Report No. 47

ANNUAL REPORT

OF THE

RESEARCH COUNCIL OF ALBERTA

1945

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The following report, the Twenty-sixth Annual Report of the Research Council of Alberta, was submitted in March, 1946, by the Director of Research Dr. R. Newton, President of the University of Alberta, to the Chairman of the Council the Hon. N. E. Tanner, Minister of Lands and Mines. The Chairman submitted the report to the Premier of Alberta, the Hon. E. C. Manning, who tabled it in the Legislature.

This Annual Report is a brief summary of the various investigations undertaken by the Council during the calendar year 1945. A more detailed report on the use of Alberta coals in automatic domestic stokers was published as Report No. 46. Three contribution series papers, "Asphaltic Road Oils from Alberta Bituminous Sands", "Bituminous Sands of Alberta", and "Purification of Silica Sand" were printed in the Technical Press in 1945. Two papers, "Recent Work of the Research Council of Alberta" and "Research and the Coal Industry in Canada" were presented to the Western Annual Meeting of the Canadian Institute of Mining and Metallurgy in 1945, and will be published in the Journal of the Institute in 1946.

The offices and laboratories of the Council are situated in the buildings of the University of Alberta. Requests for information and reports should be addressed to the Secretary, Research Council of Alberta, University of Alberta, Edmonton, Canada.

MEMBERS OF COUNCIL

The Honourable N. E. Tanner, Minister of Lands and Mines, Chairman.

The Honourable E. C. Manning, Premier of Alberta.

The Honourable W. A. Fallow, Minister of Public Works.

Dr. R. Newton, President of the University of Alberta, Director of Research.

L. E. Drummond, Esq., Edmonton.

J. E. Davies, Esq., Medicine Hat.

The Council operates under the Research Council Act of 1930, as amended 1943.

The offices and laboratories of the Council are at the University of Alberta. The Acting Secretary is W. A. Lang.

TECHNICAL ADVISORY COMMITTEE

Dr. R. Newton, President of the University of Alberta, Director of Research, Chairman.

Mr. R. S. L. Wilson, Dean of Applied Science, University of Alberta, Assistant Director of Research, Deputy Chairman.

Mr. W. D. King, Deputy Minister, Department of Trade and Industry.

Mr. G. H. Monkman, Deputy Minister, Department of Public Works.

Mr. L. D. Byrne, Deputy Minister, Department of Economic Affairs.

Mr. J. Crawford, Chief Inspector of Mines, Department of Lands and Mines.

Dr. J. A. Allan, Department of Geology, The University.

Dr. E. H. Boomer, Department of Chemistry, The University.

Dr. K. A. Clark, Department of Mining and Metallurgy, The University.

Prof. N. C. Pitcher, Department of Mining and Metallurgy, The University.

Prof. E. Stansfield, Fuels, Chief Research Engineer.

Dr. F. A. Wyatt, Department of Soils, The University.

Mr. J. E. Oberholtzer, Industrial Engineer.

Mr. W. A. Lang, Acting Secretary of Council, Secretary.

TECHNICAL STAFF OF RESEARCH COUNCIL

The following have held full time, permanent appointments during the year:

Edgar Stansfield, Chief Research Engineer.
William A. Lang, Research Chemist.
David S. Pasternack, Research Chemist.
John E. Oberholtzer, Industrial Engineer, from December.
Jack S. Charlesworth, Chemist.
Edward Tipman, Chemist.
John L. Carr, Assistant Geologist.
Willard C. Hinman, Assistant Soil Surveyor, from May.
Anna Malanchuk, Compiler, to July.
Colin A. Genge, Assistant Chemist, to August.
Raymond A. Leask, Assistant Chemist, from October.
Catherine A. Fergie, Assistant Chemist, to July.
Veletta M. Alexander, Assistant Chemist, to August.
John Gregory, Assistant Chemist, from December.
Stanley H. Ward, Assistant Chemist, from November.
John F. Fryer, Assistant Chemist, from December.

The following held temporary appointments during the year:

George H. Bull, Field Assistant, May to September.
J. Harry A. Donald, Research Assistant, April to September.
Rudolph R. Grunert, Research Assistant, May to September.
Gordon W. Hodgson, Research Assistant, May to September.
James G. Knudsen, Research Assistant, May to August.
Sam Loshaek, Research Assistant, from October.
Wallace B. McConnell, Research Assistant, May to September.
William B. McCormack, Research Assistant, February to April.
William M. Poohkay, Field Assistant, July to September.
Donald Quon, Research Assistant, April to September.
Donald S. Scott, Research Assistant, from October.
Alan C. Shaw, Research Assistant, May to August.
Douglas W. Sparrow, Field Assistant, May to September.
Andrew Wynnyk, Field Assistant, June to September.

The following University scholarship holder worked for the Council without pay:

J. Donald Lazerte.

The following members of the Faculty of the University of Alberta assisted in the work of the Council:

Dr. John A. Allan, Geology.
Dr. Edward H. Boomer, Natural gas.
Dr. Karl A. Clark, Bituminous Sands.
Dr. A. D. Hogg, Producer Gas.
Mr. J. G. Knudsen, Natural Gas.
Dr. E. H. Moss, Poplar Survey.
Dr. W. Rowan, Animal Cycles.
Dr. F. A. Wyatt, Soil Surveys.

