Imperial Oil
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Science Shapes Our Future
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25 years of research at Sarnia

SCIENCE shapes our future

No one thinks about The Hill anymore, or if they do, it's in the past tense. But The Hill is still there - on the road to Nottawasaga beach, past the tiny village of Lefontaine, Ontario.

People laugh when you tell them that back in the old days you used to walk and worry about The Hill. A heavy rain, for instance, might postpone a trip for several days, or an extra guilty might mean walking out the front door. Even in reasonable conditions, cars used until four in the path and have to be back down and doggedly try again.

People laugh - but they forget that in the 1920's motorists were still charging along dusty unpaved roads at twenty miles an hour, their ears loaded with extra supplies because service stations were few and far between; that engines had a habit of knocking and self-starters weren't reliable. In those days any hill was a challenge.

Motorists weren't unhappy about this state of affairs. Far from it. But perhaps occasionally they did wastefully long for a car with enough power to climb the hill, a car that would not "sell out" periodically and a radiator that was not always on the verge of exploding. Sometimes, perhaps, they dreamed of highways that would not choke the motorist with dust or draw him in mud. Actually, the work that was going to bring all these things to pass was going forward during the early twenties.

It was then that the word "research" began to be heard more clearly. At first only now and again, but as the years passed it became a byword and during World War II people everywhere knew that research departments were one of the war's most important battlefronts.

As far as the oil industry was concerned, high octane gasoline, petroleum gases for the production of synthetic rubber and plastics, explosives, special lubricants and greases that could stand up to the elements and defy rust, rain, cold or heat, came out of the refinery laboratories. And the people who took vacations at Nottawasaga beach didn't give The Hill a second thought.

Until the early twenties, although oil companies did a certain amount of research, chemists were mainly employed to check on product quality. But the first World War had given the impetus to an industrial development which would later cause many research departments to be founded.

In the years following World War I the tremendous increase in the demand for petroleum products, particularly motor fuels, made it imperative for the oil and automotive industries to increase output and to get the fullest value out of every barrel of crude. In the case of the petroleum industry the importance of research in increasing the yield and quality of products became obvious.

Imperial Oil's research department had its beginning one day in August, 1921, when a quiet, scholarly young man, with degrees from Canadian, American and European universities, applied for a position at Sarnia Refinery. That man was Dr. R. K. Straford, now director of the company's technical and research department. From that time he had been the research department. Then gradually he began to gather around him expert chemists, physicists and engineers, until today the staff totals 60 men and women of which half are university graduates.

The group includes Dr. Pokorny from the University of Prague, Dr. Charles Mack from Alben- Lorraine via the University of Freiberg, Dr. George Gird from McGill, Lorre Sproles from Dalhousie, Dr. Cameron H. Cemier from the University of London, England, and others who have comparable highly trained experience.

Some of the earlier members of the Sarnia research family have gone on to other allied work. Those include men like Dr. J. A. Huggett, who received his doctor's degree at the University of Paris, and who now is general superintendent of the entire Sarnia refinery; Dr. W. W. Stewart from McGill, now technical advisor in the general sales department; and Dr. A. J. McRae from the University of Toronto, now doing research in California.

These scientists together with their assistants and other section heads have helped to make Imperial a leader in many fields of petroleum research. By sharing the results of their work with other research bodies throughout the world and in return receiving new knowledge, the department has been able to make a substantial contribution to the advancement of petroleum technology.

Some of the dividends that have come out of this quarter century of painstaking effort by the petroleum scientists of the world are visible to everyone who drives or rides in a car.

Take that mental fear with which we used to approach "The Hill" 26 years ago, for example - the fear that made everyone keep a thick Manila tow- rope under the back seat in case the car stalled.

What has removed that nagging fear is power, power built into the engines of the modern automobile, power provided by the improved fuels and oils that had their beginnings in the laboratory.

Specifically, the increased power that we now enjoy is only possible with high-compression engines partnered with ghee fuel or tetraethyl lead, which will raise the rating of any gasoline. But there is a limit to the amount of lead which can be added and very early in the game it became apparent that research would have to help meet the problem by raising the octane rating of the base-gasoline to which ethyl lead was added.
Put in that way, the job of the researchers sounds simple enough. But to report on all the work done, which has had a bearing on raising octane ratings would run into volumes.

