mining and Refining Limited, and President, Northern Transportation Company Limited.

Mr. Bennett was questioned in relation to his evidence given on March 25 on the operations of Eldorado Mining and Refining Limited and of Northern Transportation Company Limited.

The witness retired.

At 11.15 a.m., the Committee adjourned until 3.30 p.m. this day.

AFTERNOON SITTING

The Committee met again this day at 3.30 p.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Brooks, Gibson, Green, Low, McCusker, McIlraith, Murphy, and Murray (*Oxford*).—(8).

In attendance: Mr. Marc Boyer, Deputy Minister, and Dr. John Convey, Director of Mines Branch, both of the Department of Mines and Technical Surveys.

Mr. Boyer was called. He outlined briefly the organization of the Department of Mines and Technical Surveys and also the functions of the Department, through the media of the Geological Survey of Canada and the Mines Branch, in the field of atomic energy. He also tabled copies of the following documents for distribution to members of the Committee:

1. URANIUM OREBODIES—How Can More be Found in Canada?
2. PROSPECTING FOR URANIUM IN CANADA.
3. CANADIAN DEPOSITS OF URANIUM AND THORIUM (Interim Account).

Dr. Convey was called. He gave detailed evidence on the organization, functions, and activities of the Mines Branch of the Department of Mines and Technical Surveys in the field of atomic energy and was questioned thereon.

The witnesses retired.

At 4.30 p.m., the Committee adjourned to the call of the Chair.

A. SMALL,
Clerk of the Committee.

72988—1½

EVIDENCE

MARCH 30, 1953
10 a.m.

The CHAIRMAN: Order. We have Mr. Bennett back with us. He is the president of Eldorado and he is now open for examination and questioning. Perhaps if there are general questions we can have them first and then go through the brief page by page.

Mr. W. J. Bennett, President and Managing Director, Eldorado Mining and Refining Limited, Ottawa, called:

By Mr. Green:

Q. I should like to ask Mr. Bennett about the extent to which people outside the government are producing uranium ore.—A. Are producing what?

Q. Are producing uranium ore?—A. At the present time?

Q. Yes. As I understand it, the original policy was that no one was allowed to produce ore except under direction of the government. And then that policy was dropped and the government allowed free exploration and unrestricted production, but no purchase by anyone other than the government agency.—A. That is correct.

Q. I would like to know to what extent non-government activities are under way, and what the results have been?—A. The most interesting area is the so-called Beaverlodge area in Saskatchewan and while there are no companies in actual production—that is, no companies which have started to mine ore, or to mill—there is one new property in particular, in the Beaverlodge area which shows great promise. This property was discovered about two or three months ago. At this time, it gives evidence of being a very large producer.

There are also in the Beaverlodge area a number of smaller properties, but it is a little early to say as yet whether they are going to be producers. Some of them may be tributary to the Eldorado operation. I mean by this, that if the tonnage is such that it does not pay the company to build its own mill, and if the property is reasonably close to the Eldorado mill, then Eldorado will buy its ore and treat it in the Eldorado concentrator at Beaverlodge.

The concentrator has been designed to handle custom ore. In other words, provision has been made for the treatment of ores other than Eldorado ores.

At this point I should like to say that the only area where we can speak with any certainty of new production is the Beaverlodge area. However other areas have been prospected. Several years ago there was some excitement in an area close to Sault St. Marie. A large number of claims were staked, and some underground work was done on several of these claims. But they did not turn out to be producers. I think the Soo field is pretty well dormant now. Consequently at the moment, the Beaverlodge area is the most interesting. This does not necessarily mean that uranium deposits will be confined to that area. But so far, it is the only area, where we have any certainty of new production.

Q. Is the mining community of Canada taking an active interest in the search for uranium ore, or is it being left largely to you?—A. Up until the

discovery of the particular property of which I spoke a moment ago—the Gunnar property—it would be correct to say that there was not too much interest on the part of the mining industry.

There were several factors which account for this lack of interest. One was the very great interest in other base metals, during the post-war period. The second was the uncertainty as to what the future of uranium might be apart from its military uses. When you consider that it takes anywhere from three to five years, depending on the location, to get a property into production, and when you consider that today it costs close to $1 million to sink a prospect shaft and to do even preliminary underground development, you can understand the hesitancy to commit shareholder's money to exploration programs in this particular field.

The third reason was the widespread impression that deposits in commercial quantity would be rare. After all, up until the war, there had only been two major discoveries of uranium, one in the Congo, and the one at Great Bear lake. Other deposits had been discovered, but these were not of a major character. For example, there was the deposit at Joachimsthal, in Czechoslovakia and the carnotites in the Colorado plateau. There was the belief that uranium was an extremely rare metal despite the fact that the geologists had told us that, considered in the abstract and not in terms of commercial deposits, it was not one of the rare metals. If I may seek the opinion of one of our experts: Dr. Lang—what is it, the 27th most commonly found metal?

Dr. ARTHUR LANG: The main thing is that occurrences are very common, but ore bodies are very scarce.

By Mr. Green:

Q. It seems clear now that there will be very extensive use of atomic energy for peacetime purposes, and that would mean, of course, there would be great demand for uranium. Is there any way in which the finding and developing of uranium can be furthered in Canada?—A. I had not quite finished what I was going to say. With the discovery of the Gunnar property, the attitude of the mining industry seems to have changed. I see quite a number of people in the industry in the course of a week and I find that there has been very great interest in the last couple of months. We always felt, those of us who were concerned with the raw materials program, that the only thing that would really interest the industry and the prospector in particular, would be a major discovery. The Gunnar find would appear to have confirmed that view. There is great interest now on the part of the public, as you probably have gathered from the market performance in the last two months or so. While I do not have the figure for the amount of money that will be spent in the Beaverlodge area this year on surface development, diamond drilling, and so on, I would imagine it would be quite substantial. There are many companies in the area which either have claims or have taken options on claims on which exploration work will be done.

Q. That is apart from expenditure by Eldorado?—A. Yes.

By Mr. Gibson:

Q. Could you outline the means by which you compensate prospectors? On how many occasions have you paid out this $1,000 for discovery?—A. You understand, of course, these are prospectors working for Eldorado.

Q. Yes, that is what I was thinking of.—A. There have been two occasions, one involving the Ace property which we hope to bring into production next month, and the other involving the Martin Lake property which I referred to in my brief. In these cases the prospector's agreement in effect at the time the discoveries were made, was not the same as the agreement now in effect.

By Mr. McCusker:

Q. What is the distance between the Ace, the Martin Lake, and the Gunnar property?—A. The Gunnar property would be approximately 20 miles from the Ace as the crow flies.

Q. Was it discovered by a private individual?—A. By prospectors.

Q. Has it been developed by one of the mining companies?—A. I am not too clear on what happened but I believe the ground staked by prospectors in the normal way and the prospectors made arrangements with the Gunnar company. I am not familiar with the details.

Q. Who controls the Gunnar company?—A. Gilbert La Bine is the president.

Q. It is a new company?—A. It is an old company. Gunnar Gold Mines Limited it is called.

Q. Have they other properties?—A. The company had gold property. It is new in this field but not new as a company.

By Mr. Green:

Q. To what extent has Eldorado purchased uranium ore from private sources?—A. We have not purchased any as yet because there are no properties in production.

Q. That means, in effect, for several years there has been nothing purchased?—A. Nothing so far.

Q. The only uranium ore produced in Canada is produced by Eldorado?—A. That is right. The reason nothing has been purchased is that nothing was discovered that was capable of being developed into a commercial producer. Even our own new property is not in production yet, and we made the first discovery in the post-war years.

Q. That is the Bear Lake property?—A. No, I am talking about the new property at Beaverlodge.

Q. What is the attraction of guaranteed prices for uranium ore, as against a free market?—A. With the uncertainty as to the future of uranium after the demand for military use ceases, it was felt the only way we could interest the mining industry was by establishing a period during which there would be a guaranteed base price, otherwise the industry would not look at uranium. Now, I think, as you do, though I do not think anybody can speak with certainty—

Q. I am not sure how I think.—A. I think the developments in the last year in the field of civilian application have been such that the attitude of mining industry may change. Certainly up until a year ago there was considerable doubt as to what the demand would be. The mining industry in this country, as in other countries, had had experience with other metals for which there was little demand during peacetime. During the last war, as you know, we tried to stimulate the discovery and production of certain metals, for which there was little demand in peacetime. You have to keep in mind also that uranium has had no commercial history, unlike copper, nickel and the other base metals. There was a certain reluctance to get in uranium on that account.

By Mr. Coldwell:

Q. To what extent are you impeded by difficulties of access to these fields? Is there any chance of pushing a highway to Lac La Ronge?—A. Beaverlodge is quite a distance from Lac La Ronge. I do not know the exact mileage from the end of the present highway to Beaverlodge.

Mr. McCUSKER: Lac La Ronge is considerably east of it for a jumping off place.

Mr. COLDWELL: I think it would be 300 miles.

Mr. McCUSKER: I think they would have to go further west.

Mr. COLDWELL: That might be so.

The WITNESS: There is no doubt the limitations imposed by the seasons in that country present a very great problem.

By Mr. Green:

Q. We hear quite a lot about the presence of uranium in Ontario and that its development has been purposely held back. Is that correct?—A. No, on the contrary we have been doing everything to get people to produce uranium regardless of its location. The officers of the Department of Mines and Technical Surveys who are present could, I believe, give you a description of the Ontario deposits and what they mean in terms of the present price structure. So far no one has ever proven any tonnage. The occurrences are of a kind or type which are fairly common throughout the world. Nowhere that I am aware of nas any commercial tonnage been developed in this type of occurrence.

By Mr. Coldwell:

Q. Somewhat similar to bauxite which I think is rather widely distributed, but not in sufficient quantities to warrant development?—A. You do not find it in ore bodies. I hesitate to speak about technical subjects in the presence of the experts from the Department of Mines and Technical Surveys.

The CHAIRMAN: We will be having another witness from the Mines Department later on, and perhaps he would be the one to question on that subject.

The WITNESS: Actually uranium is found in many places for example in the phosphates in Florida there is reputed to be large quantities of it, but it is, very widely disseminated so that you get a very small quantity in each ton of material; it is also found in certain shales. And in certain of the granite rocks in the Pre-Cambrian Shield. In fact quite close to Ottawa, you can find very low radioactivity in the granite rocks.

By Mr. Green:

Q. What further production would there have to be in Canada in order to warrant the complete refining of the uranium ore in Canada?—A. I cannot answer that question accurately at this point. First of all I could not answer it without giving you a production figure, and this I would have to do *in camera.* Apart from the security problem we have not as yet worked out the economics of metal production. We do have, I believe, a fair idea of the technique, but we have not yet worked out the economics to the point where we can say at what level of tonnage it is economic to produce metal.

Q. We do refining—partial refining?—A. That is right.

Q. But the balance of refining is done in the United States?—A. Purification and conversion to metal is carried out in the United States.

Q. Could we do that here in the foreseeable future?—A. I would think so. In the light of the new finds I think it would be a definite possibility.

Q. Is refining done at Port Hope?—A. Do you mean, is the product of Port Hope brought to the point where it can be used in a reactor?

Q. That is right.—A. No. The final stage is carried out in the United States.

Q. That is the only market for uranium?—A. Yes, the United States Atomic Energy Commission.

Q. Does the company give any aid to private companies at a technical level?—A. Yes, we have, in conjunction with the Department of Mines and Technical Surveys, given all the technical assistance that we have been able to give at the exploration level, at the mining level, and at the assaying and

milling level. This has taken several forms. One has been the distribution of technical articles, another has been the bringing to Beaverlodge of certain people in the industry who are interested or who have properties. These persons have been shown over the property and have been given the benefit of our experience with such things as the interpretation of diamond drilling results and so on. We have gone all out in this regard.

By Mr. Coldwell:

Q. Is there co-operation with the provinces in regard to exploration, prospecting and that kind of thing? In Saskatoon they are doing something along these lines. What co-operation is there with the provinces in respect to exploration?—A. I understand the government of the province of Saskatchewan has been assisting the prospector. I am not too familiar with the details of the program. The department of mines in all the provinces are always helpful to those who are engaged in exploration or mining. So far the only important discoveries of uranium have been made in Saskatchewan.

Mr. GIBSON: Would you have authority at the Eldorado company to enter into financial agreements on a minority shareholder basis with an owner of the property or even with a majority? Do we compete at all with private financing in a field like that?

The WITNESS: I do not suppose there is any question that Eldorado has the authority, but as a matter of policy we have not become involved in any companies where we would be a major or a minor shareholder. The reason we have not is that we believe that a company owned by the government should avoid participation in companies, the stock of which is being traded. So we have stayed away from that type of arrangement.

Mr. GIBSON: There would be nothing to stop a private prospector if he had a good prospect of bringing it in to you?

The WITNESS: No. What we would do if a private prospector wanted to make a deal with Eldorado would be to adopt an arrangement fairly common in the industry, that is, instead of incorporating a separate company and giving the prospector shares, we would give the prospector a cash settlement and a royalty. We would not participate as a shareholder in a new company.

Mr. GREEN: You would get yourself into a lot of trouble if you did.

Mr. MCCUSKER: Is there a power site in the vicinity of Beaverlodge?

The WITNESS: At the present time we are getting our power from a site that was developed by Consolidated Mining and Smelting.

Mr. MCCUSKER: Goldfields?

The WITNESS: Near Goldfields, at this site at the present time there is an installed horsepower of 3300. That is not sufficient to provide the power that we will require when we go into production next month. We have had to supplement this hydro power with a diesel plant, since we will need approximately 5,000 horsepower at peak demand. About half the power is coming from the hydro development at Consolidated and the other half from the diesel plant.

Mr. MCCUSKER: Are you taking all Consolidated can produce?

The WITNESS: We have leased the plant and we are taking all the plant will produce and in addition we have had to build a diesel plant. The question of power is a very lively one at the moment. We have had a survey under way since late in 1951, the object of which is to try to find out if we can get more power from the present waterhead or whether we have to go elsewhere. There is no question that more power is going to be needed. The cost of diesel in the area is prohibitive. The fuel cost alone is 2 cents per kilowatt hour.

By Mr. Stuart:

Q. How is that fuel taken in?—A. By tanker barge.

Q. In barrels?—A. No. In barges. There are compartments in the hold of the barge.

Q. Do you know what the cost of fuel oil would be under those circumstances delivered?—A. I can obtain the exact figure. I believe it is close to 30 cents a gallon.

By Mr. Gibson:

Q. On this Northern Transportation Company, you carry 80 per cent of the traffic up there I understand?—A. Yes.

Q. Does the Department of Transport maintain docking facilities there? Do they maintain the roads for those two portages you have?—A. Most of the docks, with two exceptions, were constructed by the Department of Public Works. The new dock at Bushell, which is the port for the Beaverlodge area, was built by the Department of Public Works, and, in accordance with the usual practice, was turned over to Transport for administration. The dock at Fort Fitzgerald was built originally by the Northern Transportation Company, but two or three years ago the Department of Public Works rebuilt it. The dock at Bellrock on the north end of the portage was also built by the Department of Public Works. All these docks are maintained by the Northern Transportation Company.