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This report summarizes the work of the Council for the calendar year 1945. Most of the investigations in progress last year were continued. New investigations include a soils survey made in co-operation with the Dominion Government, and studies of the possibilities for the commercial utilization of cereal straws and of Alberta poplar. As in the past few years the work was seriously handicapped by difficulties in obtaining technical staff and services, and by delays in procuring supplies. Fortunately towards the end of the year, with the return of service personnel, it was possible to fill most of the vacancies.

The Council suffered a serious loss in the sudden death of Dr. E. H. Boomer in October. Dr. Boomer, in charge of the natural gas investigations, was a member of the Technical Advisory Committee of Council and his judgment in all matters pertaining to Council was highly respected.

An industrial engineer has been appointed to study possible new industrial developments and to provide the government with authentic information regarding the technical and commercial feasibilities of such developments.

Two major reports were prepared and published during the year, and a number of papers presented to scientific societies. Members of the staff assisted in the preparation of the government brief to the Royal Coal Commission.

Reports on the work undertaken follow.

BITUMINOUS SANDS

It was noted in the Annual Report for 1944 that an agreement had been made between the Provincial Government and Oil Sands Ltd. for the building of a bituminous sand separation plant at Bitumount on the Athabaska river. This agreement assigned no specific responsibilities to the Research Council of Alberta; but it has been understood that those of the Council's staff who are engaged on bituminous sand investigations would keep in close touch with the engineers of Oil Sands Ltd. and would actively assist in carrying the project through. This assistance has been given and has determined, to a great extent, the work done in the laboratory during the year.

Design of the plant has been the main task in regard to the Oil Sands Ltd. project. The flow sheet of the hot water separation unit is based on the scheme of separation devised by the Research Council of Alberta. The task of producing drawings for the plant to be erected is an Oil Sands Ltd. responsibility. But several design questions have arisen which required laboratory study. Among these were: an assembly of equipment for flooding bituminous sand pulp with hot water which was sound in principle and suitable for large scale design; the volume of flow of circulating hot water for

a given tonnage of feed; the capacity of screw conveyors for moving sand settlings up inclines. Intelligent answers to these questions, based on laboratory test results, were found.

It is probable that most people regard the design of the hot water separation unit as being the novel, principal problem in building a bituminous sand separation plant. Actually those carrying the responsibility for the Oil Sands Ltd. plant are less concerned about the separation unit than about other units which are essential to a complete plant operation. Three separation plants have been built in the past which succeeded in washing the oil out of the sand reasonably satisfactorily and knowledge of these plants is available. None of the plants, however, succeeded in doing everything involved from mining the sand to producing marketable products by operations which worked together smoothly, continuously, and reliably. The most critical problem is the freeing of the crude oil, recovered by the separation unit, of water, sand and silt and the preparation of it into suitable form for charging into the refinery. Much of the work of the Council's bituminous sand laboratory during the past year has been devoted to this problem and workable ways of dealing with it have been demonstrated. At the time of writing, there is not agreement among all the technical personnel concerned, about the exact method to be adopted. But the question is well on the way toward satisfactory settlement.

Study of the hot water separation method, in general, has been continued during the year. The purpose of this line of work is to increase the fundamental understanding of the process. The most significant advance of the year has been the finding that the silt and clay present in bituminous sand is a powerful aid to hot water in displacing the oil from the sand and making its recovery possible. Past work had shown that high silt and clay contents (15% or more) cause serious decrease in the recovery of oil. Now it appears that some silt and clay (5% more or less) is distinctly advantageous. In fact, if it were not that such contents of silt and clay are almost always present in the bituminous sand, the hot water method for recovering oil from it would not have been proposed and studied. Hot water does not displace the oil from bituminous sand devoid of silt and clay at all readily and the oil that is recovered is very sandy.

Field work during the year was confined to one trip to Bitumount by Dr. K. A. Clark. Supplies of bituminous sand and of silt and clay were collected and brought to Edmonton for study. A survey of overburden conditions at the site of the quarry for the separation plant was made and a test pit was sunk through the top eight feet of bituminous sand beds. A fairly successful search for supplies of sand and gravel for plant construction was made.

Two articles on bituminous sands were published during the year. One was general in nature giving a summary of what is known about the bituminous deposit and of efforts at development. The other dealt with asphaltic road oils which can be made from the bituminous sands. Reprints of these articles are available.

FUELS

The work of the year was seriously handicapped owing to lack of staff. Vacancies created early in the year were only filled in December.

The sampling and analysis of the coals of Alberta, and the testing of coal mine dusts, in co-operation with the Provincial Mines Branch, was continued. Analyses were also made, for the Emergency Coal Production Board, and of samples of rocks and coals collected by geological field parties.

Laboratory work was completed for the planned investigation of Alberta coals in automatic domestic stokers. One new coal only was tested, but ash analyses and smokiness of coal tests were completed. In addition questionnaires were sent out to the users of domestic stokers in Alberta and the replies were studied. A report was then prepared and published, based on the results of the laboratory work and on the replies to the questionnaire. The report discusses the merits and weaknesses of stokers, the suitability of coals from different coal areas for use in stokers, and suggests that care in the preparation and marketing of stoker coal would result in a large increase in the market for such coal.

The laboratory model of a vertical shaft carbonizer for the low temperature carbonization of the lower rank Alberta coals, constructed and operated in 1944, was again operated in runs of up to 24 hours duration. A total of one and a half tons of Tofield and Drumheller coals was carbonized. The char made was used for briquetting tests, and also in portable gas producer tests. A shaft drier for coal was also designed, constructed and operated.