One of the continuing jobs stems from the fact that in petroleum chemistry two plus two does not always equal four. You can, for example, add the same amount of lead to two base gasoline which have the same octane rating, but end up with two leaded gasolines of widely differing rating! This means that a constant check has to be made, especially when sources of crude or methods of refining are changed.

Constant checking has now become a routine but all-important practice. Other methods of raising the octane rating have a far less orthodox background, sometimes stemming from work only remotely connected with the qualities of gasoline.

Back in 1927 when "cracked" gasoline had become a major factor and had opened the door to higher-compression, more efficient engines, Dr. Straford was faced with the problem of cutting down corrosion in the cracking units. Under the thermal cracking methods in use, heavy oil under tremendous heat and pressure cracked into lighter products, such as gasoline. With such heat, it was found that impurities in the oil had an exceptionally corrosive effect on the distillation equipment.

The solution that Dr. Straford found proved satisfactory. He added powdered lime to the oil as it entered the tubes of the roasting furnace. This brought the corrosion under control. But it did something more. It cut down the formation of layers of brick-hard carbon within the tubes of the cracking furnace.

At the time, this second result of the lime injection was merely jotted down in somebody’s notebook as a matter of academic interest.

That was in 1927. Seven years later, the discovery was recalled when the research department was trying almost into methods of raising octane ratings. If lime cut down the formation of carbon, it would permit the use of higher temperatures, since the plugging of the tubes with carbon had been the chief barrie to raising temperatures. And higher temperatures meant higher octane ratings.

This experiment with powdered lime was one of the many stages along the road to today’s high-powered gasolines. It was one of the discoveries that led ultimately to Imperial’s own method of catalytic cracking, still a major research project.

But the lime experiment reveals more than a step forward on the octane road. It reveals one of the fundamental facts about research. Research is a world in which no one project stands strictly by itself. A problem frequently solves another—quite often a problem not known when the original work was done. And this fact points to the tremendous role of management in research.

Modern research places two demands on management. First, there is the demand on the management of research itself for skilful co-ordination and tabulation of results, so that past achievements can be marshalled for the attack on new problems.

Second, there is the responsibility that research imposes on the over-all management of the industries which carry out research. Not only can vigorous and skilful management stimulate research, but it alone can ensure that the contribution of research is carried through the production and marketing phases to the final consumer.

To get back to those upheavals of 1924 motorizing: Remember how common-place it was for a car to " seize up"? How engines would sometimes get so hot that radiator caps would blow off, followed by a geyser of hissing steam and water?

Much of that was due to poor lubrication. In part, of course, this was a result of early engine design. But some of the tragedies were caused by "sludge" in the oil—thick, gummy deposits that would form in the crank case and plug the lubricating channels.

Contributing to the lubricating headaches of the early days was the fact that the lubricants in use were not adequately graded and classified. Instead of being precisely separated into today’s SAR 10, 20, 30 and other classifications they were a hodge-podge of a number of grades, sold under brand names without quality specifications. In operation, the lighter grades might boil off, leaving nothing but heavy oil in an engine that really needed a much lighter lubricant.

On top of all this, the oils were prone to form carbon in the engines, causing pre-ignition and knocking.

The removal of these ailments required research work in several directions. One of the earliest projects for Imperial’s lab was the pioneering in Canada of the vacuum process of distilling lubricating oils. By this process the feed oil is distilled in a high vacuum. Lower temperatures are required than with the old process, thus preserving more perfectly the lubricating qualities of the oil and reducing the tendency to form sludge. Of equal importance is the fact that the vacuum process results in a far more exact separation of the various grades of lubricants.

But while this new method of refining solved many of the most serious lubricating problems (actually it guaranteed a good lubricant property suited to the motor) the researchers at Sarnia did not stop—nor have they stopped yet.

Even with vacuum distillation, the lubricant is likely to include some undesirable components. These elements have poor viscosity characteristics tend to form sludge and carbon in operation.