Q. Why?—A. On those particular sections of the route Northern is the only Company using docks. Northern has leased the docks and pays the Department of Transport a rental fee based on tonnage.

Q. Would private individuals have access to these facilities?—A. If they wanted to use them subject to the usual regulations governing wharfage fees. So far there has not been a case of anybody using them.

Q. No difficulty that way?—A. No. The highway at Fort Smith is a Northern Transportation project. It is maintained by the Northern Transportation Company.

Q. Is it a toll road in the case of private individuals?—A. No. It is open.

Q. You have done something to develop this country up there?—A. I think so. Yes.

The CHAIRMAN: That is an understatement!

By Mr. Murphy:

Q. Does your company pay income tax to the government?—A. Yes, starting this year.

Q. I think you gave the other day the profit for last year?—A. I gave the gross for the years 1946 to 1951. I will be glad to give you the figure for last year. It was $1,100,00. This is not necessarily the figure our tax would be based on because the Income Tax Division, as you know, disallows certain things as item of cost.

Q. You mean because of your particular operation?—A. Yes. I mean we are the same as the normal industrial corporation.

Q. That is what I mean, a mining company.—A. Income tax has fixed rates for depreciation, for example, which may not correspond to the rates which are considered adequate by the management of a company.

Mr. GIBSON: They treat you exactly the same as a private company?

The WITNESS: Yes.

By Mr. Murphy:

Q. Your year ends in December?—A. Yes.

Q. Do you have other properties other than Port Hope where you operate, or just the mines?—A. We only have the three operating divisions: Great Bear Lake, Bearverlodge, and Port Hope.

Q. Do you pay municipal taxes at Port Hope?—A. Yes. There was no change made at the time of the expropriation.

Q. When you took it over you continued to pay?—A. Yes. No change was made in the previous practice.

Q. Do you know what you paid last year?—A. No, but I could find out.

By Mr. Green:

Q. Is Eldorado carrying on an active exploration program in any other area but Beaverlodge?—A. We have an exploration division which is separate from the mining operation. Last year, last December to be exact, as a result of a discovery that was made by one of our prospectors, we staked a block of claims in the Foster Lake area of Saskatchewan. We are going in there as soon as the ice goes out. We will do ground work and also an aerial survey with a helicopter. We have continued to carry out exploration programs because we have felt during the years since the war that we had to lead the way in this business. The discovery of the Ace mine in the Beaverlodge area is responsible for the other discoveries which have been made recently in the same area. We did, if nothing else, destroy the myth that you could not find another uranium property of commercial value.

Q. But you are not carrying on exploration activities in any other province?—A. Not so far. There is no reason for this other than that we have not had anything come to our attention so far in other parts of Canada which has been of any particular interest. That does not mean that there never will be. This is a peculiar game, this exploration for minerals. The discovery in New Brunswick is an indication of what I mean. There you had an area the geology of which had been known for years. Yet only very recently was there a major discovery of base metals.

Q. That is, in addition to your exploration activities, the Geological Survey are working in various parts of Canada and may run across something of that nature?—A. Yes, Doctor Lang of the Geological Survey will be available, to give evidence as to the part the survey is playing in the program.

By Mr. Gibson:

Q. I see by your formula here that it works out so that you pay less for high-grade ore than you do for low-grade ore. Is this to encourage production?—A. Yes. Mining economics are generally based on the cost per ton of ore mined, milled and sorted. If you have a high uranium content, the unit price per pound content might be less but the gross value per ton would be more.

Q. You still think this formula will take care of handling high-grade ore that is disseminated in a lot of country?—A. Of course that would not be high-grade ore.

Q. I mean, it might be in very small streaks, high-grade.—A. When you speak of high-grade, I am thinking of the percentage of uranium content per ton of rock.

Q. You mean mining?—A. That would have something to do with it. Basically, when you look at the economics of a mining property you say the value of the ore is so many dollars per ton in place before you mine. My point is that while this formula will give a higher price per pound of U_3O_8 per ton as the grade goes down, it would still be more profitable to have a high-grade ore because you would get more money per ton of ore, despite the lower price per pound of uranium content.

Q. But it is a bit of subsidy in a way to low-grade producers to try to get them to develop?—A. That is right.

The CHAIRMAN: Any other questions? We have an answer to the question asked by Mr. Murphy on the tax paid at Port Hope.

The WITNESS: That figure amounts to $4,904.

By Mr. Murphy:

Q. That is the municipal taxes you pay at Port Hope?—A. Yes.

Q. What is the assessment there, do you know that? Is that about the same amount you paid when you took the plant over?—A. The rate has probably gone up.

Q. What do you carry the plant on your books at?

The CHAIRMAN: We will get that information. Any other questions?

The WITNESS: I was asked about our profits in 1951. In 1951, $1,505,645; in 1950, $1,160,171. That is, of course, before taxes. We were not paying taxes in those years.

By Mr. Gibson:

Q. You get the full price that Canada receives for this metal, do you?—A. I beg your pardon?

Q. Your company receives the full price from whoever the purchaser is? Your company receives the full price for it?—A. That is right.

Mr. GREEN: You deal directly with the United States Atomic Energy Commission?

The WITNESS: Yes. At the present time we are in the position of a prime contractor of the United States Atomic Energy Commission.

Mr. GIBSON: You are not on cost-plus?

The WITNESS: Security does not permit me to discuss the details of our contracts.

Mr. MCCUSKER: Then we purchase back the rods that are used at Chalk River?

The WITNESS: That is Doctor Mackenzie's department.

Mr. GREEN: You make all the money and he has to take all the losses?

The WITNESS: It depends on the point of view.

The CHAIRMAN: We have the answer to one other question here. It was a question on the price of fuel oil asked by Mr. Gibson.

The WITNESS: I was a little high on that 30 cents. It is 24·6 cents a gallon, that is landed at Beaverlodge. That would be at the mine.

Mr. GIBSON: It costs me nearly that landed in my basement here in Ottawa.

The CHAIRMAN: Of course it is a different grade oil.

By Mr. Stuart:

Q. How far would that be transported by water?—A. Roughly, 300 miles.

Q. Then, of course, it is moved by rail? It comes from the Edmonton area?—A. Yes.

Mr. GIBSON: That is pretty cheap fuel, relatively, for that area.

The WITNESS: For ordinary use it may be cheap, but for power purposes it is high.

Mr. COLDWELL: How long is the transmission line between the mine and the power plant?

The WITNESS: As the crow flies, it would be about 25 miles.

By Mr. Murray:

Q. Do you process or refine cobalt at Port Hope?—A. We are not refining cobalt. We have a small production of cobalt as a by-product. It is a straight by-product. It is sold to the Delora refinery, which is the only cobalt refinery in Canada.

Q. Is the price of cobalt coming down?—A. I do not know the exact price at the moment, but I think in line with the other base metals it has probably fallen off a bit.

Mr. GREEN: Can we have a statement on the salaries paid by the two companies?

The CHAIRMAN: I do not want to put on record the mining company's salaries.

Mr. GREEN: Why not?

The CHAIRMAN: It is a simple matter. It is a competitive operation. It is just a matter, if these salaries are known, of another company going in and taking the staff away.

Mr. GREEN: I mean the officers of the Crown companies.

The CHAIRMAN: We are into the same problem there. I want to give the Committee all the information there is, but we are into the same problem there if we start publishing these salaries paid by the operating company.

Mr. GREEN: Doctor Mackenzie said we could have the atomic energy salaries.

Mr. MURPHY: We have them for Polymer. I know recently we have not asked the question, but some years ago we had the information on the executive officers, manager, vice-president, and so on.

The CHAIRMAN: Well, I do not know. I would want to look at that question again. Do you want it published? I will examine the question, but I am afraid there will be objection to it.

Mr. GREEN: I thought the principle had been pretty well established that the salaries of officers of the Crown companies should be made available to the Committees.

The CHAIRMAN: You would not want the salaries of the operating men? I hesitate to put that on the record. I would want an opportunity of considering it.

Mr. GREEN: I am not asking for the salaries of the technical men. I understand that information should not be produced, but I do think that the House committees should be entitled to know the salaries of the officers of the companies.

The CHAIRMAN: Are you asking that that be published in the evidence, or are you asking that the Committee have it?

Mr. GREEN: I think it should be available just like any other evidence.

Mr. GIBSON: I wonder if it could not be treated as classified information?

Mr. GREEN: Why?

Mr. GIBSON: I wonder if there is any particular virtue in that.

The CHAIRMAN: We have never given it and I do not know—we have never done it and if you start putting that information out—

Mr. GREEN: For example, the salary of the president of the Canadian National Railways has been given this session for the first time.

The CHAIRMAN: Yes, but the president of the Canadian National Railways has a salary that, I think, is a statutory matter or must be approved by order in council.

Mr. GREEN: This is the first year that his salary has been given.

The CHAIRMAN: I am quite sure it is approved by order in council.

Mr. GIBSON: That is where the information came from, isn't it?

The CHAIRMAN: Yes.

Mr. MCCUSKER: I think we should give our Chairman an opportunity to consider this.

The CHAIRMAN: I would like to consider it; I see a great many objections to putting it on the record. We are in a competing business, after all.

Mr. GREEN: Well not in the case of a Crown company.

The CHAIRMAN: Oh, yes, it is a purely commercial operation that is being carried on, as I see it. There is no point in putting out a lot of information that is going to be used to destroy your operation. Other mining businesses are not putting that information out.

Mr. GREEN: They would have to give that information to shareholders.

The CHAIRMAN: I do not know whether they do publish that to a shareholder.

Mr. GIBSON: Some do.

Mr. GREEN: The shareholders of a Crown company are in fact the taxpayers of Canada, and surely that information should be available to them.

The CHAIRMAN: Well, I have always taken the view that I rather welcomed the setting up of the Committee to get information about the operations; because of the nature of the operations and the history in the earlier years it was not possible to give much information on this whole subject of atomic energy. I come here with the view that we want to let out all the information that can possibly be put out. This is the first time, I think, that we have been asked for anything that we have not at once put out, and I would like to consider it.

Mr. GREEN: Well, I asked Doctor Mackenzie about it a few days ago and he said there would be no objection to giving the figures.

The CHAIRMAN: Will you leave the question with me and I will consider it. Now, is that all that we want to ask Mr. Bennett? If that is all, I will thank him.

By Mr. Green:

Q. There is one other question about the Northern Transportation. Is it operated at a profit or at a loss?—A. At a profit.

Q. You get that profit from other government agencies?—A. Northern Transportation is a common carrier. As a common carrier, its position in relation to the parent company is no different than in relation to any other shipper. Its rates are fixed by the Board of Transport Commissioners, so that the transactions between Northern and Eldorado, so far as the carrying of freight is concerned, are exactly the same as they are between Northern and Giant, Yellow Knife, or any of the other mines in the area.

Q. The bulk of the business would be done with Eldorado, would it not?—A. No. About 50 per cent of the business is done with Eldorado. But it varies from year to year. I would say, as a rough average, that about 50 per cent of the tonnage we carry is for the account of Eldorado, and 50 per cent of the tonnage we carry is for the account of other shippers, principally at Yellow Knife.

Mr. WINKLER: Is the boat known as the *Expeditor* in use by Northern.

The WITNESS: No.

By Mr. Murphy:

Q. With these new claims being developed in the area, would not your production be greatly increased this year in any event because of that?—A. You mean at the Ace mine?

Q. No. I mean the other companies, the private companies?—A. No. That would take a bit of time.

Q. Perhaps next year?—A. I would think that the minimum period is about two years. You have to build a mill. To give you an idea of the time factor, let us assume that one of these properties is now in a position to estimate what its tonnage is going to be. The company would have to determine what ore process was going to be used in order that the mill could be designed and equipment and supplies ordered. Under these circumstances the best schedule that could be met would be the delivery of supplies and equipment at the opening of navigation in 1954, which would be around the 1st of June. Then there would be a period of at least a year for construction.

Q. Have you anyone who could give evidence with respect to the size of the area and as to the assays or the results of exploration?—A. Do you mean our own, or the whole picture?

Q. No. The whole picture.

The CHAIRMAN: We have a witness who would be the man to speak on that.

The WITNESS: Dr. Lang is responsible for maintaining the inventory of uranium discoveries.

By Mr. Murphy:

Q. To what extent have you worked on your own claims in this new area?—A. First, we have the Ace property which is going to be a producing mine, we hope, next month and adjoining it is what I have described as the Martin lake property.

Q. Yes?—A. There we are doing underground development. We are also getting ready for mining. The Martin lake group of claims is contiguous to the Ace. Then, to the east of the Ace, on the so-called St. Louis Fault, which is the structure on which the original discovery was made, we are carrying out quite an extensive diamond drilling program. About six miles from the Ace, we have a block of claims on which we are also carrying out a diamond drilling program.

Mr. MURPHY: Would that be east of the Ace?

The WITNESS: That would be northeast of Ace. These are programmes apart from the work in the Foster lake area.

By Mr. McCusker:

Q. Does the underground temperature in these mines vary greatly from the underground temperature, let us say, in the mines in northern Ontario?—A. No.

Q. What are those temperatures, approximately?—A. We have to ventilate these mines quite thoroughly throughout most of the year. When you ventilate mines so far north, you also have to heat the air. If you did not heat the underground air, I suppose the temperature underground would be somewhere around 45°.

Q. But would not 45° be a favourable temperature in which to work? Perhaps they would work a little harder at a temperature of 45°?—A. It would if we did not have to ventilate. But the moment you start ventilating, you bring in sub-zero surface air, so you have to heat. These heaters, of course, do not work in the few warm periods which we get in summer.

Q. Why is it necessary to ventilate?—A. Ventilation is a problem in every mine.

Q. Because of gas?—A. We have no evidence at the moment that there are any conditions underground which are different from what are found in other mines. But despite the fact that we have no evidence that there is any special hazard, we feel it best not to take any chances.

Q. Have you had any trouble with water seepage?—A. Oh, yes. The Great Bear lake mine is a very wet mine. We pump 800 gallons a minute. That will give you an idea of the amount of seepage.

The CHAIRMAN: Thank you, very much, Mr. Bennett.

The WITNESS: I have the Port Hope figure. It is $1,206,000. That is not the assessment; that is the book value of the plant.

Mr. MURPHY: You have not got the assessment?

The WITNESS: No, but I can get it for you. Then you asked about the number of shareholders, the other day. We have had a little difficulty in securing this information. There were actually 5,909 cheques issued. Whether that represents the number of shareholders or not, I do not know, but I would imagine that it is fairly close.

The CHAIRMAN: Thank you, very much, Mr. Bennett. This afternoon we will have a witness from the Mines Branch of the Department of Mines and Technical Surveys. Dr. Convey will be leaving, and I would like to finish his evidence this afternoon. That is the reason for the extra meeting this afternoon which will be at 3.30. Thank you.

AFTERNOON SESSION

The committee resumed at 3.30 p.m.