The work on briquetting was mainly directed towards the production of a strong, weather-proof, high heat value briquette, suitable for shipping to a distant domestic market. Both smoky and smokeless briquettes were made, the latter are preferable, but for some consumers, with equipment giving smokeless combustion of a smoky fuel, the former would be better and cheaper.

Briquettes were made with free burning coal of Groups III, IV or V, mixed with a coking coal, Group II, to give strength to the briquette in the fire. They were also made with a char made from Group III, IV or V coal, mixed with a coking coal. It was found possible to render either entirely smokeless by heat treatment. This investigation, which is still in progress, has not yet reached the stage where the relative costs and advantages of the different types of briquettes can be assessed.

A briquetting investigation of Lethbridge coal was carried out for an operator in that field. Different types of briquettes were made and submitted for consideration, briquettes which appeared to meet all commercial requirements, other than smokelessness, were made with 20%of a coking coal and 6% of asphalt. Briquetting investigations were also made with the non-coking smokeless coals of Group I, and asphalt; good briquettes were made with both semi-anthracite and low volatile bituminous coal. Briquettes of both coals were of course slightly smoky due to the use of a smoky binder, but the briquettes for semi-anthracite could, if desired, be rendered completely smokeless by a brief heat treatment. The low volatile bituminous coal briquettes tested could not be so heat treated on account of a tendency to swell. Three possible binders, of a smokeless type, were studied; but not found satisfactory. No progress was made with the proposed investigation of the binderless briquetting of Group I and II coals.

As the cost of gasoline and other liquid fuels rises the demand will increase for a cheap tractor fuel, particularly for farm opera-

tion. An investigation was therefore carried out to determine the technical feasibility of burning char from low rank Alberta coals in portable gas producers.

The investigation was carried out by Dr. A. D. Hogg, lecturer in Mechanical Engineering at the University, assisted by regular members of the Research Council staff. Most of the tests were carried out in a British Emergency portable, cross draft, gas producer, kindly loaned by the National Research Council. Unfortunately, it was soon found that this producer, although satisfactory for use with a very low ash content fuel like charcoal, was not adapted for coal char. It was not possible, in the short time available, to obtain the use of a more suitable producer; but some supplementary tests were made in a simple, locally made producer, designed for studying some of the factors involved. All the tests were made with stationary equipment, rather than attached to a tractor, and were further handicapped because lack of a suitable exhaust fan made it necessary to operate under pressure instead of under suction.

It was found that when air alone is supplied to the fire both clinkering, and overheating of the producer in the combustion region, are excessive. Mixing a suitable amount of steam, or of steam mixed with carbon dioxide to simulate feeding back part of the exhaust from the engine, with the combustion air reduced the clinkering to a negligible amount. It was also found that the ash in the fuel is such that the fire required frequent cleaning. The heat value of the gas produced compared favourably with that produced in producers of this type with more commonly used fuels. It was concluded that, if the char is utilizable from an economic standpoint, the results of the tests warranted further work with a producer better suited to the fuel.

The possibilities for the use of coal as a source of chemicals or other high value products are being increasingly studied in different countries. This subject is of particular interest to Alberta, since the lower rank coals are notably soluble in caustic alkalies and susceptible to possible treatments. Some work along these lines was carried out during the year; but this was seriously handicapped by lack of staff.

Members of the staff assisted in the preparation of the Government brief to the Royal Coal Commission, and attended the hearing of the Commission in Calgary and Edmonton.

W. A. Lang in March visited research and industrial workers, laboratories and plants in Ottawa, Toronto, Montreal, Pittsburgh, Columbus, Chicago, St. Paul and Estevan, also later in Victoria and Vancouver. Valuable information, and contacts were gained. Two papers were prepared and submitted in October to the Western Annual Meeting of the Canadian Institute of Mining and Metallurgy in Edmonton: "Recent Work of the Research Council of Alberta", by E. Stansfield, and "Research and the Coal Industry in Canada", by W. A. Lang. A resolution approving the work of the Council and urging its continuation and increase, was passed by the above meeting of the Canadian Institute of Mining & Metallurgy.

The gasoline testing laboratory was employed during the year mainly in the testing of aviation gasoline for the Royal Canadian Air Force and in the conduct of a Provincial survey of the com-

mercial gasoline on sale in filling stations. Some 531 samples were tested, 63% for the Air Force and 37% for the Provincial Survey.

Two reports were prepared for the Provincial Government, one of the 1944-45 winter survey and one of the summer survey. A survey of gasolines on sale in the winter of 1945-46 is now in progress.

Some minor investigations were made, one on the length of time gasoline samples can be stored without change—this is still in progress—and one on the corrosion test for gasoline. Some reported corrosion tests were challenged, but investigation revealed the reason for the difference in results between laboratories and the results from this laboratory were found correct.

In view of the notable reduction of work on aviation gasoline it has been decided to widen the scope of work, and to equip the laboratory to test other fuel oils and lubricating oils. The laboratory will in future be the Gasoline and Oil Testing Laboratory.

GEOLOGY

The geological work of the Council is carried on under the direction of J. A. Allan in conjunction with the Department of Geology at the University of Alberta.

The major project was a geological field investigation of that portion of the Highwood coal area where there are extensive deposits of coal. Preliminary details on this investigation and results obtained on other minor projects are given below.

1. Highwood Sheep River Coal Deposits.

In the Second Annual Report on the Mineral Resources of Alberta published by the Research Council of Alberta in 1920, the coal deposits being prospected by H. A. Ford in the Highwood valley and by the P. Burns Coal Mining Company in the Sheep River valley are briefly described by J. A. Allan.