So in 1938 a new phase was begun at Sarnia, the search for a process which would yield the low viscosity-index elements out of the oils.

The problem boiled down to finding something that would dissolve the low V.I. sludge-forming
In lubricating oils, the job is basically different from the problems faced by the gasoline researchers. In gasoline, the problem is to find the perfect fuel for gasoline engines, most of which are broadly similar. In lubricating oils, Dr. Pokorny must devise a host of perfect lubricants for hundreds of exacting and widely different applications. For instance, oil for steam turbines must be rust resistant, capable of standing up under speeds four times as fast as those of an ordinary auto engine and to steam that is practically red hot.

Impossible though it may seem, oil to meet such specifications has been successfully developed at Sarnia by Dr. Pokorny’s group. There is no cut-and-dried formula for breeding oils of this sort, but the general approach is first to duplicate in the laboratory the conditions under which the oil will have to work, then to try a host of different oils in the guinea pig. The solution may prove to be a compound of different oils. It may come through the addition of a chemical, such as an emulsifying agent or a rust inhibiter. The number of combinations is infinite.

Still wider is the field that Dr. Pokorny’s division serves in its research into waxes. Here there is still more work to be done. Tests aimed at improving petroleum products for industrial use are an important part of the work of the laboratories. James Botsie trims out a heavy duty grain on a set of gears.

Jeanette LeNeve, laboratory assistant, uses the infra-red spectrophotometer to test a gas sample. Its invisible rays will determine the presence and amounts of component gases.
much pure research work to be done in separating and grading waxes, just as there used to be in the lube oil field. And the designing of specialized waxes for specialized purposes takes the wax researchers into areas not usually associated with petroleum at all. These specialized waxes may turn up in a lady’s lipstick or her husband’s shoe polish. They may appear on the wrapper for this morning’s loaf of bread or as a coating on tonight’s turnips. As with lubricating specialties, researchers duplicate the operating conditions for waxes, then work out the ideal wax for the job.

Lorna W. Sproule works with another mysterious, yet commonplace, grease. In spite of their many uses, there is very little known about why certain greases act the way they do, in fact, it can be said that scientists are not satisfied that they know what greases actually are. True, this lack of theoretical knowledge does not prevent the development of specific greases for specific jobs by Mr. Sproule and his assistants, but it imposes on them the responsibility for pure research in the “why” of greases. And in this pure research Mr. Sproule rates as one of the world’s leading pioneers, and is engaged in some very advanced work in the internal structure of greases. This work involves the use of the University of Toronto’s electron microscope—the first of its kind in the world.

To the speeding motorist, asphalt is asphalt, the smoothest surface he knows. To the fuer it spells salt, hunting fields. To Dr. Charles Mack, asphalt is a life’s work. Dr. Mack knows asphalt for what it really is—a material that can take on many different properties, and he is working on basic studies into the reasons for asphalt’s unusual versatility.

Asphalt comes from the bottom fractions of crude oil, after all the lighter fuels and lubricants have been driven off by distillation or cracking. But as it comes to the asphalt plant it is still a sticky fluid and it is only when the asphalt man has blown steam and air through it that it becomes hard enough for its many uses.

Now the reason that asphalt can be used for jobs ranging from paving to battery boxes is that it is tough yet elastic. And by varying the proportions of steam and air in the treating process you can get varying degrees of hardness, ranging from quite brittle to a substance that is still fluid.

Dr. Mack’s section works towards the development of the right formula for each use to which asphalt is put. For instance northern roads require an asphalt that will resist summer heat but that will also be elastic and not crack under winter’s cold. For southern roads, he can play down elasticity in favor of toughness to withstand the heavier traffic.

A new trend in research is illustrated by the extent of the effort being devoted to studying the basic structure of the components of petroleum especially in the pure research applied to greases, waxes and gasolines. To the services of the chemist and the engineer who formerly carried on virtually all the studies in petroleum have been added those of the physicist. The tools which the physicist has provided, such as the electron microscope, and the precise measurements which physical methods of analysis have made possible are opening broad new horizons.