The CHAIRMAN: Order. We have with us this afternoon Dr. Marc Boyer, Deputy Minister of the Department of Mines and Technical Surveys. It was my intention to call Dr. Boyer to tell us very briefly about the activities of the department in the field of Atomic Energy. Then it was my intention, with your approval, to call Dr. John Convey, Director of the Mines Branch of the Department of Mines and Technical Surveys and to deal today only with Dr. Convey's evidence.

Dr. Convey's branch is that of the Mines Branch, in which Mr. A. Thunaes is the chief of the Radioactivity Division, but we can call him later. As I explained to most of the members of the committee, Dr. Convey has to leave on Wednesday morning for Australia and I wanted you to have his evidence before he goes. If we could deal with Dr. Convey and leave the supplementary evidence until later, it would be very agreeable. I now call on Dr. Boyer.

Dr. Marc Boyer, Deputy Minister, Department of Mines and Technical Surveys, called:

The WITNESS: Mr. Chairman and members of the committee, the Department of Mines and Technical Surveys comprises five branches, the Surveys and Mapping Branch, the Geological Survey of Canada, the Mines Branch, the Dominion Observatory, and the Geographic Branch.

Of these five branches there are two only which have any connection with atomic energy. These are the Geological Survey and the Mines Branch. I believe you will find a difference in the presentation of any information we have

for you. You have just heard the difference between the Department and the Eldorado Mining Company. The Eldorado Mining Company is in production but we operate as a service department, offering service to the public and to the mining industry, with certain supervision of technical problems.

I should like to give you briefly the functions of the Geology Survey of Canada and the Mines Branch which are associated with atomic energy.

The Geological Survey of Canada first of all acts as official agent for the Atomic Energy Control Board in collecting and filing information on all occurrences of radioactive minerals with content of over 0·05 per cent of uranium or thorium oxides. It examines and studies as many deposits of radioactive deposits as its staff permits. It does geological mapping work specifically directed towards uranium in areas of known or possible importance to assist in prospecting and discovery of uranium ore deposits. It cooperates in the development of a suitable reconnaissance airborne instrument for detecting radio-active deposits. It makes, free of charge, radiometric tests for the amount of radioactivity in samples; it reports also on the identification of the particular radioactive minerals present in the samples received. It carries out laboratory research on the mineralogy and geology of radioactive deposits, and it prepares special reports and pamphlets on prospecting, Geiger counters, and uranium deposits.

The chairman will make available to you at the end of the meeting some of these reports, possibly to assist you in clarifying certain points before the presentation of the geological survey at a later stage in your meetings. (*See today's Minutes of Proceedings for list*).

The Mines Branch has two of its divisions connected with atomic energy. As to the Physical Metallurgy Division, it carries on investigational and development work on metallurgical matters in connection with the design, construction and operation of the Chalk River reactors.

The Radioactivity Division is concerned with development and application of suitable instruments and methods, physical and chemical, for efficient recovery of uranium concentrates from various types of ores.

Normally it might have been very helpful to the Committee if the Geological Survey presentation had been made before Mines Branch. It is more of a private service, not so much specialized as that of the Mines Branch. It might have given you general information on the areas where radioactive minerals can be found.

We have given assistance to prospectors and mining companies in locating, assessing, and in knowing more about possible potential areas for survey. But as your Chairman explained, Dr. Convey will be leaving soon for an extended trip, and it was easier to have him present the facts for you, before the Geological Survey.

That is all I have to say. I think that Dr. Convey will be better versed than myself on the scientific aspects to answer your questions or to give you an additional presentation of certain of the details.

The CHAIRMAN: Perhaps we can hear now from Dr. Convey, who is the Director of the Mines Branch of the Department of Mines and Technical Surveys.

Dr. John Convey, Director of the Mines Branch of the Department of Mines and Technical Surveys, called:

The WITNESS: Mr. Chairman and members of the Committee: At the outset I should like to emphasize that the Mines Branch is a technical research laboratory, a laboratory wherein we examine ores and minerals of all types. It

is our purpose to assist in the development of these ores from the point of view of processing them, and in that way to help the Canadian mining and metallurgical industry.

In the beginning the Mines Branch was interested mostly in the application of known technical methods to the processing of minerals. But with advancing times it soon became recognized that a broader field was necessary. Hence today we find that we have extended not only into the processing of minerals and the extraction of metals from ores, but into the actual development of metals and their uses, and into the development of new metals and the improving of existing alloys.

You will find that we have a budget of a little over $2½ million, and what affects us in this particular Committee is that 16 per cent of that budget is spent directly on atomic energy work.

The Mines Branch is divided into six divisions. There is the Mineral Resources Division, and their function is to keep their fingers, as it were, on the pulse of the Canadian mining industry. It is not just a case of collecting statistics. We have a division wherein are engaged mining engineers whose sole purpose is to analyse from an engineering sense statistics associated with mining companies and the metallurgical industry.

Then we have the Radioactive Ores Division whose sole purpose in life is the processing of radioactive ores. Then there is the Mineral Dressing and Process Metallurgical Division who handle the processing of all metallic ores.

There exists the Industrial Minerals Division which attends to the processing of industrial minerals which includes clay, ceramics, asbestos and similar non-metallic minerals.

The Fuels Division which, in a broad sense, is interested in the development of the fuel industry in Canada. Their work takes them into the field of both solid and liquid fuels.

Last but not least, there is the Metallurgy Division who have as their purpose the development of the Canadian metal industry.

To be a little more specific, we have 16 per cent of our activity presently related to the atomic energy project. At the outset, it is one thing to find uranium ores, but it is quite a different task, and a more difficult problem, to process those ores.

In the beginning I mentioned that the Mines Branch activity was primarily the application of known techniques in the processing of ores. But unfortunately those ores of immediate atomic interest are of such low-grade metallurgical value that special techniques must be worked out for their processing. When you think that in the case of uranium ore the only part of it in which we are interested is one part in a thousand, you will realize that we have to get rid of the other 999 parts which we do not need. That is not an easy thing to do using the old techniques. We cannot use solely the gravitation method, where the differences in gravity between the constituents assists in their separation, and similarly with the floatation methods. But today we have gone a little further into the process than that, and it is now the function of the Radioactive Ores Division to work out techniques whereby we can process these low-grade ores.

Chemical methods have come very much to the front. In other words, we find that chemical metallurgy is growing today to such an extent that in the process of radioactive ores there are two main methods in use, the acid leaching process, and the basic leaching process.

As to the details of cost and so on, and the specific functions of the Radioactive Ores Division, I leave that to Mr. Thunaes.

We have a staff of some 69 in the Radioactive Ores Division. Our laboratory is located in modified quonset huts and available space is something which we find is rather at a premium today.

Our work up to the present since 1945, when this division was being set up, has been to provide assistance to the Eldorado Crown Company. But as you know, today private companies and private enterprise are entering this atomic picture and they expect the same service from us as we have been able to give to the Crown companies. That is a pressing problem which we must face now. The problem is: How can you spread your staff and facilities thin enough and still provide the type of service which is required?

That briefly gives you the picture, as it were, of the Radioactive Ores Division. In addition to the main processing of ores, we have a thousand and one other details to work out, both chemical and radiometric. In other words, we find that in the laboratory we must adapt ourselves to the times, and that being so, we are using techniques in analytical procedures which were not even thought of some 10 or 12 years ago.

As we get down to lower and lower grades of ore, the technical difficulties increase accordingly, and the problems become complex. In other words, we are faced with these ores which we can process today as well as the marginal ores which we cannot process economically, but which will provide the future source of uranium. In other words, it would be uneconomical now with modern techniques to process the lower grade of ores with which we may have to deal in probably 5 or 10 years.

We have to keep the present situation in mind and at the same time we must look towards the future. So in addition to an immediate solution of the problem wherein we carry out investigational pilot plant operations and so on, we must foster sufficient fundamental research to meet the low grade ore processing problems of the future.

In the Radioactivity Division we actually carry on from the test tube stage to the pilot plant operations. In fact, the milling processes and so on which are now in operation at Port Radium and which will be in operation in the Beaverlodge area were originally worked out in our Mines Branch laboratories. When a process is developed which proves successful, the staff has to be available to train the operators who will actually work with the process in the mills concerned. So we have a further dilution of staff and it is at times difficult to keep everything going. Fortunately we have not up to now been required to do actual work on the refining of uranium concentrates through to the finished metal, otherwise our facilities and staff would need to be expanded.

To get into the Metallurgical Section, in Canada at the beginning of the last war the Mines Branch I believe had a staff of less than 12 in metallurgy. As you know the last war was fought on the development of weapons where we used many scarce strategic metals and new alloys. Hence in Canada we were met with a problem of lack of staff and facilities. Fortunately we had such men as Dr. Camsell, Dr. W. B. Timm, and Mr. C. S. Parsons who had sufficient foresight to look into the future and develop or extend the facilities of the Mines Branch to such an extent that today we have on Booth Street the six divisions I have mentioned which exist as one integrated mining and metallurgical family. There is no one independent of the other. The Metallurgy Division has today a staff of around 150. This division is broken down into sections. We have a section on steel, one on cast iron, another on non-ferrous metals, a section on mechanical testing, metaphysics, the metal forming and the welding section, in addition to the high temperature alloy section. As you can see, with time these various sections have grown up and when you add to them the nuclear metallurgy section you have a cross sectional view of metallurgy as it exists today.

To come more clearly to the purpose in mind here today, that of atomic energy: As you know, the lifetime of the reactor as we know it is controlled by the materials that go into it, primarily the metallic materials, and especially the uranium itself. As I mentioned, we have difficulty extracting that metal which is one part in a thousand in ores but add to that the fact that you have got to get rid of all the impurities from the refined uranium. It is the presence of the odd little impurity that will upset the whole nuclear action, hence careful examination of all rods for impurities and flaws is essential. Hence in building a reactor the nuclear material that goes into it must be very carefully selected because the uranium metal must be very pure. If one puts sufficient uranium of a certain type together in a pile you can produce a chain reaction. On the other hand, if one places ordinary uranium in a pile, I doubt if you would get the result you look for; however, if you can moderate the reaction so that you can produce the correct nuclear conditions you would have a pile such as at Chalk River. Hence the use of a moderator is required and the pile consists of a number of uranium rods suspended and submerged in a pool of heavy water. Unfortunately the uranium rods must be protected from the heavy water. Corrosion takes place and the uranium rods must be sheathed. That is where the choice of sheathing metal enters the project. The material must be such as to reduce corrosion and withstand the ambient pile temperatures and above all it must not prevent nuclear chain reactions. That last little phrase rules out a lot of the commonly known metals which we have today. So we must use those metals that are available and at the same time the staff must do sufficient investigational work to produce new alloys that can be used in the actual reactor. Hence one section of the metallurgy division is engaged in the search for new alloys. This means research for an alloy that can resist corrosion and is ductile enough to allow the sheathing of a bar of uranium. New reactors are required that can be operated at higher power. So again the metallurgist is saddled with the problem of what alloy can be used and so these investigations appear to have no end.

Now, suppose we have the alloy. We have as you know the metal aluminum which we are using at present. You want to sheath a rod and design the reactor such that a minimum amount of uranium to produce a desired end result is used and no more. Hence as much nuclear material must be packed into as small a space as possible. That being so the shape of the rods you put into the reactor enters into the picture, so much so that in the new reactor under design today, the research engineer must team-up with the nuclear physicist. A nuclear-physicist can tell you what shape of rod he wants but the metallurgist makes known the possibility of the shething of such rods.

Hence it is a case of physicist and engineer working together and with a little time and effort the ideas of both are married and a new development is born. Such a solution is not always as simple as it sounds. New techniques for the sheathing of uranium rods of various shapes and dimensions are under investigation continuously, in addition to the never ending search for better sheathing metals. The next problem that comes along is that of the cooling operations in the pile. A chain reaction is accompanied with the creation of high temperatures. Dissimilar metals usually have different coefficients of expansion, then the uranium rods and sheathing metals must be critically examined for the possibility of the non-production of ruptures.

Now, imagine a reactor where you have two dissimilar metals under high temperature conditions; they have a tendency to pull away from each other. Once they do, there is the creation of voids and ruptures which will lead to disastrous results.

There is another metallurgical element of trouble that enters into the picture. A coolant must pass through the reactor. At Chalk River we want as

much of the Ottawa river flowing through the piles as possible to extract the heat which is generated. Thus the design of rods and metal containers must be such that coolants can flow around the segments concerned. Therefore the subject of corrosion appears re the metal from which you make your outer sheath and the cooling water.

Experience has shown that low alloys of certain metals are more corrosion-resistant than the parent metals. Such experience is found by time-consuming research work and heavenly-guided mistakes.

In the case of corrosion in the reactors, one must consider the treatment of the cooling water that is used. In addition the effect of the moderator, namely the heavy water, affects metallurgically the pile operation. Now, these two factors alone, namely, heavy water and coolant, provide a sufficient headache to keep one busy for a number of years, but on top of that again the fact exists that the pile materials are subject to intense radiation and metals have the strangest way of behaving under the effects of these extreme nuclear radiations. For instance, metals, in addition to other effects, show a tendency to distort under the influence of radiation. The success or failure in the operation of a pile depends upon the ease with which you can re-allocate the position of your rods, the speed you can get them into their appropriate positions and out again.

You can imagine what would happen where there is a close packed assembly of nuclear rods and one of them suddenly warps and controls cease to exist.

In the case of these chain reactors, one has not got five seconds to work but a fraction of a second. Hence it is essential to be as certain as one can that the metals used in pile construction are not going to misbehave. Hence operational research work is needed whereby materials can be examined metallurgically.

So two of the main metallurgical problems are the effects of radiation and the corrosion action of the medium on the metals used in reactors.

Another problem is the metallurgical examination of irradiated materials. One must work out a mechanism whereby this can be done, and the mechanics for unsheathing the material. This sounds like a simple task but unfortunately one cannot always get close to the material when it comes out of the pile. Protective shielding against harmful radiation is needed. The work is done by means of remote controls.

For instance, irradiated uranium rods are prepared under sufficient protective shielding for metallurgical examination, to find out just what has happened while those materials were in the pile. The physical characteristics of the materials such as mechanical strength and structure are determined for nuclear rods whose history is known prior to entry and after irradiation in the pile.

Those are typical tasks which are continuous with pile operation. Then the main structural materials are examined for possible changes with time while they are in the atomic energy pile. Steel structures, plumbing, etc., in particular are carefully investigated. So complex are the metallurgical problems in nuclear plants that a team of metallurgists is required who can pool their experience and so to arrive at an answer as to what materials can be used in pile operations.

So, in the Mines Branch we have various sections, with metallurgists experienced in both ferrous and non-ferrous metallurgy. Added to this, there are scientists trained in metal physics, who, with modern scientific tools, search into the inner structure of metals behaviour. The pile must be designed in such a fashion that should anything go wrong, and it requires repairs, then the practical engineer enters the project—the mechanical engineer and the welding engineer—and the ease with which these operators can bring about

first aid metallurgically is very important. So we find that today the experience gained in the past few years at Chalk River is all pooled and that experience has been used as a directive towards the building of the new reactor. I may say that our metallurgical engineers have spent an appreciable length of time with the C. D. Howe Construction Co. re the New Reactor. In other words, we learned after building the last reactor that there were certain deficiencies about it which we did not like, but fortunately it worked and has worked very well, and we expect the next one to do a little better, and the experience gained in the past we are applying to future problems.