Within the past three years wide attention has been drawn to these coal deposits and there has been renewed prospecting activity. In order to obtain more detailed geological information on these extensive coal deposits, a field investigation of the Highwood coal area was commenced in 1945.

Between May 30th and September 30th, 1945, a geological survey party, with John L. Carr as field geologist, was engaged in mapping the geology of that portion of the Highwood coal area west of the Highwood range. The area examined includes about 150 square miles, situated about forty miles west of the town of High River and about twenty miles west of the Turner Valley oil field. The geological investigation was primarily concerned with the coal deposits of the area.

The strata including the coal seams within this area have suffered considerable deformation. The general strike is north 30 degrees west. The strata are generally dipping over 45 degrees and in places are vertical or overturned. The structure is controlled by steeply west-dipping thrust faults. Folding is of less importance.

The coal in the area examined occurs in the lower 500 feet of the Kootenay formation. These coal-bearing rocks lie between the Highwood range which forms the most easterly range in the mountains and the Continental Divide range on the west. The Kootenay

strata containing the coal seams form two principal bands within the area.

The eastern band of Kootenay is divided into three zones, called A, B and C from east to west. These three zones represent the same strata which have been repeated by fault structure. Considerable open cut prospecting has been done with a bulldozer by the Highwood Coal Mines Limited on Zones A and B. These open cuts extend up the mountain side to an elevation of about 2000 feet above the Highwood river at the Sentinel Ranger Station. These cuts are all shallow, at no place is the coal exposed more than about 8 feet below the rock surface. The coal is intensely crushed and much weathered. It is fine and very friable. No coarse coal was observed. Development to date does not indicate what the character of the coal will be at depth. It is unfortunate that none of the strip pits have been carried deep enough to expose the character of coal below the weathered zone.

There are four coal seams in Zone A, exposed in the open cut one-half mile west of Sentinel Ranger Station. These four seams contain 49 feet 0 inches of coal, as follows:

7 feet 6 inches *Egbert coal seam.*
7 feet 2 inches *Connors coal seam.*
12 feet 4 inches *Douglas coal seam.*
22 feet 0 inches *Holt coal seam.*
49 feet 0 inches—Total thickness of coal in about 460 feet of strata.

Several cuts have been made in Zone B directly north of Highwood river. Two seams have been exposed, the upper being about 45 inches thick, while the lower, known as the *Glover seam,* varies widely in thickness. The Glover seam, where exposed, shows a maximum thickness of 50 feet on the side of the hill but thins to a few feet on top. There is evidence of considerable internal folding in this seam. A cut has also been made in Zone B on Cat Creek, but is not deep enough to extend below the badly weathered portion of the seam. A ten-foot seam is exposed in the canyon of Cat Creek.

Zone C has not been prospected recently in this area. However, a prospect tunnel by Ford on Cat Creek in Zone C shows the presence of coal. Showings of coal in Zone C occur in the lower part of the Kootenay formation to the northwest into the valley of Sheep river.

On Sheep river the Allied Industrials Ltd. have recently made one cut on the Burns coal property from which a small tonnage of coal is said to have been recovered for experimental purposes. The coal at this point occupies an horizon close to the base of the Kootenay formation in a similar stratigraphic position to the Holt seam on Highwood river. The section in the open cut on Sheep river is as follows:

9 feet	6 inches	Coal, hard, firm, clean-looking, banded
	5 inches	Sandstone, carbonaceous
	7 inches	Coal, somewhat crushed
9 feet	10 inches	Shale and shaly sandstone
5 feet	0 inches	Coal, uncrushed, firm
2 feet	6 inches	Coal, crushed
	11 inches	Shale, carbonaceous
6 feet	8 inches	Coal, dirty, partially crushed
3 feet	10 inches	Coal, badly crushed, folded.

Propect tunnels made several years ago by the P. Burns Coal Mining Company show the presence of at least six separate seams in Zone B and one or two in Zone C. These tunnels have caved in and no details on the coal are available.

Samples of coal from the Highwood and Sheep river open cuts have been analysed. Some are classed as low volatile bituminous and others as semi-anthracite in rank.

2. *Clay Deposits.*

There is a wide range of clays known to occur in Alberta, but there are no known deposits of fire clay. Information is being accumulated on several clay deposits. The Council does not have laboratory facilities for the testing of clays, but during the year satisfactory arrangements have been made between the Council and Professor W. G. Worcester, in charge of the Department of Ceramics at the University of Saskatchewan in Saskatoon, whereby samples of clay will be tested by Professor Worcester for the Research Council of Alberta.

During the year four samples of clay from Grande Prairie, Beaverlodge and the Notikewan districts have been so tested. One sample was collected from the pit at the brick plant at Grande Prairie. This sample was submitted to Professor Worcester for a test and for an opinion on how the quality of the ware might be improved. He reports in part as follow:

"While this clay is not all that could be desired, it can be used for the manufacture of common brick where a high absorption may be permissable. Extreme care must be exercised in the pugging and tempering of this clay for the stiff mud process; a little wider variation is possible in the temper for soft mud or hand molded ware.

"The burning must be carefully controlled as to the maximum temperature. This part of the work should be in the hands of an experienced kiln burner, and if possible, one who has had to deal with short vitrification range clays.

"This clay could no doubt be improved through the addition of a more highly plastic clay, that is, one carrying more clay substance and less quartz (rock dust). The blending would have to be well and uniformly made to avoid other troubles."