The time you add all these branches of research together, and tabulate the flow of information that comes from each of the operations, the total output of facts becomes quite formidable. So much so, in fact, that two staff sections are needed to co-ordinate and serve the organization.

One of these is concerned with the statistical interpretation of data. The function of this section is to evaluate the results of the countless experiments that are constantly going on, make sure that the facts are correctly interpreted, and in so doing lift a very heavy task from the shoulders of those who are in charge of the actual experiments.

Akin to this job is the work of Jack Easterbrook, chief librarian and a chemist himself. In charge of the research body’s collective memory, he has in his library thousands of volumes and reports on technical subjects, and his staff keeps the researchers in touch with the work being done in universities and industrial laboratories all over the world. As Dr. Stratford puts it, “No research organization can hope to be self-sufficient. Our work at Sarnia would be greatly handicapped if we were not able to draw on the achievements and services of such organizations as the Standard Oil Development Co., National Research Council, Ontario Research Foundation and the university.”

Perhaps the importance of co-ordinating research illustrates as well as anything the vast change that has come about since Dr. Stratford signed on 25 years ago. Research has become an industry in itself, and is just as meticulously organized.

THE AIM OF PETROLEUM RESEARCH is to discover methods that will permit the production of more and better products at lower cost to the consumer.

While the development by industry of research laboratories is now widespread this may be said to be a phenomenon of the 20th century. The petroleum industry has benefited greatly from the findings of its laboratories and has passed these benefits on to the consumer.

The improved methods in the refinery that were brought about by research have resulted in greater comfort in the home, faster means of transportation and increased industrial and agricultural production.
Alberta's Leduc field has made oil history in Canada. In less than three years it has grown from a single discovery well located in a district noted for wheat farming to more than 220 wells with a daily production of 26,000 barrels of crude. It covers 22,000 acres containing estimated proven reserves of 242 million barrels of oil.

Now, in a motion picture, the story of the transformation of the Leduc district has been recorded on film. It is a story of success after years of costly searching and heart-breaking disappointment.

"A Mile Below the Wheat" is a 16-mm color film with music and voice describing how the discovery of oil affected the community and small Alberta town after which the now famous oil field was named.

As oilmen today continue their work of probing the depths for new wells, farming goes on much the same as if there were no other crop being harvested. But there are profound changes because of the Leduc oil—changes that affect all of Canada. There is a new prosperity in the Leduc area; there are increased revenues for Albertans; Canada is saving precious U.S. dollars that formerly had to be spent on imported oil.

In the war years—and after—we were dependent on foreign oil for roughly 99 per cent of our supplies. Now since the advent of Leduc, which set off a chain of other important discoveries, prairie production exceeds wartime refining capacity. With continued effort and reasonable success, it is not too much to hope the men who search for oil will make Canada self-sufficient in petroleum in years to come.
A Mile Below The Wheat (Continued)

5 As soon as that first well blew in things began to happen. The oil drillers with their striped helmets, wore at jointly ample, increased in numbers as new wells were spudded in

6 The railroad station at Leduc soon lost its tranquil air as flat cars bearing strange machines, huge metal tanks and miles of hollow drill pipe arrived and were quickly unloaded

7 The equipment that arrived by rail was rushed by trucks to the fields to supply drilling crews who were working day and night, good weather and bad, to bring in more oil wells

8 As the drill hits tore at the underground rock, specially prepared mud was pumped down the pipe to be returned to the top carrying up rock cuttings. Here the mud is being tested

9 Batteries of tanks were thrown up to store the oil after it was freed of impurities. A network of pipe lines was put down to transport the oil from producing wells to the tanks

10 Long lines of tank cars moved the Leduc crude in increasing quantities to western refineries to be processed into petroleum products supplying an oil hungry post-war market

11 As the work of the drillers progressed and new wells came into production it was necessary to open up new roads and improve old ones to move in supplies and take out oil

12 With new and improved roads it was possible to transport to the field such heavy equipment as storage tanks that were already riveted and to get them up to store crude

13 At Nisku, a railway siding 15 miles south of Edmonton, where a new refinery was fast taking shape, tank cars lined up to receive the Leduc crude and transport it to refineries