I have described very briefly some of the more common problems met with by the Mines Branch staff in the atomic energy project, and the more detailed account of the radioactive treatments I have left for my colleague Mr. Thunaes to describe later. However a visit by you to the Booth street laboratories would amplify our remarks.

There is one phase of this work which is frequently overlooked, namely that the age of the pile is no longer than the time that the material can stand up to the conditions under which they must act. One can replace the nuclear rods, or the nuclear fuel, but the main structural material is also important. It is impossible to think we can do all the necessary scrutiny re materials used. We cannot. We do the best we can, but in order to try and facilitate this work, we have in Chalk River a section of the laboratory that at the present time has a meagre staff of six, five professional and one technician, and the Metallurgy Division of the Mines Branch has a staff of 150, sixty per cent of whom are professional; all of whom are cleared for atomic energy work. The team at the Chalk River plant itself is engaged in day to day project activities. They are engaged there in the examination of materials that have come out of the pile, and the materials going into the pile. When these materials can be examined in our main laboratory here in Ottawa, naturally we bring them down here.

You might think, why not build the same metallurgical set-up in Chalk River as exists on Booth street in Ottawa. I think the answer to this is that it would cost more than $10 million to duplicate the facilities re equipment alone and a considerable time-lag in delivery of the same. In addition I do not know where you would get the staff at the present time. Hence there is a working agreement between Atomic Energy Crown Company and ourselves, in that we do the actual physical metallurgical work associated with the atomic energy project. In addition, in the Radioactive Ores Division, we work out processes whereby the operators can treat their uranium ores economically.

That, very briefly, gentlemen, gives you a thumb-nail sketch of what we are trying to do in the Mines Branch.

The CHAIRMAN: Thank you Dr. Convey. Any questions?

Mr. GIBSON: Too many questions, Mr. Chairman. I am afraid that in the few minutes at our disposal we could not even start to go into the broad range of questions that might arise from this.

By Mr. Green:

Q. You work very closely with Atomic Energy of Canada Limited?—A. Yes. In my own case, I visit Chalk River as a rule about once a month, and I have staff up there every week.

Q. You also work very closely with Port Hope?—A. Yes, but Mr. Thunaes could give you a better exposition on how we actually work hand-in-glove with them on pilot plant operations.

Q. You are responsible for working out the method of refining to a much greater degree?—A. Yes.

By Mr. Gibson:

Q. Do you take any students in the summer time that you can probably start in with their training?—A. Yes, we take in 20 summer students in the Mines Branch. We used to take in 39, but we were instructed to reduce that number for reasons of economy, very few into the atomic energy picture. By the time you have cleared them from a security viewpoint, the summer has gone.

Mr. BROOKS: In your Geological Survey Branch, are you finding any radium ores in other parts of Canada?

The CHAIRMAN: That would not be Dr. Convey's subject. He would not be able to answer that. Mr. Bell, our witness next day, would be able to answer that.

By Mr. Gibson:

Q. Dr. Convey, that was an interesting comment you made that by the time you cleared them the summer would be over. Is there something perhaps we might do or recommend, that will give you assistance in that field?—A. The summer students enter a competition which they submit in December. By the time they are processed, by the Civil Service Commission it is well into March, and then, to initiate a complete clearance on top of that before we allow the student to enter this work, I am afraid he will have taken another job somewhere else. The mechanics of security clearance is somewhat unpredictable re the time required. In some cases it does not take very long. In other cases it takes quite a long time. The need for the students is quite evident and there are a lot of routine operations at which they can assist. Mr. Thunaes takes in about seven in the Radioactive Ores Division. Now, we do not go into complete clearance for them for the simple reason that they can attend to routine work primarily in the chemical laboratories. Frequently students are required by the universities to write a thesis on their summer work, and classified material doesn't lend itself to this practice.

Mr. MURPHY: Are they university students?

The WITNESS: Yes.

Mr. MCCUSKER: How far have they proceeded in their studies at the university?

The WITNESS: We try to get them in their final year, when they have completed their third year, but our experience in the past few years has been that we are lucky if we can get them in their second year. Our bargaining power is not very extensive.

Mr. BROOKS: Are the universities giving any special courses in atomic energy subjects?

The WITNESS: Yes, in nuclear physics, but I do not know of any that are giving any courses in any phase of nuclear engineering.

By Mr. Murphy:

Q. Do you have any difficulty, Doctor, getting capable and efficient professional staff?—A. Yes. Again, our bargaining power is very limited by the Commission who sets the limits of salary, etc., and also the conditions that they must have so many years of experience. Unfortunately, we are losing quite an appreciable number of our key personnel who have been with the Mines Branch for several years after graduation.

Q. You mean, after a good man has been with you a short time, private industry takes him away?—A. That is what happens.

Q. For more money?—A. Definitely more money; in a few cases for double the salary.

Mr. BROOKS: Are they going to private industry in Canada or going to the United States?

The WITNESS: Most of them are staying in Canada.

By Mr. Green:

Q. Are you working with any mining company?—A. Outside of atomic energy?

Q. Pardon?—A. Do you mean firms other than those interested in the atomic energy project materials?

Q. Well, in connection with atomic energy.—A. Yes, but I think Mr. Thunaes will probably be able to answer that better than I can. There are quite a few companies who send in their samples for assay and we do concentrational work when the radioactive assay and reserves merit the additional service. Such work is going to increase, naturally, with private enterprise now entering into the atomic energy picture. From the metallurgical side of the question, most of these sheathing experiments that I mentioned, the sheathing of the metals: Procedures are worked out in the Mine Branch laboratories and then personnel from the outside firm are trained in the operations.

By Mr. Murphy:

Q. Do you have any contact or liaison, for instance with this development in Detroit between the Detroit Edison and Dow Chemical? Do you have any contact there? Is any department of government including atomic energy having contact or liaison with a project of that sort?—A. I do not know of any in Canada.

Q. The point I want to find out is, does any department of the Government of Canada, including Atomic Energy of Canada, Limited, have liaison with this project that is now being undertaken in Detroit?

The CHAIRMAN: I do not know that Doctor Convey can speak for Atomic Energy of Canada Limited. He can speak for his own department. That is for Dr. Mackenzie. Doctor Convey can speak for his own Department of Mines and Technical Surveys.

The WITNESS: We have not got any direct relationship with any firm on a contract basis, but we do have a very good liaison from the point of view of exchanging information.

Mr. GREEN: For example, did you work with Sherritt Gordon in connection with their experiments for processing their nickel ore?

The WITNESS: Yes, Sherritt Gordon did their original process work and small pilot plant operations in the Mines Branch, and even today we work very closely together.

By Mr. Murphy:

Q. Are there any publications coming today from behind the iron curtain? —A. Not that I know of.

Q. There is nothing to prevent them getting all the information that is published by us?—A. Anything that appears in the public press they are entitled to, but the major part of our work is classified.

By Mr. Gibson:

Q. Do you allow laboratory technicians to go into your laboratory, say, from Sherritt Gordon, this being one of the companies you mention? When they do work in your branch, are they cleared for security, or are they in a

different sphere?—A. If they come into a section which is cleared for security, we expect that that firm will clear their staff before they bring them in. If they do not, we refuse them admission.

Q. They actually come down and use your equipment there?—A. Under our direction.

Q. In which case, do you charge them anything for the use of your equipment?—A. Yes, there is a nominal charge in so far as any materials which they may use are concerned, any extra time, say, with respect to prevailing rates staff, and if we should require equipment that we do not possess for that particular project, then they must produce it and at the end of the project mutual arrangements are made for the disposal of the equipment, and experience has shown that it is an arrangement that benefits the Mines Branch.

Q. And it is quite satisfactory?—A. Absolutely. Then there is this point to consider that if we work upon a contract basis with some of these firms, whatever we do would be the property of that firm. Any information which would be obtained would be theirs, but as arrangements exist at the present, wherein we work on projects of mutual interest, the results which we obtain are ours to deal with subject to their approval. Naturally, we would not want to use results which are confidential, but we can carry over results from one project into another. This provides us with a flexible research unit.

Q. There might be another nickel mine, for instance, found in Canada and that information would be valuable to them and it would be made available to them?—A. Yes.

Mr. GREEN: Do you work with provincial mines branches at all?

The WITNESS: Yes, a good example of that is the work in metallurgy which we do in conjunction with the Ontario Mines Department. That is usually associated with projects that they have in the Ontario Research Foundation. In the Nova Scotia Department of Mines there are quite a few common projects there, particularly in the coal mining operations. There are none in atomic energy.

Mr. MURPHY: Have any other provinces that type of research committee? What is it called in Ontario?

The CHAIRMAN: The Ontario Research Foundation is the name of it.

The WITNESS: There is the Ontario Research Council, who have committees under them, but then there is the independent laboratory of the Ontario Research Foundation. I believe most of their funds are derived from the Ontario Research Council. I may be wrong on that, but there is a close link between them. I do not know of any similar set-up in any other province. Most of the other research councils concern themselves with local problems, through their respective research laboratories.

Mr. GIBSON: I wonder if I might be excused? I am sorry, gentlemen, because I find this most fascinating.

The CHAIRMAN: Well, now, another committee is sitting and three of our members want to go to it, so I guess that brings us to a conclusion for today. Are there any other questions you want to put to Doctor Convey?

Mr. MURPHY: I only wish I had been here at the start.

The CHAIRMAN: Thank you, Doctor Convey.

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament

1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE

No. 5

WEDNESDAY, APRIL 8, 1953

WITNESSES:

Mr. Marc Boyer, Deputy Minister;
Mr. A. Thunaes, Chief, Radioactivity Division, Mines Branch;
Dr. W. A. Bell, Director of Geological Survey of Canada;
all of the Department of Mines and Technical Surveys.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

73336—1

MINUTES OF PROCEEDINGS

WEDNESDAY, April 8, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 4.00 p.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Bourget, Brooks, Coldwell, Kirk (*Digby-Yarmouth*), McIlraith, Murray (*Oxford*), Pinard, and Winkler.—(8).

In attendance: Mr. Marc Boyer, Deputy Minister, Mr. A. Thunaes, Chief of Radioactivity Division, Mines Branch, and Dr. W. A. Bell, Director of Geological Survey of Canada, all of the Department of Mines and Technical Surveys.

Mr. Boyer was recalled and gave a broad description of the two distinct functions of the Mines Branch of the Department of Mines and Technical Surveys in the field of atomic energy.

Mr. Thunaes was called. He gave detailed evidence on the functions and activities of the Radioactivity Division of the Mines Branch of the Department of Mines and Technical Surveys in the field of atomic energy and was questioned thereon.

The Chairman tabled copies of the following documents which were to be presented and distributed to members of the Committee at its next meeting:

1. Recovery of uranium from Canadian ores.
2. The function of the mines branch radioactivity division.

Dr. W. A. Bell was called. He gave detailed evidence on the functions and activities of the Geological Survey of Canada of the Department of Mines and Technical Surveys in the field of atomic energy and was questioned thereon.

The witnesses were also questioned in relation to accommodation, salaries, recruitment, and training of professional personnel. (*See also pp. 85 et seq of evidence by Dr. Convey on Monday, March 30—No. 4*).

The witnesses retired.

The Chairman notified the Committee that Dr. A. H. Lang, Chief of the Radioactive Resources Division, Geological Survey of Canada, Department of Mines and Technical Surveys, would be the witness at the next meeting. He also announced that a film, "The Highway of the Atom", would be shown in the Railway Committee Room on Tuesday night, April 14.

At 5.30 p.m., the Committee adjourned until 4.00 p.m., Tuesday, April 14.

A. SMALL,
Clerk of the Committee.

73336—1½

EVIDENCE

APRIL 8, 1953.
4:15 p.m.

The CHAIRMAN: Gentlemen, can we come to order? At the last meeting of the Committee we heard evidence from Dr. John Convey, Director of the Mines Branch of the Department of Mines and Technical Surveys. Today I propose calling Mr. A. Thunaes, Chief of the Radioactivity Division of that department. Just before calling him, I would ask the Deputy Minister of Mines and Technical Surevys, Mr. Marc Boyer, to clarify the division of duties as between the different branches with which we are concerned in his department.

Mr. MARC BOYER (Deputy Minister of Mines and Technical Surveys): At our last appearance before you, I personally outlined the functions of the Department of Mines and Technical Surveys related to atomic energy. I have related them to two branches of our department, the Geological Survey of Canada and the Mines Branch. We had Doctor Convey explain after that the functions of the Mines Branch in relation to atomic energy. These are two different functions; one is all the assistance we give to the Chalk River project on its metallurgical problems; the other one is conducted by the Radioactivity Division, and that is the development and application of suitable processes for the recovery of uranium concentrates from the different ores of both the Eldorado Mining and Refining Company at Beaverlodge and Great Bear Lake and any private operator that comes into the picture as an independent operator. We have as chief of the Radioactivity Division of the Mines Branch Mr. Arvid Thunaes, and he will explain to you all the particulars of the work we are conducting there.

Doctor Convey at the last presentation gave a lengthy explanation of the metallurgical functions. He is a physicist and the ex-chief of the Physical Metallurgical Division and knows about all the problems of metallurgy at Chalk River. He left it to Mr. Thunaes to explain the functions of our Radioactivity Division dealing with uranium ores in Canada.

The CHAIRMAN: Mr. Thunaes, will you proceed.

Mr. Arvid Thunaes, Chief, Radioactivity Division, Department of Mines and Technical Surveys, called:

The WITNESS: Mr. Chairman, I will try to explain to you the functions of the Radioactivity Division. In 1945, when the demand for uranium became very great, there was only one operating mine in Canada, that at Great Bear Lake, and the particular ore at Great Bear Lake was treated by gravity methods. Now it very soon became apparent that such methods were wasteful and that, furthermore, they could not be used for the large majority of Canadian ores because most Canadian ores are low-grade and cannot be treated by the simple methods that were then known in 1945-46. The Mines Branch was asked to assist the Eldorado Company, which was formed in 1944, with its work at the uranium mines—were asked to assist in improving the recovery of uranium from that ore, and the group gathered together for that purpose was named the Eldorado project. Then, in 1948, uranium was thrown open for prospecting. Great interest was shown and a great many claims were

immediately staked. This staking has been going on at an increasing rate ever since. It became very apparent that most of these ores were not a source of uranium unless we could find new methods for treating them, and in the metallurgy of uranium we had no history in treating such ores, so the long process started of trying to develop these methods. We had to resort to chemical methods of extraction, leaching processes, and that has been the job of the Radioactivity Division; to develop such methods not only for Port Radium ores but for all the ores coming in from private prospectors. These ores vary a great deal and require individual treatment. Uranium occurs in a great many minerals and in a great many types of ore associated with different elements that may cause trouble in extraction. To emphasize the importance of research, I may say that the famous Beaverlodge field would not at all be an important source of production if we did not have chemical methods of treating these types of ores, because the amount of uranium that is recoverable by simple gravity processes would probably not exceed 10 per cent of the uranium in the ore.