3. *Minor Projects.*

A re-study of the Edmonton coal basin has been commenced and most of the coal properties have been visited. This investigation is being continued.

Silica sand deposits suitable for glass making are being investigated. Samples were collected from Pigeon, Gull and Sylvan lakes and from McLaren sand pit at Leduc. These samples are being examined in the laboratory.

Many requests received on various mineral products and on water supply have been attended to, insofar as the information has been available. Additional information has been obtained on water horizons in certain districts but the need of a more detailed water survey in various parts is urgent. Data on the best drilling methods for water supply and on the "bringing in" and maintaining of water wells are frequently requested but are not available.

A report on the Cutbank-Wapiti area in the Grande Prairie district has been completed and will be ready for publication at an early date.

A report on the "Geology of the Red Deer and Rosebud Sheets" has been completed and published during the year.

An inspection trip to various coal mining districts was made by W. D. King, Deputy Minister of Trade and Industry, N. C. Pitcher and J. A. Allan. Visits were made to the coal mines at Canmore, Highwood river, Bellevue, Blairmore, Coleman, Lethbridge and the Summit lime plant. The coal strip pits were visited at Taber, Camrose, Tofield, Dodds, Dinant and Roundhill.

NATURAL GAS RESEARCH

The natural gas research project of the Research Council of Alberta was carried out under the direction of Dr. E. H. Boomer until his death in October 1945. Since then Mr. J. G. Knudsen has supervised the work. The work for this laboratory was planned in consultation with Dr. H. H. Storch of the U.S. Bureau of Mines at Pittsburgh and the two laboratories have worked in close co-operation.

This work, a study of the Fischer-Tropsch synthesis of gasoline and other liquid fuels from natural gas, was commenced in the summer of 1944. The process is of interest as a possible source of liquid fuels produced from natural gas or from coal. Alberta with large reserves of both of these natural resources is in a favored position.

The work has involved making and purifying a synthesis gas from natural gas, but is mainly concerned with a study of catalysts which promote the conversion of the synthesis gas into liquid products. The apparatus, largely erected in 1944, was ready for test by April 1945. It consisted of equipment for converting the natural gas to a synthesis gas with the desired carbon monoxide-hydrogen ratio, and a battery of six independent catalyst testers for studying different catalysts. A unique feature is that the equipment has been so designed as to be automatically controlled at all stages. This has the very big advantage that with only three assistants the plant can be operated twenty-four hours a day.

One of the most important phases of the Fischer-Tropsch work is a study of the catalysts and it is a problem which can be studied with the limited accommodation and facilities at the disposal of the Research Council. The natural gas project has therefore been mainly concerned with an attempt both to improve existing catalysts, and to develop new catalysts. A number of catalysts that had been used elsewhere as well as two new catalysts were prepared and tested. Two commercial catalysts from the Harshaw Chemical Co. were also tested.

Fischer-Tropsch catalysts are very sensitive to poisoning by extremely small concentrations of sulphur and oxygen, so that extreme care is required for their exclusion.

The results of the operations have not been entirely satisfactory but this can be expected until the operators gain experience in technique and in the optimum operating conditions of temperature, pressure, etc.

Recent developments however have shown that reduction and conditioning of Fischer-Tropsch catalysts is an all important operation and one in which the best conditions can only be determined empirically. For example, the yields of liquid hydrocarbons with certain catalysts were raised from 20 to 50 grams per cubic meter of synthesis gas by a long, high temperature reduction with hydrogen.

Early in 1945 a few short-period static tests were carried out on some Fischer-Tropsch catalysts. It is hoped to correlate the results of these tests with the behavior of the catalysts in the continuous tests. As yet insufficient data have been obtained to work out such a correlation. This is continuing and new equipment is being designed and constructed.

Just before the conclusion of the war in Europe, Dr. E. H. Boomer represented Canada in an investigation of enemy science and technology. He spent some time studying the oil industry of northern Germany, particularly that of synthetic fuels and lubricants. The Research Council did not have any part in sending Dr. Boomer to Germany but it did benefit greatly from the information he gained there.

SOIL SURVEY

A co-operative soils survey program for Alberta was planned for 1945, with the Research Council of Alberta and the soil survey department of the Dominion Government making equal contributions. Owing to war conditions and labor shortage, it was impossible to secure sufficient qualified men to carry out the complete program projected for the year. The Research Council of Alberta were only able to secure one full time employee (Mr. W. C. Hinman) but later appointed three students and a cook. These men worked under experienced Dominion soil surveyors and as a result considerable progress was made.

Three separate soil surveys were undertaken, as outlined below: (1) a soils survey in the area between Tangent and Wanham in Northern Alberta; (2) a soils survey in connection with the Bow River Irrigation project and the Canadian Land and Irrigation Company project and (3) a continuation of the regular soils survey in the Peace Hill Area.

Northern Soils Survey

The northern soils survey party was under the direction of Wm. Odynsky of the Dominion survey. It consisted of seven men, four of whom were employed by the Research Council of Alberta and three by the Dominion Government.

The area surveyed was between Tangent and Wanham, and was bounded on the east by the Smoky River and on the north by the Peace River. It extended west to include range 4 and south in include township 75. Altogether this area comprises approximately 720,000 acres. In addition to the main projects a pack trip 70 miles north and west of Whitecourt was made by two members of the party. This was later completed to Valleyview near Sturgeon Lake. Several short reconnaissance trips were also made to districts adjacent to the main area.