14 At the Nisku railhead, more storage tanks were built as one step in a new system for handling the growing volume of oil because Leduc production was exceeding all expectations

15 To move the oil economically from Leduc field to Nisku railhead an eight-mile pipe line system was constructed. This was extended later to reach Imperial's Edmonton refinery

16 After welders had joined 200-foot lengths of eight-inch pipe, mechanical trench diggers prepared a channel along a surveyed course. Here pipe is being handled to protect it

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The 1949 Fellowships

Four Imperial Oil fellowships, designed to encourage post-graduate scientific research and valued at $3,000 each, have been awarded this year to graduates of Canadian universities. This is the fourth consecutive year in which fellowships of this kind have been granted.

The 1949 winners are: George Walter Morgan, of Montreal, for research in mechanical engineering; Robert Donald Heyding, of Saskatoon, for research in chemistry; Henry Gordon Basset, of Montreal, for research in petroleum geology; and Gerald Alexander Martin, of Edmonton, for research in petroleum engineering.

These young men are under no obligation to the Company and the subject of research in the field for which the fellowship is awarded is a matter of arrangement between the successful candidate and the university he plans to attend. The competition for the fellowship is open each year to any graduate nominated by a Canadian university.

G. W. Morgan is a McGill University nominee. While an undergraduate he was awarded the University Scholarship and the title of University Scholar. He also won the British Association Medal for highest standing in the graduating class in mechanical engineering. After graduation he worked in a knitting mill for two years and since 1947 he has been doing post-graduate work at Cornell University, where he received his Master’s degree in mechanical engineering. He intends to proceed to a Ph. D. degree and will use his fellowship to continue the study of fluid motion.

G. A. Martin was nominated by the University of Alberta. He is a veteran of World War II and served four and a half years as a radar mechanic with the R.C.A.F. After his discharge Mr. Martin entered the chemical engineering course at the University of Alberta and this spring received his Bachelor of Science degree. He is proceeding to a Master of Science degree and plans to use his fellowship to carry out research in petroleum engineering.

The winners were chosen by the selection committee under the chairmanship of Dr. R. W. Boyle of Ottawa.

The 1949 Scholarships

This year’s winners are: Monica Dentley Barker, daughter of D. E. Barker, Calgary refinery; Betty Anne Heffernan, daughter of J. V. Heffernan, Edmonton refinery; Clare James Irwin, son of James A. Irwin, Manitoba marketing division; Kenneth Richard MacKay, son of Alexander M. MacKay, British Columbia marketing division; John Donald McGeachy, son of R. A. McGeachy, mechanized department, Sarnia refinery; Barbara Anne McNutt, daughter of Harold O. McNutt of the comptroller’s department; Norman Garfield Stoner, son of Mrs. A. N. Stoner, formerly of Toronto maintenance department and now a company accountant; Richard Laurence Weldon, son of Arthur H. Weldon, Imperial refinery at Halifax; Charles Ernest Wielhake, ward of Miss Ethel Peeker, Saskatchewan marketing division.

Producers and directors of "A Mile Below the Wheat" is Gerry Moses, graphics editor of Imperial Oil's public relations department. Using a Ciné Kodachrome Special camera and 16-mm Kodachrome film Mr. Moses shot the scenes at intervals during the spring, summer and fall of 1947. The film is available free of charge for group showings: see your local film council or community film library, or write to the regional office of the National Film Board in your area, or the nearest divisional office of Imperial Oil Ltd. Prints may be obtained through the provincial departments of education.
Majoring In Mud

Veteran oil men go back to school to study scientific methods of handling drilling fluid

As robust a group of pupils as ever darkened a classroom with cigar smoke waltz back to school this summer to study a subject usually given more attention by children than by adults. The subject was mud, and they tackled it in deadly earnest. They studied it, weighed it, tested it and got elbow-deep in it.

No ordinary mud, it was, but the stuff used in drilling. And the pupils were some 200 oil field workers who were attending a course at the University of Alberta.