The Radioactivity Division grew as the demand increased and at present it consists of four sections. These are, the sections for ore dressing and extractive metallurgy, the sections for chemical analysis, for mineralogy, and for radiometric analysis. The analysis of uranium is difficult in itself, and five or six years ago it was extremely difficult to even get an accurate estimation of the uranium in low-grade ores. Reliable methods had to be worked out slowly and they were worked out in co-operation with the laboratories in the United States and Great Britain so that we now have excellent methods for chemical analysis of uranium. The Radioactivity Division has contributed through the physics section to radiometric methods of analysis; that is, methods based on the geiger-counter principle and similar principles, and we now have several accurate methods for assaying ores by radiometric means as regards concentration of uranium ore. One rather unique process was developed at the Mines Branch, namely the LaPointe Picker Belt which utilizes the geiger tube and the radioactive properties of uranium to sort the ore on a conveyor belt. The efficient recovery of uranium can be accomplished only by chemical methods and these have been tested first of all on a beaker scale, and later by pilot-plant opertaions. For instance, the leaching process now being used at Port Radium for the treatment of tailings from the gravity mill was developed at the Mines Branch and by this process the ultimate loss of uranium from Port Radium is now very low indeed. Similarly, other processes have been developed for the treatment of carbonate types of ores and we can say we have processes available for treating most pitch-blende and uraninite ores. The aim is to make these processes more and more economical so that lower and lower grade ores can be treated, because the amount of uranium occurring as high-grade ore is quite limited. As we include ores of increasingly lower grade, the actual pounds of uranium available in Canada becomes very much greater providing we can extract it.

The Division has co-operated very closely with the Eldorado company and in the early years most of the research was concerned with Eldorado ores. In later years an increasing number of private companies have sent in samples for test work and each sample is a separate problem. In the last six months the rate has again increased, and it has come to a point where it will be rather difficult to maintain efficient service. We have certain ores in Canada which as yet cannot be very efficiently treated. There are the Columbate Tantalate types of ore, quite common in Ontario. Recovery of uranium from these ores require a great deal of research work, and we are now engaged in trying to find efficient methods for treating these ores; progress has been quite good but considerable research remains to be carried out.

Another function of the Division was to train operators for the new plant at Beaverlodge which is starting operations very soon. This training was done in a small pilot plant in the Mines Branch laboratories. As I mentioned before, the requirements for test work have increased tremendously and the space available is inadequate. We are hoping, due to the expansion of the work, that a new building will be available because we feel that, if more space is not available, we will soon get a backlog of samples on hand and that will have a very unfavourable reaction in the mining field. We hope through these expanded facilities to maintain efficient service.

The CHAIRMAN: That concludes Mr. Thunaes' general remarks. We are now open for questions.

By Mr. Winkler:

Q. As the methods of concentration—if that is the right word—improved, has it been found profitable to work over the old tailings at all as yet?—A. Yes. For instance, at Port Radium the tailings that formerly were dumped or stored are now being re-treated. They are being dredged from the lake, where they were buried, and re-treated.

By Mr. Brooks:

Q. What methods do they use in other places to treat ore? You said that experimental work was being carried out at Eldorado. What do they use in the Belgian Congo for instance?—A. In the Belgian Congo they had ores similar to the Port Radium ores, and they used gravity methods for concentration.

Q. It was a rich ore?—A. Yes.

Q. With this ore there must be a tremendous quantity of materials which are of no use. Do they eliminate as large a quantity of useless material as they can and then bring more or less the concentration of ore to some central place for testing for uranium? They would not bring great quantities of material out from Eldorado, for instance, or from Great Bear lake, or do they make tests there?—A. They make the actual concentrations at Great Bear lake, and the concentrates shipped out from Eldorado have been obtained either by gravity concentration or by leaching. So it is the precipitates or the gravity concentrates which are shipped out.

Q. They do not complete the tests at Great Bear lake?—A. The refining is being done at Port Hope.

Q. What percentage of the original material would be sent out from Great Bear lake to Port Hope?—A. I do not believe I am allowed to give the actual tonnage.

The CHAIRMAN: No, you are not.

The WITNESS: But I can say that the figure is well above 90 per cent.

By Mr. Brooks:

Q. You say more than 90 per cent of the material is sent out?—A. The uranium in the Port Radium ore is recovered in two plants, and the concentrates are shipped out. These concentrates would contain about 90 per cent of the uranium that was originally present in the ore.

Q. What I meant was, what quantity would be sent from Great Bear lake to Port Hope after they treated it?

The CHAIRMAN: Are there any more questions?

By Mr. Brooks:

Q. Are they training men at the universities to do this work, as well as at this special school you speak of?—A. Yes. At the University of British Columbia, at the University of Alberta, and at Queen's University there are

small groups working on these particular problems, specific problems in ore treatment. For instance, at Queen's University a group is doing research on the flotation of uranium ores. That is a rather important phase of the concentration of such uranium ores that are rather refractory as regards leaching. The uranium mineral must be concentrated before leaching, otherwise the process is too expensive.

Q. Are the students connected with the National Research Council before going to the universities, or are they just students who go to universities to take a course?—A. No. They are regular students.

Q. You say they are regular students?—A. Yes.

The CHAIRMAN: Are there any more questions?

By Mr. Brooks:

Q. In what other parts of Canada have they discovered low-grade ore? For instance, has any been discovered in the martimes?—A. We have had very few samples from the maritimes so far. Most of the ores have come from Saskatchewan, the Northwest Territories, Manitoba, and Ontario. Those are the main sources.

Q. But they are finding new locations all the time?—A. Yes.

By the Chairman:

Q. Mr. Thunaes, can you tell us what percentage of your work arises out of the ores supplied by other than the Eldorado Mining Corporation?—A. Yes. At the moment I would say from 50 to 60 per cent of our work is connected with ores coming from private companies. This particular percentage has been increasing quite rapidly. Some years ago most of our research was concerned with Eldorado ores, but such is not the case today.

Mr. BROOKS: What percentage of uranium are we using in Canada, and what percentage do we ship abroad? Is that a fair question?

The WITNESS: Well—

The CHAIRMAN: I think we are in difficulty there.

Mr. BROOKS: Well, I imagine perhaps we can skip it.

By the Chairman:

Q. How much of a staff have you on this work?—A. At present we have about 60 engaged on the regular staff of the Division.

Q. Yes?—A. But we generally have engineers from other companies, Eldorado or private companies, working on their particular ores.

Q. I mean: of your own staff, you would have about 60?—A. Yes.

Q. And you provide facilities for engineers from private companies who are working on their own ores?—A. That is right.

By Mr. Brooks:

Q. Do the men who go prospecting into the Beaverlodge or the Great Bear lake area proceed on their own? Does the department take any responsibility for them at all, or do they have to look after themselves altogether as far as food is concerned, for example?—A. That is outside my field, but I believe they are entirely on their own.

Q. It is a pretty risky business?

The CHAIRMAN: Is that all? There was one other question which was bothering me. Perhaps you could clear it up. I understand you to say that you were training operators for the new plant at Beaverlodge?—A. Yes.

Q. Why is it necessary to have your people train them?—A. We have the equipment for pilot plant operations. If we did not train them at the Mines Branch laboratory, Eldorado would have to build a separate pilot plant for that purpose, which would be rather a lengthy and costly process. But we have this equipment available.

Q. I take it that the pilot plant was your development? You developed it, did you not, in conjunction with Eldorado?—A. At Beaverlodge?

Q. Yes.—A. This carbonate-leaching process was originated at the Mines Branch. But in its present form it was developed to quite an extent at the University of British Columbia and by Eldorado. The Mines Branch has developed during the last year or two an alternative carbonate process, which is considerably simpler and less costly, and this process is now undergoing final pilot plant testing by Eldorado.

Q. Yes. Now then, do you have occasion to train operators for any private companies.—A. We have had requests from two companies lately for the pilot plant testing of ore, but I do not think we could say it is for training operators as yet.

Q. You are not at that stage as yet, or the private companies are not at that stage as yet?—A. Two of the private companies have requested pilot plant tests this summer, one starting in June and the other perhaps in August.

Q. Could you elaborate a litle more fully on the extent to which a change is taking place in your work, comparing the work done for the Crown-owned company and the work done for the privately-owned companies?—A. Well, there are two reasons for that change. One is that the Eldorado Company ores have ben tested sufficiently so that efficient processes are available. Therefore we do not need to carry on quite as much work for the Eldorado as previously. But the main reason is this: that there are more samples coming in from private companies than in previous years.

The CHAIRMAN: Are there any further questions?

By Mr. Brooks:

Q. How many private companies are operating in connection with this uranium?—A. Actually operating?

Q. Yes.—A. I could not give you the exact number. There are quite a number of companies who are now in mining development, in other words have started underground mining; but the only producers at the moment is the Eldorado company. It is expected that this condition will change in the next year or two and even this year there might be a couple of smaller companies shipping uranium concentrates, both from the Northwest Territories.

Mr. BROOKS: Has the government control of all companies engaged in handling uranium and does the government look on the uranium mining as sort of its special function?

The CHAIRMAN: No. They try to encourage private companies by undertaking to pay a minimum price for uranium ore for ten years.

Mr. BROOKS: But the government buys the uranium.

The CHAIRMAN: It undertakes to buy it all at a fixed minimum price for a fixed minimum time running out in 1962.

Mr. BROOKS: I was wondering what private companies were selling to the government that you know of?

The WITNESS: There are none yet, but they expect two small companies to ship this year and the private companies that are now developing in the Beaverlodge area are expected to produce within a few years.

Mr. BROOKS: These companies cannot do business with any other business concern organization except the government; they must sell to the government?

The WITNESS: Yes. As is the case with gold, the companies must sell to the government.

The CHAIRMAN: Any further questions of Mr. Thunaes?

Next week there will be two papers given by departmental officers at the Canadian Institute of Mining and Metallurgy with your permission, I would like to indicate them as having been tabled today and distribute them when they are delivered next week in Edmonton. They are somewhat technical papers but, if I could indicate them as having been tabled at this meeting, it would be convenient.

If there are no further questions for Mr. Thunaes, I will call on Dr. Bell. Dr. Bell is the Director of the Geological Survey of Canada.

Dr. W. A. Bell, Director, Geological Survey of Canada, Branch of Department of Mines and Technical Surveys, called:

I might explain that Dr. Bell is also going to be away next week and I would like to finish his evidence today. I expect it will be brief.

The WITNESS: Mr. Chairman and gentlemen: Direct participation by the Geological Survey in the federal activities in the atomic energy field began in 1944 when the Eldorado Crown Company took over the assets of the Eldorado Gold Mining Company. But, prior to that year, the Survey made very important although indirect contributions to the discovery of radioactive minerals. I would like to mention a few of the contributions that were the initial starters of the activities in most of the known important camps today where uranium is found. The first of these contributions consisted only of notices in several of our survey reports beginning in 1863 of the discovery of uranium mineral by an American on the north shore of Lake Superior. The exact locality of this discovery was not known, but the notices in the survey reports led a prospector in 1948, when he was equipped with a geiger counter, to rediscover this locality and that led also to the discovery of other occurrences in the Sault Ste. Marie district. The second occurrence which is important in this connection was made by an exploratory geological party in 1900 in the Northwest Territories. In their report they noted the occurrence of Cobalt on the east shore of Great Bear Lake. Now, thirty years later, this 1900 report led Gilbert La Bine to visit this locality in the hope of finding silver because silver was known in many instances to be associated with cobalt, particularly in the Cobalt camp of Ontario. He succeeded not only in finding silver but also pitchblende. This led directly, of course, to the Eldorado Mine. Following that discovery, the Geological Survey made several geological maps in that region and these proved to be very important when uranium took on the dominant interest in that field.

Between the years 1920 and 1932, the Geological Survey published several reports of very comprehensive investigations that were made of radioactive minerals associated with rare earth minerals in Ontario. These investigations were made by the late H. V. Ellsworth of the Survey staff who became, on account of this work, internationally famous as a pioneer in this geological work on radioactive minerals.

In recent years some of the survey parties have reinvestigated these deposits in Ontario and while, at the present time, their commercial importance is open to some question, as Dr. Thunaes pointed out, on account of the difficulty of concentration of material, it is not unlikely that some of them may be of commercial importance in the future. It is still being investigated by private capital.

We come now to 1934 when there was the discovery of gold in the Lake Athabaska region. This led the Survey to send a party to re-investigate and remap this district in the vicinity of what is now Goldfields, and in their report they recorded the occurrence of pitchblende in a gold-copper prospect at what was called the Nicholson. Ten years later, when the geologists of the Crown company and Geological Survey jointly made investigation of all known radioactive occurrences, it led to a re-investigation of the Nicholson occurrence and the survey of the surrounding district. As a result of the recommendation of the geologists, the Crown company took up many claims in that district and, of course, this was the beginning of the present activities in the Lake Athabaska area. In 1944, when the Crown company was formed, it immediately asked the Geological Survey to assist in searching for new ore by making special investigations of the known occurrences at Great Bear Lake and by extending the Geological Survey maps in that district and through other favourable districts. Among these latter districts was the Lake Athabaska one which has been referred to already. Prospectors were attached to some of these parties and as a result very many occurrences of uranium were found, particularly in the Lake Athabaska district.

All together, since 1944, the Survey has made 19 geological maps of the most important uranium districts. Their scales vary from very detailed maps, one inch to 400 feet up to one inch to one mile.

That briefly outlines the general activity of the Geological Survey in regard to atomic energy, but in 1947 when the mining of uranium by private individuals and companies was again permitted by the government, the Geological Survey realized that the demands upon it for information and for field work would be greatly increased, and to meet this demand they formed a special division within the Survey known as the Radioactive Resources Division. One of the primary functions of this division is to act as an official agent for the Atomic Energy Control Board in matters dealing with the prospecting and mining of uranium. Doctor Lang, who is the present chief of the division, will be able to explain more fully the work of the division.

In closing, I would like to mention that one of the greatest difficulties that we have in carrying on our work, both in this division and in other divisions of the Survey, is the difficulty of security-qualified geologists and keeping them on our staff. Within the past 15 months we have lost 14 fully qualified geologists, which is 20 per cent of our total staff of that grade, and they have resigned from the Survey to accept positions which, on an average, pay 60 per cent more salary. This, of course, affects not only the Radioactivity Division but it affects the other types of mapping which are indirectly almost as important as the mapping in the known areas, because most of our parties now in any areas that are at all favourable for uranium occurrences are equipped with geiger counters and are sent out to look for areas that might be suitable ground for uranium. I think that is all, Mr. Chairman.

The CHAIRMAN: Could you explain just a little more clearly just what Doctor Lang's part in the organization is? I do not quite understand how the Radioactive Resources Division fits into the Geological Survey.