These surveys, together with explorations in areas both north and south of Falher, furnished information on crown lands and other unoccupied lands suitable for location of returned men, from the

standpoint of suitable soil, accessibility, ease of clearing, etc. The information gained will be of great value to the Province, the soldier settler, and the company proposing to do contract clearing.

The northern survey may be extended to the area adjacent to the present highway and railway in and adjoining the area roughly between High Prairie, Peace River and Watino. This area also contains accessible, suitable crown lands surrounding areas of settlement which might meet the requirements for immediate soldier settlers. It also contains areas which might be reserved as forest lands.

Irrigation Surveys

During July and most of August a soil survey party consisting of W. E. Bowser, R. L. Erdmann, J. N. Leat of the Dominion Soil Survey and D. W. Sparrow, Research Council of Alberta, made detailed surveys of two separate areas, proposed as extensions to irrigation projects, between Vauxhall and Medicine Hat. The total area surveyed in this connection was 60,000 acres.

The first project, consisting of 32,430 acres is known as the Bow River Irrigation Project, Cecil-Alderson Area. It is located east of the Bow River, from Cecil, across to Alderson, and just west of Suffield. The second project, known as the Central District of the Canadian Land and Irrigation Company, consisting of 27,360 acres, is located in the forks of the Bow and Old Man Rivers, extending from Scope to Ronalane.

Peace Hill Area

The soil survey in the Peace Hill Area, previously undertaken by the Alberta Soils Survey was continued by the above named party during May and June, previous to the irrigation survey, and again in September after it. The party covered 760,000 acres in the western half of the Peace Hills Sheet.

Preparation of detailed reports on the above surveys are in progress but it will be some time before they can be completed for publication.

UTILIZATION OF POPLAR

A committee consisting of Drs. E. H. Moss, and F. A. Wyatt of the University Departments of Botany and Soils, and Mr. T. F. Blefgren, Director of Forestry, Department of Lands and Mines, was asked by the Research Council of Alberta to investigate the possibilities for the commercial utilization of Alberta Poplar. A number of meetings were held and a preliminary report presented to Council.

Their chief conclusions were, that existing knowledge of timber resources, while lacking in exact information, appear to justify further investigation with a view to the appraisal of these resources for paper pulp, wall board, match and plywood industries. More exact information however must be obtained by aerial and ground surveys before any specific recommendations can be made concerning the resources available for these industries. Thus it will be necessary to determine such details as proportion of coniferous growth; density, age, size, and condition of trees; soil characteristics; proper utilization methods, having in mind conservation, watershed protection, and regeneration problems. Information is also required concerning the use of poplar for various kinds of wall boards, including the possible requirements of long-fibre material to be used with the poplar.

UTILIZATION OF STRAW

The use of cereal straws for the manufacture of paper, straw board and insulation board has been considered from time to time. However, very little information on the practicability of such schemes has been available here. To obtain such information Mr. G. W. Govier, of the Department of Chemical Engineering, visited at the request of the Council, a number of laboratories, machinery manufacturers, and pulp and paper plants in Canada and the United States. Since previous work had shown that the use of straw for manufacture of straw board and insulation board offered the greatest hope of economic success attention was concentrated on these aspects of the problem.

A report on the information gained has been presented to Council. This showed that the most economical size of plant for the production of straw board would cost $500,000 to $700,000 and it would have an output of 40 to 50 tons per day. This production is considerably above the probable western market indicating that conditions are not yet favorable to the commercial establishment of a straw board industry. The cost of the minimum size of a "Standard" plant for the production of insulation board would be from $600,000 to $800,000, and would have an output of approximately 25 tons per day. This capacity is close to the combined market of Alberta and Saskatchewan indicating marginal commercial possibilities. In contrast to the above, the Northern Regional Laboratory at Peoria, Ill. has recently developed a process for the small scale production of insulation board from straw, that may be well adapted to Alberta. It is expected that the quality of the board so made will be inferior with respect to appearance and dimensional tolerance but equal to any competitive material in other respects.

It is suggested that in consideration of any scheme for utilizing straw, the costs for collection, handling and storage, and also the nature and composition and consequent cost of treatment of the different straws require further investigation.

ANIMAL CYCLES

A study by Dr. W. Rowan, Department of Zoology and Dr. E. H. Gowan, Department of Physics, is related to the periodic rise and fall in the number of rabbits, fur bearing and other animals and birds. This rise and fall at intervals of approximately ten years which has been noted for at least two centuries, is of great economic interest, particularly as it effects the trading companies, trappers and prospectors. One possible factor in the variations in animal population is the variation in the incidence of biological ultra-violet in natural sun and sky light through the year. The required recording apparatus for measuring ultra-violet light, ordered nearly two years ago, only arrived at the end of the year. It is hoped in 1946 to instal this equipment in a permanent location suitable for an observational program over the next ten to fifteen years.

Rabbit drives and counts, with the aid of large numbers of students, are now started and will be continued. A fifth annual province-wide questionnaire is also being carried on. Wire netting is still not available, so the plans for rabbit enclosure are still deferred.

INDUSTRIAL DEVELOPMENTS

J. E. Oberholtzer was appointed late in the year to the newly created position of Industrial Engineer. He took up his duties in December.

It is anticipated that the main functions of this position will be investigations of such industrial problems as the practicability of technical processes, availability and suitability of new materials, prospective markets, and utilization of waste products; but particularly the study of the feasibility of proposed industrial developments.

Several government and research laboratories were visited in Montreal and Ottawa and inquiries made with respect to some Alberta problems.