What they were studying is more accurately described as drilling fluid. But roughnecks and drillerseverywhere, who use it daily on the job, regard that as fancy talk. They call it mud. Hence, it was a "Mud School", held to further their knowledge of mud's functions and importance in drilling.

The study of mud has been important since rotary drilling began, for a circulating fluid of some kind is essential. A mud mixture has been found to be most satisfactory. It has certain functions to fulfill and when it fails to perform properly it must be treated

until it will do its many jobs. This requires constant vigilance by a mud engineer or some member of a drill crew trained in its use.

Among the functions of mud are: contributing to speed of drilling; preventing hole cave-ins; over- coming subterranean gas, oil and water flows, or blowouts; carrying rock cuttings up from the bottom of the hole to the surface; lubricating and cooling the walls of the hole in which the steel drill pipe turns; lubricating and cooling the drilling bit at the bottom of the hole.

At each well site a large sump is dug by bulldozers for mixing the mud. A smaller but deeper connecting pit is also excavated from which large quantities of mixed mud are sucked up by powerful pumps. The pumps, in turn, force the mud through a pipe and hose system and down inside the drill stem in the hole during drilling. Pressure from the pumps forces the mud out through the teeth of the drill bit at the bottom. Then it travels back up between the drill stem and the wall of the hole.

That is a simple explanation of the mud's complete circuit down the hole and back to the surface. The important thing is that during the trip it must be performing all of its functions satisfactorily.

The petroleum industry's attitude toward the "mud school" was best indicated in the enrollment. Men with 20 years' experience on drill rigs took classes. Geologists, petroleum engineers, mud engineers, drillers, derrickmen, equipment purchasers and other field specialists attended. All were enthusiastic about the school. Some even said the steady classroom and laboratory grind was "better than working".

They were motley groups which assembled in the university's chemical engineering department classrooms. Because of the shifts they worked many of the men reported for classes oil-stained and muddy, right off the job at some well in the Edmonton district.

Fred Keller, veteran Imperial Oil geologist, with pencil in one hand and cigar in the other, concentrated on a problem during a "Mud School" session. His classmates are men from drill rig

While students of the University of Alberta course were studying the rubidium of making drilling mud, not many miles away a "mud engineer" was preparing his batch to feed his pumps

1. E. Conway of the division of extension, petroleum branch, University of Texas, was chief instructor at the University of Alberta's "Mud School" held for some 200 oil field men.

Because maintaining effective drilling mud is a heavy item of expense in drilling an oil well and a big factor in its ultimate success, many companies active in western oil field development had key employees attending the school. Imperial Oil had several representatives enrolled, including Charles Vienne, the producing department's western divisional drilling superintendent.

Typical of the Imperial men best able to convert new classroom knowledge to immediate use at drilling wells were Jim Todd and Don Hunt. They are known as mud engineers, and are responsible for good mud control and practices at Imperial well sites.

Because some students lacked the experience of these two men and others like them, lectures were presented in layman language. These were given by an affable and efficient Texan, James B. (Jim) Conway, drilling fluid specialist of the University of Alberta.
Texas. "Teacher" went over big with the all men.

"He knows mud and everybody can understand what he's talking about," one veteran driller-student said.

Despite the impressive array of technical talent represented in the student body, Jim Conaway started his course with the fundamental question: "What is mud?" From that point, the studies progressed through many intricate phases of mud handling and control, analysis of its properties and method of conditioning mud by chemical treatment. A maximum of practical work was the objective and this permitted many hours in the laboratory experimenting with mud samples.

With a flow chart of drilling fluids, students like Jim Todd and Dan Hunt conducted unannealable tests. Density, weight and viscosity — viscosity in the assistance mud offers to flow or to being pumped — of samples were measured. Modern lab equipment was used to establish water loss in certain types of mud; alkalinity, salts or calcium contents were accurately determined, and mud samples analyzed.

These small samples served to demonstrate testing and treating methods which engineers could apply to the thousands of gallons of mud used at a single drill rig. Actual samples from mud sumps at Leduc field wells were brought into classes for examination, linking the school directly with drilling operations a few miles away.