The WITNESS: As far as the field work is concerned, it is tied in intimately with our general field parties. Our main division for field work is called Regional Geology Division. Its function is to prepare geological maps, utilizing base maps furnished by the Surveys and Mapping Branch of the Department, but the Radioactive Resources Division was set up to carry out duties arising from the circumstance that we were designated the official agent of the Atomic Energy Control Board for filing and keeping of information of all radioactive occurrences and developments. It was a regulation of the Board that required prospectors and others to record all occurrences and all analyses or assays that were made of uranium. So, the main function of that division is to maintain a confidential inventory of all occurrences, and it also examines in the field as

many deposits as possible in order to advise prospectors and to gather data that will be useful in searching for other deposits. So we have in the division a very limited number of geologists. We should have more. In addition we have one or two mineralogists who make special studies of deposits. For instance, currently we are studying in very great detail scale the ores at Beaverlodge.

The CHAIRMAN: You said in your evidence a few moments ago that the commercial importance of the deposits in Ontario was open to some question. I take it that that is all linked up with the proved methods of recovery?

The WITNESS: That is linked up entirely with the recovery. There is one hopeful advantage of such deposits, and that is that associated rare earths may be of importance, such as beryllium, cerium, columbium, and tantalum. The chief difficulty, I understand, as to the uranium is to get a concentrate that will carry 10 per cent of uranium, that is to provide the Crown company with the required concentration.

By Mr. Winkler:

Q. Are there a large number of mapping parties engaged every summer?—A. As I say, we would like to have more. We have on an average of about four geologists in uranium country. The provinces, of course, are doing a great deal of detailed work; Saskatchewan, particularly, Manitoba to some extent. We coordinate our programs with theirs.

Q. And in the Northwest Territories?—A. In the Northwest Territories we are responsible entirely. One of the reasons why we had a helicopter operation last year was to speed up the reconnaissance mapping of an area that looks really favourable for uranium occurrences. We shall provide reconnaissance maps on the scale of eight miles to the inch, which will be of great help to the prospector in drawing attention to those areas worth while looking into with more detail on the ground. It came out that from ten to almost forty per cent of that area looks rather promising for mineral deposits, which is a high percentage in a pre-Cambrian country. We covered last year 57,000 square miles by using five geologists; ordinarily a party of five would take about 25 years to cover the area by ordinary ground methods.

By the Chairman:

Q. How did you achieve that?—A. They achieved that by examining by helicopter hovering close to the ground, making about 15 landings per day and testing the rocks.

Q. You used airborne reconnaissance instruments as well?—A. Well, that is one thing that we are still working on. There is considerable need, and it would be a great help if we had an airborne instrument that could be used in a plane for detecting radioactivity. A great deal of work was done on that a few years ago by the Crown company and we cooperated in that work with our geophysicist. While they have an instrument, a scintillometer, it was not too successful for reconnaissance from the air in pre-Cambrian country. They found they had to do so much ground work to check anomalies that showed radioactivity, so the idea now is to try to improve that instrument so we can suspend it from a plane on a cable, and have another instrument on the plane so that you have two recordings. In finding the differential between them, we figure we may do away with some of the general background anomalies which seemed to confuse the picture previously. We are coordinating with the Crown Company in developing such an instrument by making tests from a plane this summer. We have to decide the length of the cable safe to use, and the instrument itself will be suspended in a cage, called a "bird", at the end of the cable. If it works successfully, we are going to instal it in the plane which will be used this summer in aerial magnetic surveys. We hope to give it a fair test this summer and judge of its value as a reconnaissance instrument.

By Mr. Brooks:

Q. Is it a difficult matter to store uranium concentrates for future use with all this radioactivity?—A. That question is really for the Mines Branch.

The CHAIRMAN: Could you come over here, Mr. Thunaes? Mr. Thunaes can answer that.

Mr. BROOKS: It may be a silly question.

The CHAIRMAN: No, we can have an answer to that.

Mr. THUNAES: There is no danger if ordinary precautions are taken. We have to be careful but, as far as actual radiation is concerned, there is no danger.

Mr. BROOKS: You have to make special provisions for storing it. You cannot store it like gold at Fort Knox or iron or these other minerals. I would think you would have to take some special precautions for the storing of uranium.

Mr. THUNAES: It is not kept in very large quantities in this country.

Mr. BROOKS: We are speaking of increasing production and I am wondering what facilities you have to store it.

Dr. LANG: I do not think there is any danger of theft.

Mr. BROOKS: I am not talking about theft, but radiation.

Dr. LANG: If there was any danger we would lower the content of the stock, but that would be over a period of years and it is quite common for the mines to store it.

The WITNESS: They do not encourage people to carry samples around in their pockets.

Mr. BROOKS: That is what I understood.

Dr. LANG: Ores are not concentrated to that extent.

The WITNESS: No, these are pure pitchblende samples.

The CHAIRMAN: Any further questions for Dr. Bell?

By Mr. Kirk:

Q. Did I understand Dr. Bell to say that this new apparatus, the bird cage, would be used this summer?—A. Yes. We are hoping to have a test with a plane before we go out to the field on aeromagnetic surveys. We will have a couple of weeks test to see how it will work. They may run over the Soo area where we know there are deposits or they may have tests with planted uranium.

Q. You will make the test and then go into Nova Scotia and Newfoundland?—A. Yes.

Q. This apparatus I believe hangs from the plane?—A. Yes. The Crown Company is trying to develop a radioactive detector which can be suspended in a bird suspended from the plane. We will have a magnitometor in the same plane. We are going to experiment with the length of cable that can be used. Too long a cable may be too big a drag on the plane. We are going to use a cable of some length for suspension of a second magnetic detector and if we can get a suitable reconnaissance radioactive detector from the Eldorado Company there will be no difficulty in combining a radioactivity survey with a magnetic one.

Q. You mean two surveys at once?—A. Yes. You can do two surveys at once. It would show up certain anomalies that might warrant direct ground surveys of a more detailed and more thorough nature.

Q. Is this part of a general plan to survey all across Canada?—A. In general, we have a regional plan in aero-magnetic work, but private people are doing this work too, and our programs are of a more regional nature and

are designed to fit in with our long range geological mapping programs. The aeromagnetic maps will aid in an interpretation of the geology of an area.

Q. In other words, this is part of a general plan, but at the present moment there is no specific reason for going to one area rather than another except to fit in with the general plan?—A. No, except that the general area chosen is considered probably more favourable for metallic deposits.

The CHAIRMAN: Any further questions?

Mr. BOURGET: I would like to ask Mr. Boyer if the department is contemplating getting better accommodation for the Radioactivity Division, because, if I understand correctly, Mr. Thunaes said they were carrying on their work in two small huts and if they cannot get better accommodation the work will fall behind.

Mr. BOYER: We have a preliminary sketch of the building that will be added as an annex to another building of the Mines Branch on Booth Street, to take care of all the expanse there of the work, and the new work that will be coming in from private companies. The project is presently at a preliminary stage, but we are trying to get the government to allow a certain amount of money for the design, and possibly start on the construction of that building as soon as possible.

The CHAIRMAN: You are pretty badly overcrowded in these huts?

Mr. THUNAES: Yes.

The CHAIRMAN: That is my impression. Your work is being interfered with right now through lack of space?

Mr. THUNAES: Yes, because through lack of space we have not got space to put more men in there to catch up with the work.

The CHAIRMAN: Are there any further questions?

By Mr. Kirk:

Q. There was one statement you made a little while ago about the resignation of 14 geologists in a period of 15 months, and that it was 20 per cent of the staff of trained geologists?—A. Those were all Ph.D's.

Q. Roughly 14 out of 69?—A. We have had more resignations outside of that class, but that was the hardest hit one, the professional class, because it takes years of training and experience.

Q. These men have had training at university?—A. They got their training with us. They had at least 5 years of training in field work with us.

Q. What about your replacements, aside from the loss of the five years of training? Are you getting replacements?—A. We are not able to get replacements because we are having the same difficulty in getting younger men from among the graduates. We need this year, or we should have about 72 senior geological assistants, men who are graduates of a university and who have had at least one year's experience in the field. But we have only had applications from 50, and of them only about 30 have had that one year's experience, so they cannot be classified as suitable senior assistants as yet. It is from the senior assistants that we get the senior recruits to take their Ph.D. degrees and continue work on the staff. It seems as if this crisis will go on for years.

Q. These men who are leaving are getting 60 per cent more than they would have got in the federal civil service?—A. It varies from 30 to 85 per cent.

By Mr. Brooks:

Q. Where are they going?—A. Some are going into the same line of work. Some are going to metal mining companies. Oil companies are one of the big competitors now; but it is just about fifty fifty between them and mining companies.

Q. But they are in that general picture. It is not such a loss at all, so far as the work is concerned in the country, if they are going to private concerns and to universities?—A. Well, of the 14, 2 are going to India; 1 is going to East Africa, with a mining company; and 2 are already in Trinidad with an oil company.

Q. I think Dr. Mackenzie told us the other day that they used to lose a lot of good men, but since they lost to industry in Canada it was not really such a great loss after all, as far as the development of the work is concerned.

Mr. BOURGET: With respect to those who are going to India, are they going under a technical assistance plan, or are they going under the auspices of private concerns?

The WITNESS: I did not include them in the 14. These are men who resigned.

By Mr. Kirk:

Q. With the increase in the work of your department and in prospecting, and in what the various companies are doing, you are going to be put into a position where you cannot carry on in the way you have been, let alone look after an increase?—A. That is it, precisely. Outside of the 14 who left, I have a list of about 20 on our staff who have received offers for the most part involving the same amount of salary increase. It is just nip-and-tuck whether those men will go or remain. But they are men who like to do research, and they are not anxious to go.

Among the older men there would be a lot more offers from industry in Canada, except that the mining industry does not wish to weaken the Survey. We provide the basis information. That is one reason why we do not lose more to industry. In the first instance they may be able to get our men, but at the same time they are at a loss in gathering that general basic information which is important for the discovery of new deposits, or even for their development.

By the Chairman:

Q. Your problem is the problem arising from these men leaving because they can get more adequate compensation for their services?—A. Yes.

Q. But there is also another problem. We are not developing enough graduates in that line of work?—A. That is true, but I think that if we could have met the competition in salary, not the full way, but let us say half way, I do not think we would have lost any of those men.

Q. But would not private industry then be short of men? Where would they get their supply of men?—A. That is possible.

Q. So, to come back to it, there is a shortage in the number who are going through?—A. Yes.

Q. Do you have any system of scholarships or fellowships similar to that which the National Research Council has in its work?—A. No.

Q. You have nothing of that sort?—A. We have nothing of that sort, because the National Research Council scholarships and bursaryships include geology as well as the other sciences. The Survey does not give research grants to universities on a research project basis. They are granted according to recommendations of a National Advisory Committee for Research in the Geological Survey that was set up several years ago.

Q. Yes?—A. This Committee was formed as a result of recommendations by the C.I.M.M.

Q. What is that?—A. That is the Canadian Institute of Mining and Metallurgy. They asked the government for such a Committee because they felt there should be more geological research done. The Committee has been instrumental in getting the research grants established. It has encouraged a certain amount of research work in the universities, because they give grants somewhat similar to the National Research Council grants in other fields of science. The grants are for projects only. They may help students already doing graduate work at university, but we have no scholarships for undergraduates.

Q. That grant is made to a university?—A. The grant is made to a university for a specific type of research.

Q. Is that under the direction of your department?—A. It is included in the Survey estimates.

Q. How many of those grants have you made in fact this year?—A. Roughly, around 15.

Q. Around 15?—A. Around 15, and they are distributed as follows: McGill, Laval, Toronto University, Queen's, McMaster, Manitoba, and British Columbia. I think that includes most of them. Any university can make application each year.

Q. How much are those grants?—A. They vary. It is based on a project basis. The total sum that we had out last year was about $18,000, I think. We had applications for about $23,000. So $25,000 in the estimates for this year are included for grants, which sum, I think, with the available personnel now, would be about standard for a few years. We can probably give out $25,000 for different projects in the universities.

Mr. BOURGET: Would you employ students during the summer holidays?

The WITNESS: Oh, yes. We would like to employ students. We would like to get about 115 undergraduates, and between 70 to 80 graduates, but it is difficult.

By Mr. Kirk:

Q. It seems to me that is a rather sad commentary on the present state of affairs. What are you paying your junior geologists? What is the range? And what are you paying your senior men who have their Ph.D. degrees and the years of experience when they come to you?—A. The student, first coming in—not the graduate—will receive about $140 per month.

Q. That is the undergraduate?—A. The undergraduate would receive from $140 to $200; and the graduate would start off with about $220 and go to about $340 per month, that is only for seasonal work; and I am afraid that I cannot give you the exact figures just now. Would you know that, Dr. Lang? It varies on a scale according to their experience. They are graded by the Civil Service Commission entirely.

The CHAIRMAN: Could we have the salary classification put in the evidence?

Mr. KIRK: I think it would be a very good idea.

The CHAIRMAN: For junior geologists and for senior geologists.

Mr. KIRK: I mean the full-time men you have lost, not the summer jobs. I mean the men who come in for full time. I am interested in their salaries and those who had their post-graduate degrees, such as the Ph.D.

SALARY RANGES BY CLASSIFICATIONS

Geologist, Grade 1—$3,120, $3,300, $3,540, $3,780, $4,020, $4,220; Grade 2*—$4,300, $4,500, $4,700, $4,880, $5,080, $5,260; Grade 3—$5,260, $5,460, $5,640, $5,920; Grade 4—$5,980, $6,220, $6,460, $6,580;

Senior Geologist: $6,600, $6,900, $7,200.

The WITNESS: I can only give you offhand that we start at $4,300 with Ph.D's. Industries take these same men out at an average salary of $7,500 to start. We start at $4,300 and go up to a fully qualified senior geologist at $6,800.

Dr. LANG: $7,200.

By Mr. Bourget:

Q. Do you think your loss is due to a question of salary?—A. I think it is at the present time. The younger man we have been getting has had to struggle. It is quite a financial burden to go through three years post-graduate work to get your doctor's degree. So a good many of them are almost in debt when they come in the Survey. Then they come to the housing situation in Ottawa and a lot of them have had to buy homes with a mortgage and most of these men told me that for financial reasons they just simply could not stay.

Q. They did not tell you how much they would be getting?—A. Yes. We supplied the civil service just recently with a list of these 14. We could not in all cases, but in the majority of the fourteen we did.

Q. Did private industry offer a lot more than the department?—A. The average is 60 per cent more on the initial salary. If a man makes good in industry his chances of promotion are more rapid than in the government.

Mr. PINARD: How long does it take a man to obtain the top salary of $7,200?

The WITNESS: It depends on the promotion and promotion depends a great deal on the wastage through superannuation and so on, but generally it takes fifteen years, ordinarily, before he would go from geologist grade two up to senior geologist which is the highest he can reach.

Mr. MURRAY: Do your geologists share in any stake if they make a strike?

The WITNESS: No.

Mr. MURRAY: Does private enterprise?