Liaison has been established with several Dominion Government departments in Ottawa, and also with a number of the Provincial offices which will be concerned with the investigations to be made.

Preliminary organization has progressed, and some minor problems have been dealt with.

LIST OF PUBLICATIONS
of
RESEARCH COUNCIL OF ALBERTA
EDMONTON, ALBERTA

ANNUAL REPORTS OF COUNCIL

No. 3 (for the calendar year 1920); pp. 36. **(Out of print.)**
No. 5 (for the calendar year 1921); pp. 86. **(Out of print.)**
No. 8 (for the calendar year 1922); pp. 64. **(Out of print.)**
No. 10 (for the calendar year 1923); pp. 76. **(Out of print.)**
No. 12 (for the calendar year 1924); pp. 66. **Price 35 cents.**
No. 16 (for the calendar year 1925); pp. 65. **Price 35 cents.**
No. 20 (for the calendar year 1926); pp. 53. **Price 25 cents.**
No. 22 (for the calendar year 1927); pp. 49. **Price 25 cents.**
No. 24 (for the calendar year 1928); pp. 53. **Price 35 cents.**
No. 25 (for the calendar year 1929); pp. 65. **Price 35 cents.**
No. 26 (for the calendar year 1930); pp. 76. **Price 35 cents.**
No. 27 (for the calendar year 1931); pp. 53. **Price 35 cents.**
Nos. 28, 29 and 32 (for the calendar years 1932-1934); pp. 90. **Price 35 cents.**
No. 33 (for 1935); pp. 43. **Price 35 cents.**
Nos. 37-43 (for 1936-1942). Not published.
No. 44 (for 1943); pp. 14. **Price 5 cents.**
No. 45 (for 1944); pp. 18. **Price 5 cents.**
No. 47 (for 1945); pp. 21. **Price 5 cents.**

REPORTS—FUELS

No. 10A (1923); COMBUSTION OF COAL FOR THE GENERATION OF POWER, by C. A. Robb. **(Out of print.)**

No. 14 (1925); pp. 64. ANALYSES OF ALBERTA COALS, with 18 maps and 2 charts. By E. Stansfield, R. T. Hollies, and W. P. Campbell. **(Out of print.)**

No. 35 (1944); pp. 174. COALS OF ALBERTA—THEIR OCCURRENCE ANALYSIS AND UTILIZATION, by Edgar Stansfield and W. Albert Lang. In six parts. **Price $1.00.**

Parts I-V—Occurrence, classification, production, special tests, general properties, preparation, utilization and combustion. **Price 50 cents.**

Part VI—Analytical and technical data by coal areas. **Price 50 cents.**

No. 46. ALBERTA COALS AND AUTOMATIC DOMESTIC STOKERS. Edgar Stansfield and Colin A. Genge. **Price 20 cents.**

REPORTS—ROAD MATERIALS

No. 18. THE BITUMINOUS SANDS OF ALBERTA, by K. A. Clark and S. M. Blair.
Part I (1927)—Occurrence, pp. 74. **Price 25 cents.**
Part II (1927)—Separation, pp. 36. **Price 25 cents.**
Part III (1929)—Utilization, pp. 33. **Price 25 cents.**

REPORTS—SOIL SURVEY DIVISION

No. 23 (1930); PRELIMINARY SOIL SURVEY ADJACENT TO THE PEACE RIVER, ALBERTA, WEST OF DUNVEGAN, by F. A. Wyatt and O. R. Younge; pp. 33 and colored map. Scale 1 inch to 4 miles. **Price 50 cents.**

No. 31 (1935); PRELIMINARY SOIL SURVEY OF THE PEACE RIVER-HIGH PRAIRIE-STURGEON LAKE AREA, by F. A. Wyatt; with colored map. Scale 1 inch to 4 miles. **Price 50 cents.**

REPORTS—GEOLOGICAL SURVEY

By Dr. J. A. Allan, Professor of Geology, University of Alberta.

No. 1 (1919); pp. 104—A summary of information with regard to the mineral resources of Alberta. **Price 25 cents.**

No. 2 (1920); pp. 138+14. Supplements the information contained in Report No. 1. **(Out of print.)**

No. 4 (1921); GEOLOGY OF THE DRUMHELLER COAL FIELD, ALBERTA; pp. 72, and 6-color map (Serial No. 1). **(Out of print.)**

No. 6 (1922, Part I); GEOLOGY OF THE SAUNDERS CREEK AND NORDEGG COAL BASINS, ALBERTA, by J. A. Allan and R. L. Rutherford; pp. 76 and 2-color map (Serial No. 2). **(Out of print.)**

No. 7 (1922, Part II); AN OCCURRENCE OF IRON ON THE NORTH SHORE OF LAKE ATHABASKA, by J. A. Allan and A. E. Cameron; pp. 40; two maps (Serials Nos. 3 and 4). **(Out of print).**

No. 9 (1923); GEOLOGY ALONG BLACKSTONE, BRAZEAU AND PEMBINA RIVERS IN THE FOOTHILLS BELT, ALBERTA, by J. A. Allan and R. L. Rutherford; pp. 48, and 6-color map (Serial No. 5). **(Out of print.)**

No. 11 (1924); GEOLOGY OF THE FOOTHILLS BELT BETWEEN McLEOD AND ATHABASKA RIVERS, ALBERTA, by R. L. Rutherford; pp. 61 and 8-color map (Serial No. 7). One inch to two miles. **(Out of print.)**