Essentially, mud used in present-day drilling is a mixture of just two substances — water and clay. But just any clay or any water will not do. To perform efficiently, the mixture must have certain properties of weight, density and viscosity. The school provided useful data on achieving that basis of efficiency, particularly in cases where mud performance was unsatisfactory before treatment.

The correct technical name for the clay used in most mud mixtures is bentonite. Alberta bentonite was used in the course. This is a mixture of tenequac powder and arcidice for shipment to well sites.

This clay is used because of its spectacular swelling quality when introduced into clear water. Each finely-ground particle of good bentonite will swell to 40 times its original size. It must swell to the point where it will hang in suspension by itself in water and encourage rock cuttings to "ride" in the fluid the same way. Ordinary clay, therefore, is not satisfactory.

Students at the mud school learned why clay dug from the ground anywhere will not make good drilling mud. It contains no "montmorillonite" — one of the few 64-dollar words encountered during the course. Montmorillonite is the substance which causes swelling, so important for a good mud mixture.

Similarly, classes learned that soft water is best for obtaining a good mud. Where two or more choices of water are available at a well site, soft water would be chosen every time. Where that is the ease, test points were given on testing water for hardness, soft or other contamination. Suggested treatments were outlined to show how chemicals would make such water suitable.

Cuttings brought out by the drill bit deep in the earth must be removed. This is one of the important tasks of the circulating mud. Inefficient pump pressure could result in failure of the mud to return cutting upward but mixing the viscosity of the mud itself also will make for a clean cut.

Pressure of the drilling fluid in the hole must be sufficient to keep out water, gas or oil contamination in underground formations during drilling. Weight and density of mud are important factors for control of the hole is best because of some mud deficiency, a breakfast could result with serious consequences to the particular drilling operation.

In the mud tank pumped from the pump, flows down the shell into the drill pipe and around the bit, then up between the pipe and wall of the hole, above a flow back to the reservoir drilling. The mud men must maintain a balance of all the desirable properties. If difficulties arise it cannot concentrate on one certain quality of the mud to the neglect of others or trouble may descend on the men from another direction.

The school stressed that the business of "making hole" is that of the driller and his crew, and good men and equipment come first. A mud program was described as good insurance to be applied intelligently along with good equipment to promote drilling progress effectively. Each field, it was pointed out, has a problem all its own when it comes to mud reaction but certain basic principles assist those responsible for an individual well's behavior.

Drilled around numerous weird-looking mechanical contraptions in the university lab, "pulpier" tackled all the problems deemed likely to affect that insurance and render it ineffective in Alberta wells. With hydrodynamics and mud balance they learned to calculate the density of mud accurately. Viscosity was calculated repeatedly with the simple Marsh funnel or the more complicated Bierman viscosimeter. Characteristics and classifications were tabulated and filter press results were put into action to maximize the water loss of mud.

Ordinary electric arc mills were used to agitate mud samples for various tests. Shale samples were mixed into slurry for brin water determination. Intraction was given in the use of chemicals and weighting materials for controlling mud quality.

All this had a direct bearing on the mud work going on at oil wells drilling throughout Alberta. Shells at most Leduc wells, the instance, are in excavations near the derrick and run about 40 by 70 feet and 3 1/2 to 4 feet deep. Thousands of gallons of mud can be mixed in such a tank. The great masses of gray-moon mud vary in texture, as drilling progresses, from that of a very thin milkshake to an extremely thick and gummy chocolate pudding.

During pipe pulling and stacking operations when the bit is being changed the mud frequently splatters the roughened floor to feet of wet, as it bursts from boomed coupling joints. On the derrick floor its slippery texture, desirable underground, makes for dangerous footing for the crew members. Since
mud often is required to "sit" in the hole while circulating pumps are shut down, it must retain its required properties during this period of non-agitation. If the drill stem and bit can be withdrawn from the hole without hindrance and returned to the bottom even after a considerable shutdown of the pumps, mud is functioning adequately.

Then there also is the possibility of the hole walls taking on some of the characteristics of the mud itself. Some clay formations of a suitable bentonite type will swell when contact is made with the water in the circulating fluid. The clay may swell to the point where the bit becomes jammed in the hole and the oilman's headache, "stick pipe", results.