The WITNESS: I could not say offhand. Some companies do, particularly if they go out with smaller companies they may get a share. I could not say. But we cannot even speculate in mining properties of any kind. That is against our oath of office really. We are not to get any outside remuneration, which is only fair, because we must write unbiassed reports.

Mr. PINARD: Is your problem more acute than in other departments of the civil service?

The WITNESS: I think at the present time in geology there is more competition. Exploration started it off and there has been a tremendous exploration since the war.

Mr. BOYER: The problem has been put before you by Dr. Convey and Dr. Bell, but the more acute is that of the Geological Survey and it is getting to a situation of panic there. It is presently before the Civil Service Commission for discussion.

Mr. BOURGET: The secretary of the engineering corporation at Quebec knows there is an acute problem in trying to get professional engineers, so it

*The initial salary for a Geologist who has obtained his Ph.D. is $4,300 per annum.

goes for geologists and other scientists. But I do think the question of salary is one that will have to be looked into because they are not paid the salary they deserve.

The WITNESS: There it too big a discrepancy. The government service has a distinct attraction to a lot of men who are interested in science and research work because they can publish their results and are given a pretty clear opportunity or right to do research work. I think in industry they are much more handicapped; there is more routine work. Some of the companies permit them to publish scientific papers, but they do miss a great deal if they are interested in science. Some of them, of course, want to go out and make money.

The CHAIRMAN: This problem, I think, narrows down to the amount of salary. There are certain benefits working in your branch that are better than in private industry to anyone really interested in research, and then your superannuation provisions are good and things of that nature.

Mr. BOYER: I think I can add that the Geological Survey of Canada has existed for 110 years and there is tradition and there is pride in belonging to the Survey for all geologists there. If they leave in those numbers, it is a question of salary.

The CHAIRMAN: Any further questions? Thank you Dr. Bell.

Now, on Tuesday night, in the regular film showing for members, the film "The Highway of the Atom" will be among those shown. It is a thirty-five minute film of the Northern Transportation Company's activities. It is of no particular informative value in relation to the work of the Committee, but should be of considerable interest.

We have one more witness from the Department of Mines and Technical Surveys, he is Dr. Lang of the Radioactive Resources Division of the Geological Survey of Canada. We also have the slides of the Eldorado Company showing their activities. I understand the slides of the Eldorado Company are quite interesting and quite informative to anyone seeking to understand the operations of that company. We also have slides from the Geological Survey of Canada and it occurred to me that we might hear Doctor Lang and then see the slides from the department and the slides from Eldorado all at the one meeting. Does that arrangement meet with your wishes?

Agreed.

What about the time of the next meeting? Tomorrow morning is impossible; we cannot have the Eldorado slides available tomorrow. What about next Tuesday?

Agreed.

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament

1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS AND EVIDENCE

No. 6

TUESDAY, APRIL 14, 1953

WITNESS:

Dr. A. H. Lang, Chief of the Radioactive Resources Division, Geological Survey of Canada, Department of Mines and Technical Surveys.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

MINUTES OF PROCEEDINGS

TUESDAY, April 14, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 4.00 o'clock p.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Bourget, Brooks, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Murray (*Oxford*), Stuart (*Charlotte*), and Winkler.—(9).

In attendance: Dr. A. H. Lang, Chief of the Radioactive Resources Division of the Geological Survey of Canada, Department of Mines and Technical Surveys.

The two documents tabled by the Chairman on April 8 were distributed to members present.

Dr. Lang was called. He gave detailed evidence on the special activities of the Radioactive Resources Division of the Geological Survey of Canada in the field of atomic energy and was questioned thereon.

Dr. Lang also tabled a pamphlet, "URANIUM IN CANADA IN 1952—PRELIMINARY", for later distribution to members of the Committee.

The witness retired.

At the conclusion of today's evidence, the Committee viewed lantern slides, with commentaries by Dr. Lang and Mr. Bennett, respectively portraying:

1. Types and distribution of Canadian uranium deposits and tables showing their statistics; also, diagrams and views illustrating some of the principal uranium mines in Canada.
2. Transportation and construction activities of the Northern Transportation Company Limited and Eldorado Mining and Refining Limited in respect of operations at Great Bear Lake and Beaverlodge, Saskatchewan.

The Committee agreed that no further evidence would be taken from witnesses for the record. Following a discussion on proposed visits, the Committee also agreed to limit itself to an inspection visit to the laboratories of the Mines Branch and the Geological Survey of Canada, Department of Mines and Technical Surveys, on a date to be arranged by the Chairman.

The Chairman reminded members of the Committee present of tonight's feature film, "The Highway of the Atom", to be shown by the National Film Board in the Railway Committee Room, portraying in colour the operations of the Northern Transportation Company Limited in the Mackenzie River watershed with particular reference to the launching of the vessel *Radium Franklin* and its maiden voyage from Waterways in Alberta to the Bear River in the Northwest Territories. (Produced by Crawley Films for Eldorado Mining and Refining Limited).

At 6.20 o'clock p.m., the Committee adjourned to the call of the Chair.

A. SMALL,
Clerk of the Committee.

73689—1½

EVIDENCE

APRIL 14, 1953.
4.00 p.m.

The CHAIRMAN: Gentlemen, if you will come to order, the clerk will distribute the two papers "Recovery of Uranium from Canadian Ores" and "The Function of the Mines Branch Radioactivity Division" to which I referred at the last meeting—the technical papers—and I will call on Dr. A. H. Lang of the Radioactive Resources Division of the Geological Survey of Canada to complete the evidence on the Geological Survey. I propose at the conclusion of his evidence to ask him to show us some slides of the types of deposits and their distribution in Canada, and then call upon Mr. Bennett to show slides on the Eldorado operations. If that meets with your approval, I will call on Dr. Lang.

Dr. A. H. Lang, Chief of Radioactive Resources Division, Geological Survey of Canada, Department of Mines and Technical Surveys, called:

The WITNESS: Mr. Chairman and gentlemen: At the last meeting Dr. Bell, Director of the Geological Survey, outlined the general work of the Survey related to uranium, and he mentioned that we had parties making geological maps and reports of areas that were known to be favourable or might be favourable for uranium. He also mentioned that the Survey had set up a special division to do special types of work and it is about that work that I would like to speak briefly today.

The Radioactive Resources Division had its beginning in 1948 when private prospecting and mining for uranium was permitted. Its work has mainly to do with special research on the origin and distribution of uranium deposits in Canada, to keep track of the resources, and to act as the official agent of the Atomic Energy Control Board in matters dealing with private prospectors and mining companies.

I will describe that work briefly under four headings: Field Work, Laboratory Work, Office Work, and Publications.

Field Work

Geologists of the division examine as many deposits as possible each year, trying to go to the main new discoveries and the properties with the most active development work; but as we have never had more than two geologists for that work we can now only go to a very small fraction of the discoveries and properties each year.

When we began in 1948 there were about thirty properties in Canada; most of those were old ones that had been known for years and were not considered to be of much value. At the end of 1952 there were 645 properties, and we have about the same staff now for field work as we had originally; so we can only skim the cream off now. When we examine these properties we try to study their origin, and the kinds of rocks and geological structures that are favourable, and we make generalizations that may be useful in prospecting and exploration work in general; and we also collect information for an inventory which I will mention in a moment.

We also have one mineralogist doing field work, making a special study of the mineralogy of the deposits of the Athabasca region. This has a useful

bearing from the point of view of the origin of the deposits and it also provides basic information useful to the Mines Branch if they do test work on the ores.

Laboratory Work

Our laboratories include a laboratory for making radiometric assays. We make these assays free of charge on samples sent in by the public, and also on samples that are collected by our field men. Results are almost always mailed to the public within 24 hours of receipt of sample.

A few years ago we made as many tests as people wanted to ask for, as long as they were for properties in early stages of exploration, but as the method for making these tests became published and many of the private assaying firms in Canada are now able to do that work, they made representations to us that we were competing unfairly in making these free tests, so we limited the number of tests to six. They would have preferred us to cease making them entirely, but we felt it was essential to make some in order to encourage new discoveries and help people who could not afford to pay for the tests. So we now limit the number to six from any one discovery or property. A few years ago when we were making as many tests as were requested, we made up to about 8,000 a year. Last year it ran to a little over 3,000 partly because of the limit in the number for any one sender and partly because prospectors are learning more about the deposits and are not sending in as many worthless samples.

We also make free mineral determinations to help the prospectors to know what the mineral is, because as I will explain later in the talk accompanying the lantern slides, there are many types of minerals and some of them are much more favourable than others; so it is desirable to have accurate methods of identifying them. We have laboratories for making microscopic studies of minerals and ores, X-ray tests and spectrographic tests. We have a small chemical laboratory and we are now equipping a mass-spectrometer laboratory which will make accurate determinations of the age of the deposits which should help in determining which rocks are most favourable.

Office Work

Our office work serves two main purposes: First, as agent for the Atomic Energy Control Board, we receive and compile reports of all discoveries showing 0·05 per cent uranium or thorium oxide or more. Also, there are now 131 individuals and companies operating under exploration orders from the Board and they are required to send detailed monthly reports on their operations; these are sent directly to us. We file them. Our geologists collate this information and boil it down into short resumés which go into what is called the confidential inventory of "Canadian Deposits of Uranium and Thorium," which is brought up to date annually. One set of that inventory now comprises nine volumes, and it contains a short up-to-date description of each of the 645 properties; as the number has increased, of course, the work of receiving that information and collating it has increased enormously.

I think I might mention that one possibility I have in mind is to suggest to the Board that perhaps monthly reports are no longer needed. Actually it has been seldom that monthly reports were required, and if the property owners made one report every six months or one every year it would take much less filing and office work; but that is a matter for the Board to decide. Certainly, when we began this work five years ago, we had no idea there would be 645 properties to deal with.

Secondly, we get an enormous number of inquiries from the public, not only from Canada but from all parts of the world—people who want to come to Canada to prospect, companies that want to get into the uranium business, and persons desiring geological information about uranium. They ask such questions as where to prospect and what kind of Geiger counters to use. I

might mention that we contribute to the development and testing of new types of Geiger counters for field work, and we are able to advise prospectors and companies which types are most suitable for a particular purpose. Much of my time is taken up in dealing with visitors and phone calls and letters. At present we are flooded with letters and requests from people in the United States who want to come to Canada to prospect for uranium.

Publications

The other day Dr. Bell tabled a paper having to do with general publications of my division. One was a handbook on "Prospecting for Uranium in Canada", one was a detailed interim report on "Canadian Deposits of Uranium and Thorium", and there was a third paper called "Uranium Orebodies—How Can More be Found in Canada?" If I may, sir, I would like to table this pamphlet "Uranium in Canada in 1952—Preliminary" which came out today. The Department publishes annual reviews on gold and copper and so on, and later they are printed and bound in a report called "Canadian Mineral Industry for 1952," etc. This year I contributed a review on uranium. I think it would be of interest as an up-to-date summary of the activities.

The CHAIRMAN: This report "Uranium in Canada in 1952—Preliminary" will be tabled and copies distributed later to members.

The WITNESS: There are other publications that were not tabled. This one (*indicating*) is the French edition of the prospecting handbook. This one (*indicating*) is a special report on certain pegmatite deposits in the Wilberforce district of Ontario. We also have mimeographed pamphlets on "The Economics of Radioactive Pegmatites in Canada"; "Prices and Markets for Thorium and Rare Earths"; a list of dealers who sell Geiger counters; and several more technical publications that are of interest to geologists in their work on uranium. Also, we are frequently asked to give lectures at mining conventions and prospectors' conventions in Canada and the United States. We do what we can but we cannot begin to fill all the requests for such kinds of engagements. The staff of my division consists of only twelve persons including clerks, stenographers, and laboratory technicians; and our greatest problem now is to find staff and to find quarters to keep up with the tremendous increase in activity in uranium.

I would suggest that if there are any questions dealing with administration or other matters I have discussed, that it might be well to take them up now; and then it has been suggested that I take a little time to discuss more technical matters with slides.

By Mr. Stuart:

Q. You mentioned more Americans were interested in coming to Canada to explore for uranium?—A. Yes.

Q. Would they come under the same regulations that Canadian prospectors would? The board would still have complete control over any find or deposit? —A. Yes. An American citizen may stake a claim, just as for gold or copper. For uranium, he would be under the same control as is exercised over a Canadian.

By Mr. Green:

Q. Are any of these prospects approaching the point where they would be in production? I ask that question because I was amazed to hear Mr. Bennett say the other day the only properties actually producing uranium ore were the two at Eldorado.—A. Yes. I could answer that better perhaps after I have shown some of the slides that have diagrams. But, to give it briefly now, there is one privately-owned property in the Northwest Territories which announced

it had got into production by the end of last year, but it is on a small scale, and when Mr. Bennett said there were no private producers, I think he meant the ore is still stockpiled; it has not been delivered to Eldorado as yet. There are several small properties in the Beaverlodge region of Saskatchewan which will almost certainly ship ore to the Eldorado plant when it is in operation this year. There are also probably two in the Beaverlodge region that appear now to have a good chance of having enough ore to warrant their having their own plants; I think there may be others in time, but it generally requires several years to establish enough ore to assure that a mine would warrant a treatment plant, and it costs money.

Q. Is there any market for a uranium claim?—A. Yes. Some of the claims that were staked last summer were sold at $1,000, and they did not necessarily have discoveries on them; they were known to be in a favourable place. The Saskatchewan government had a concession system until last summer and then they were thrown open. The people who had concessions were able to stake a certain amount as claims and the balance was left open.

By Mr. Brooks:

Q. Does the provincial government get any royalty from them?—A. Yes. Just the same as from copper or iron or anything else. It depends on the profits of the company. That is how they get their revenue from mining, by a royalty on profits.

Q. Do their departments of Lands and Mines assist in any of your work? —A. Some provincial governments have geologists and mining engineers examining properties and we work closely with them. We often exchange non-confidential information.

By Mr. Green:

Q. Why is there such a rush of prospectors when there does not appear to be a great deal of money in the business?—A. I think there is money in the business. In any kind of mining, it is well known among professional mining people that less than 1 per cent of discoveries become producing mines, but that has not prevented important mining industries in Canada. However, many persons seem to think that all they have to do is buy a Geiger counter, find some uranium, and the world will beat a path to their doors. Actually, there will probably be a smaller proportion of successful uranium finds than of other metals because it tends to be dispersed and to form many small or low-grade deposits. Also, the Geiger counter allows one to sniff out small occurrences that might not be found if they contained a non-radioactive metal. However, the rewards from a successful discovery should well balance the situation. Exploration should be done as a process of elimination, and too much should not be spent in exploring the poorer prospects.

By Mr. McCusker:

Q. How many claims may an individual file?—A. It varies in different provinces. In some, six claims may be staked in one mining division, but one can also hold proxies.

By Mr. Green:

Q. Uranium is considered for staking in just the same way as lead or gold?—A. Yes, but in addition, the regulations of the Board require notification of discoveries and so on, and the Government controls the finished product.

The CHAIRMAN: Any additional questions, gentlemen?

By Mr. McCusker:

Q. You referred to concessions by the provincial government. Was that for individuals or mining companies?—A. For either.