No. 13 (1945): GEOLOGY OF RED DEER AND ROSEBUD SHEETS, by J. A. Allan and J. O. G. Sanderson; pp. 125. Two geological maps in 8 colors. Scale one inch to three miles. Serial No. 8 Red Deer Sheet and No. 9 Rosebud Sheet. Five structure sections. **Price 75 cents.**

Map No. 10 (1925); GEOLOGICAL MAP OF ALBERTA, by J. A. Allan. In 14 colors. Scale one inch to 25 miles. **(Out of print.)**

No. 15 (1926); GEOLOGY OF THE AREA BETWEEN ATHABASKA AND EMBARRAS RIVERS, ALBERTA, by R. L. Rutherford; pp. 29 and 3-color map (Serial No. 11). One inch to two miles. **Price 50 cents.**

No. 17 (1927); GEOLOGY ALONG BOW RIVER BETWEEN COCHRANE AND KANANASKIS, ALBERTA, by R. L. Rutherford; pp. 46 and 9-color map (Serial No. 12). Scale 1 inch to 1 mile. **Price 50 cents, or map alone 25 cents.**

No. 19 (1928); GEOLOGY OF THE AREA BETWEEN NORTH SASKATCHEWAN AND McLEOD RIVERS, ALBERTA, by R. L. Rutherford; pp. 37 and 3-color map (Serial No. 13). Scale 1 inch to 3 miles. **Price 10 cents.**

No. 21 (1930); GEOLOGY AND WATER RESOURCES IN PARTS OF PEACE RIVER AND GRANDE PRAIRIE DISTRICTS, ALBERTA, by R. L. Rutherford; pp. 80 and 6-color map (Serial No. 14). Scale 1 inch to 4 miles. **Price 50 cents.**

No. 30 (1934); GEOLOGY OF CENTRAL ALBERTA, by J. A. Allan and R. L. Rutherford; pp. 41 and 10-color map (Serial No. 15). Scale 1 inch to 10 miles. **(Out of print.)**

Map No. 16 (1937); GEOLOGICAL MAP OF ALBERTA (Coloured), by J. A. Allan. Scale 1 inch to 16 miles. **Price 75 cents.** Obtainable from the Dept. of Lands and Mines, Administration Building, Edmonton.

Map. No. 17 (1939); GEOLOGICAL MAP OF ALBERTA (Black and white), by J. A. Allan. Scale 1 inch to 32 miles. **Price 5 cents.**

Map No. 18 (1940); COAL AREAS OF ALBERTA, by J. A. Allan. Scale 1 inch to 32 miles. **Price 25 cents.**

No. 34 (1943), in five parts by J. A. Allan; pp. 202. **Price $1.50.**

Part I—General Geology of Alberta, pp. 37, and geological map No. 17, scale 1 inch to 32 miles. **Price 50 cents.**
Part II—Rock Salt Deposit at Waterways, pp. 19.
Part III—Geology of Alberta Soils, pp. 87. **Price 25 cents.**
Part IV—Relief Model of Alberta and its Geological Application, pp. 9.
Part V—Coal Areas of Alberta, pp. 36, and Map No. 18, scale 1 inch to 32 miles. **Price 75 cents.**

REPORTS—RURAL ELECTRIFICATION

No. 36 (1944); pp. 107. RURAL ELECTRIFICATION IN ALBERTA, by Andrew Stewart. (Not available for distribution.)

Appendix I (1944); pp. 77. (Not available for distribution.)
Appendix II (1944); pp. 115 with maps. (Not available for distribution.)

CONTRIBUTION SERIES

This series comprises papers submitted to technical societies or journals by members of the technical staff. They are not available for general distribution; but can be consulted in the original publication cited.

No. 1—Fuel Investigations of the Research Council of Alberta (1919-1940), by W. A. Lang. Trans. Canadian Institute of Mining and Metallurgy, Vol. XLV, 1942, pp. 27-44.

No. 2—Humidity Data Expressed in Grains Water Vapour per Pound of Dry Air, by Edgar Stansfield. Canadian Journal of Research, A 21, 1943, pp. 51-55.

No. 3—Alternative Fuels for Motor Vehicles, by W. A. Lang, The Engineering Journal, August 1943, pp. 449-454.

No. 4—Hot-Water Separation of Alberta Bituminous Sand, by K. A. Clark, Trans. Canadian Institute of Mining and Metallurgy, Vol. XLVII, 1944, pp. 257-274.

No. 5—Some Physical Properties of a Sample of Alberta Bituminous Sand, by K. A. Clark, Canadian Journal of Research, F 22, 1944, pp. 174-180.

No. 6—Purification of Silica Sand—Alberta Tar Sands Suitable for Glass Manufacturing, by E. O. Lilge, Canadian Chemistry and Process Industries, Vol. XXIX, July, 1945, pp. 480-482.

No. 7—Bituminous Sands of Alberta, by K. A. Clark, The Oil Weekly, August 13, 1945, pp. 46-51.

No. 8—Asphaltic Road Oils from Alberta Bituminous Sand, by K. A. Clark, Canadian Chemistry and Process Industries, Vol. XXIX, September, 1945, pp. 616-618.

No. 9—Research and the Coal Industry in Canada, by W. A. Lang, Trans. Canadian Institute of Mining and Metallurgy, Vol. XLIX, 1946, pp. 51-62.

No. 10—Recent Work of the Research Council of Algerta, by E. Stansfield, Bulletin Canadian Institute of Mining and Metallurgy, No. 406, February, 1946, pp. 121-128.