Q. Was it a fee or a rental?—A. I cannot recall the details. I think there was an original fee and an annual fee; and, if the holder spent enough on exploration, he was allowed to hold a part of the ground as claims after the concession expired. That was just in Saskatchewan, and they all expired last summer, after which there was a staking rush.

Q. Is the information submitted by an individual prospector or company, relative to their property, made public, or is that retained within the department?—A. We keep it confidential as long as they wish. A great deal of our work in confidential, but very little for security reasons. There are a few matters, such as production figures, which are security secrets; but most of our information is confidential for business reasons, and we protect the individuals and companies to the limit. However, we try to publish as much as possible. When I brought this out I had to write 300 registered letters to discoverers or property owners to seek authorization of their particular parts. About 5 per cent declined.

The CHAIRMAN: The book Dr. Lang referred to was "Canadian Deposits of Uranium and Thorium".

By Mr. McCusker:

Q. The reason I made this inquiry was that a few years ago, when these concessions were let in Saskatchewan, certain charges were levelled that individuals, on account of the position they held, had obtained information that enabled them to take unfair advantage. Now, what I want to know is, is this information filed with the Department of Mines in the provinces as well?—A. Some of the provinces have provision for collecting information as well. I think you may be referring, not to the reporting of discoveries, but to the fact that geological maps had been made which showed what was thought to be the more suitable sections, and if a person had access to the maps he would know what concessions were most favourable. Some of these maps were published and some were in the process of publication. I know at the time we had requests for advance copies, and we just said we would put their name on the mailing list, and mail them when they were released. We always lean over backwards to prevent leakage of advance information.

Q. I was not referring to anything which occurred in your department. I think you know what I was referring to.

The CHAIRMAN: If there are no more questions, perhaps we can conclude this part of the evidence now. Is it agreed that this terminates our evidence?

Mr. GREEN: Is Dr. Mackenzie coming back?

The CHAIRMAN: Well, do we want him back? Is there any further evidence you wish him to give?

Mr. GREEN: I asked him about Eldorado, and the Northern Transportation Company and Atomic Energy of Canada Limited.

The CHAIRMAN: We are going to be in difficulty about that. I do not know whether you wish to press it, but we do not want to give detailed information.

Mr. GREEN: We could take it up at another meeting.

The CHAIRMAN: I do not know what your idea is about calling additional meetings. I am quite prepared to go on with more meetings, but it is getting to the point where we will obviously have to conclude the evidence. I do not know what your idea is. Do you want to keep it open?

Mr. BROOKS: Have you abandoned the idea of making a visit to Montreal?

The CHAIRMAN: It is still open. We have never really dealt with it. However, I do not see how it is possible to go to Montreal at this stage.

Mr. BROOKS: Dr. Mackenzie suggested we would not see very much.

The CHAIRMAN: I had some further discussion on that, and the impression I got was that it was not going to be as satisfactory as we might wish, or as beneficial as we might wish. I do not know whether you wish to leave the question of additional meetings open or decide it at this point.

Mr. MCCUSKER: May we decide it at the close of this meeting before we adjourn?

The CHAIRMAN: That will be all right. If there are no further questions, we can now proceed with the slides.

(For an account of proceedings conducted following the showing of the slides, see today's "Minutes of Proceedings").

HOUSE OF COMMONS

Seventh Session—Twenty-first Parliament

1952-53

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McILRAITH, Esq.

MINUTES OF PROCEEDINGS

No. 7

TUESDAY, APRIL 21, 1953

MONDAY, APRIL 27, 1953

FRIDAY, MAY 8, 1953

REPORT TO THE HOUSE

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1953

SPECIAL COMMITTEE

on the

Operations of the Government

in the field of

ATOMIC ENERGY

Chairman: G. J. McIlraith, Esq.

Messrs.

Bourget	Kirk (*Digby-Yarmouth*)	Pinard
Brooks	Low	Stuart (*Charlotte*)
Coldwell	McCusker	Winkler—14
Gibson	Murphy	
Green	Murray (*Oxford*)	

(Quorum—8)

A. SMALL,
Clerk of the Committee.

MINUTES OF PROCEEDINGS

TUESDAY, April 21, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met at 9.00 o'clock a.m., at the Parliament Buildings for the purpose of making an inspection visit to the Department of Mines and Technical Surveys in Ottawa, proceeding by private cars.

Members present: Messrs. Bourget, Brooks, Gibson, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Murphy, and Murray (*Oxford*).—(9).

In attendance: Dr. W. A. Bell, Director of the Geological Survey of Canada, Dr. A. H. Lang, Chief, Radioactive Resources Division, Geological Survey of Canada, and Mr. R. J. Traill, Acting Director, Mines Branch, all of the Department of Mines and Technical Surveys.

The Committee inspected the offices and laboratories of the Department, as follows:

1. Radioactive Resources Division, Geological Survey of Canada, being conducted on its tour by Dr. Lang who, after introductory remarks by Dr. Bell, gave commentaries on various activities of the Radioactive Resources Division, and answered questions thereon; and

2. Radioactive Division, Mines Branch, being conducted on its tour by Mr. Traill who gave commentaries on various activities of the Radioactivity Division, assisted by various officials, and answered questions thereon.

Having returned from its visit the Committee adjourned at the Parliament Buildings to the call of the Chair.

MONDAY, April 27, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met *in camera* at 3.30 o'clock p.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Bourget, Gibson, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Murray (*Oxford*), Stuart, (*Charlotte*), and Winkler.—(9).

After discussion, the Committee agreed on a number of general topics for inclusion in its Report to the House on the results of its examinations made into the operations of the Government in the field of Atomic Energy.

Agreed,—That a Sub-Committee be appointed to assist the Chairman in drafting a Report to the House, consisting of the Chairman, Mr. G. J. McIlraith, and Messrs. Gibson, Kirk (*Digby-Yarmouth*), Murray (*Oxford*), and Stuart (*Charlotte*).

The Committee adjourned to the call of the Chair.

73924—1½

FRIDAY, May 8, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy met *in camera* at 9.00 o'clock p.m. The Chairman, Mr. G. J. McIlraith, presided.

Members present: Messrs. Brooks, Gibson, Green, Kirk (*Digby-Yarmouth*), McCusker, McIlraith, Stuart (*Charlotte*), and Winkler.—(8).

The Chairman presented and read the draft Report to the House as prepared by the Sub-Committee. After discussion thereon, including several minor changes, the Report was amended and adopted.

On motion of Mr. Gibson,

Ordered,—That the Chairman present the said Report to the House as the *First Report* of the Committee.

The Committee adjourned *sine die*.

A. SMALL,
Clerk of the Committee.

REPORT TO THE HOUSE

MAY 9, 1953.

The Special Committee appointed to examine into the operations of the Government in the field of Atomic Energy begs leave to present the following as its

FIRST REPORT

Your Committee was appointed on February 17, 1953, under the following Order of Reference:

Resolved,—That a Special Committee be appointed to examine into the operations of the Government in the field of Atomic Energy; that the said Committee be empowered to sit during the sittings of the House and to print such papers and evidence from day to day as may be ordered by the Committee; and to report from time to time; that the said Committee consist of Messrs. Bourget, Brooks, Coldwell, Gibson, Green, Kirk (*Digby-Yarmouth*), Low, McCusker, McIlraith, Murphy, Murray (*Oxford*), Pinard, Stuart (*Charlotte*), Winkler.

Throughout its deliberations, your Committee treated its work "to examine into the operations of the Government in the field of Atomic Energy" as a continuation and extension of that of the Special Committee appointed during the Second Session in 1949 "to examine into the operations of the Atomic Energy Control Board."

Your Committee held 10 sittings, all of which were open to the public and fully recorded with the exception of the last two that were called to outline and consider the Report to the House. The evidence heard and recorded by your Committee in its examinations was adduced from the following:

Atomic Energy Control Board, and Atomic Energy of Canada Limited

Dr. C. J. Mackenzie, President, assisted by Mr. G. M. Jarvis, Legal Adviser and Secretary,

Eldorado Mining and Refining Limited, and Northern Transportation Company Limited

Mr. William J. Bennett, President and Managing Director.

Department of Mines and Technical Surveys

Mr. Marc Boyer, Deputy Minister.

Dr. John Convey, Director, Mines Branch.

Mr. A. Thunaes, Chief, Radioactivity Division, Mines Branch.

Dr. W. A. Bell, Director, Geological Survey of Canada.

Dr. A. H. Lang, Radioactive Resources Division, Geological Survey of Canada.

Your Committee visited the Atomic Energy Project at Chalk River and while there heard evidence from the following:

Dr. David A. Keys, Chairman of the Co-ordinating Committee, Atomic Energy of Canada Limited.

Dr. A. J. Cipriani, Director of the Biology and Radiation Hazards Control Division.

Dr. R. M. Taylor, Director of the Medical Division.

Dr. L. G. Cook, Assistant Director and Head of the Chemistry Research Branch.

Dr. W. B. Lewis, Vice-President in Charge of Research and Development.

Dr. C. J. Mackenzie, President, Atomic Energy Control Board, and Atomic Energy of Canada Limited.

Your Committee visited the office and laboratories of the Radioactive Resources Division, Geological Survey of Canada, Department of Mines and Technical Surveys, Ottawa, and while there heard evidence from the following:

Dr. W. A. Bell, Director, and Dr. A. H. Lang, Chief of Radioactive Resources Division, assisted by various officials, all of the Geological Survey of Canada.

Your Committee visited the office and laboratories of the Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys, and while there heard evidence from the following:

Mr. R. J. Traill, Acting Director, assisted by various officials, all of the Mines Branch.

Your Committee finds that the program in the field of Atomic Energy is well integrated and finds that the various parts of the program are well managed and conducted.

CHALK RIVER PROJECT

Since April 1, 1952, the operation of the Chalk River Project in the field of atomic energy application has been carried on by the Crown Company, Atomic Energy of Canada Limited. This Crown Company, in addition to carrying out the Chalk River Project, has taken over the work formerly carried on by the Commercial Products Division of Eldorado Mining and Refining Limited which involves the handling and sale of radioactive isotopes and the Cobalt Beam Therapy Program.

Your Committee confirms the opinion expressed in the Report of the 1949 Special Committee that the Chalk River Project is well and efficiently operated.

NRX Reactor

The NRX Reactor was brought into operation in 1947 and for five years has been the outstanding research reactor in the world due to its "high flux" and flexible design features. The experimental results obtained from NRX constitute a major contribution to atomic research. The previous Special Committee on Atomic Energy heard evidence to the effect that this reactor had a life-expectancy of perhaps five years after which time it would probably be necessary to write it off.

In December, 1952, due to an extraordinary combination of circumstances, this reactor developed leaks and had to be shut down. This provided Canada with the first opportunity anyone in the free world has had to examine a major atomic reactor internally after a sustained period of full-scale operation. It has been found possible to repair and rebuild this reactor and that it will not have to be written off but will be restored to service with improved operational and safety factors.

This accomplishment, together with the knowledge that it is scientifically and mechanically practicable to repair and rebuild a reactor, is a most significant development in the atomic energy field. Your Committee commends the outstanding work of all the scientific, technical and other personnel at the project for their remarkable achievement and wishes to commend especially the officers and men of the Industrial Operations Branch which carries the major responsibility for repairs.

NRU Reactor

The previous Special Committee recommended "that the Government undertake the expansion of the present facilities by the construction of an additional reactor and such research equipment as may be required." Your Committee finds that the additional reactor recommended in that report is under construction and is proceeding to completion in a very satisfactory manner.

The experience gained from the reconstruction of the NRX Reactor is providing invaluable information in the construction of the new and more powerful reactor, known as NRU. This will enable Canada to stay in the forefront of atomic energy development and research and to meet the growing demands in the industrial, medical and agricultural fields.

Atomic Power

From the evidence it is clear that the large-scale application of atomic power is closer at hand than had been expected when the previous Committee met. Your Committee notes with interest and approval that the Board of Directors of Atomic Energy of Canada Limited has on it several persons with an intimate knowledge of development, distribution, and economics of industrial power. Your Committee recommends that any possible development of atomic energy for industrial power be pressed forward with vigour.

RAW MATERIALS PROCUREMENT POLICY

Eldorado Mining and Refining Limited

Procurement of the raw material in the atomic energy development program is handled through Eldorado Mining and Refining Limited. Your Committee, from evidence presented by the President, as well as the pictures shown, feels that the management of this company is good and that the policy with respect to the procurement of raw materials is a sound one. Your Committee regrets that it was not possible in the time available to visit the mining and refining operations of the Company, but from the information placed before it, considers the operations well handled.

UNIVERSITY RESEARCH GRANTS

Your Committee finds that the recommendations made by the previous Committee on Atomic Energy in 1949 have been carried out by the Atomic Energy Control Board in cooperation with the National Research Council. The Committee has noted with approval that these grants have been extended to the metallurgical and isotope development fields and recommends a continuation of the policy of awarding these grants.

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

Radioactive Resources Division, Geological Survey of Canada.

Your Committee finds that the work of the Radioactive Resources Division, Geological Survey of Canada, Department of Mines and Technical Surveys, is being hampered by a lack of adequate accommodation and your Committee recommends that the Government give immediate consideration to providing adequate accommodation for the important work being carried on by this Division.

Your Committee finds that this Division is losing an abnormally high proportion of its highly qualified scientific personnel due to the unsuitability of the salary and classification procedures in relation to scientific personnel and recommends that the Government give immediate consideration to the adoption of more flexible and suitable reclassification and promotion procedures.

The general excellence of the work being carried out by this Division and the *esprit de corps* of the staff, considering the conditions under which they are working, is outstanding.

Radioactivity Division, Mines Branch.

Your Committee finds that the work of the Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys, is being somewhat hampered by overcrowding. Your Committee recommends that the Government give immediate consideration to this problem.

Your Committee finds that this Division is also losing an abnormally high proportion of its highly qualified scientific personnel due to the unsuitability of the salary and classification procedures in relation to scientific personnel and recommends that the Government give immediate consideration to the adoption of more flexible and suitable reclassification and promotion procedures.

The general excellence of the work being carried out by this Division is also to be commended.

A copy of the printed Minutes of Proceedings and Evidence adduced, together with a list of documents tabled with your Committee, is appended.

All of which is respectfully submitted.

GEORGE J. McILRAITH,
Chairman.

APPENDIX

LIST OF DOCUMENTS TABLED WITH THE SPECIAL COMMITTEE ON ATOMIC ENERGY

1. *The Atomic Energy Control Act, 1946* (Chap. 37);
2. *The Atomic Energy Regulations of Canada* (Order in Council P.C. 5513 November 3, 1949);
3. "Canada's Atomic Energy Project" (March 1953);
4. "Uranium Orebodies—How Can More be Found in Canada?";
5. "Prospecting for Uranium in Canada";
6. "Canadian Deposits of Uranium and Thorium" (Interim Account);
7. "Recovery of Uranium from Canadian Ores";
8. "The Function of the Mines Branch Radioactivity Division";
9. "Uranium in Canada in 1952—Preliminary".