These examples are just a few of the things which can happen to mud and to a well if the "insurance" is not handled with knowledge and skill. The mud school coached its students in recognition of trouble when it first appears, then stressed the fastest methods of combating that trouble.

The University of Alberta provided much of the costly equipment used at the school and all the classroom and laboratory facilities. The university offered the courses in co-operation with the Canadian and American Associations of Oil Well Drilling Contractors and The Alberta Petroleum and Natural Gas Conservation Board. The school provided a fine example of co-operation between industry and an institution of learning.

The school's popularity was such that plans already are under way to hold another in the near future to meet the demand for instruction by men who could not be accommodated in the first sessions.

Oil men are certain that courses of this kind will add to the efficiency of well drilling as more knowledge is acquired by greater numbers of men in what still is a young industry in western Canada. Going back to school becomes a profitable and painless project when the day-to-day job is made easier as a result—especially when some of the oil men find the process "better than working".

After school, the oil men applied their new knowledge of mud to actual drilling practice. Shown here is the mud pump of a typical drilling rig, with powerful pumps in the background.

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**Delivery At Seven Islands**

Three hundred miles north of the St. Lawrence River lies one of the largest potential iron ore fields in the world. In the desolate wilderness along the Quebec-Labrador boundary 300 million tons of high-grade ore already have been found and exploration is expected to locate an even greater reserve of the red iron oxide.

Prospectors are tramping the bleak country and their finds are being probed by diamond and churn drills. An exploration headquarters has been set up at Burnt Creek—a settlement of Quasset huts and log cabins.

Everything—nuts, bolts, food, drills, fuel and even the men themselves—has to be brought in by air to Knob Lake airstrip, 10 miles from Burnt Creek.

The exploration work requires the use of aircraft for moving supplies into the district being searched; jeeps for transport; bulldozers for clearing roads; diamond and churn drills for proving up the ore bodies discovered. All require petroleum products in their operations and the men's living quarters need oil for heat.

The venture is a classic example of enterprise. It will cost $200 million to bring the first trainload of ore to the St. Lawrence. Mining equipment will have to be brought in, a 360-mile railway built and docks and loading facilities will have to be erected near Seven Islands before the first ore carrier can pick up a cargo.

Holinger Consolidated Gold Mines Ltd. controls the venture and the M. A. Hanna Company, of Cleveland, has a minority interest. Since the area under exploration straddles the Quebec-Labrador boundary, two subsidiaries were formed. The Holinger North Shore Exploration Company acquired...
rights for 3,000 square miles in Quebec and the Labrador Mining and Exploration Company holds a 20,000-acre lease concession in Labrador.

Iron ore was discovered in the region as long ago as 1883 by Dr. A. P. Low of the Geological Survey of New South Wales who then had lots of more accessible ore and it was forgotten. In 1906 Dr. J. A. Ritty, who planned a geological search for gold, was fascinated by a piece of "pretty metal" which Mathieu Andre, an Indian trapper, found in the wilds. Dr. Ritty recognized it as high-grade iron ore.

This led to the discovery of the Sweeney Lake deposit and later to outcroppings at Burnt Creek. There were activities for 1940 and 1941, but the conflict which used up so much iron ore also convinced Copper that the Labrador had commercial value. Since then more than 40 large ore bodies have been found.

During the early exploration stages oil products were delivered in barrels to Seven Islands but last summer it became apparent that a large base would be required to keep the operation going at its ever-increasing tempo. Imperial got the job of supplying 755,000 gallons of products to fuel operations.

The problem of making this first delivery was a complicated one—a constant race against the time when the stormy weather of late fall would make the operation impossible. This year's delivery, made in September, was much easier by comparison.

Last year the operation started from scratch. A site had to be chosen. Tanks were needed, but steel was in short supply. Once obtained, there was the task of getting the heavy plates to the site and welding them into tanks. Then came another problem—delivering the fuel.

Imperial awarded the contract for the tanks to the Horton Steel Works of Fort Erie. They were to build three 300-gallon tanks and one of 150,000 gallons requiring about 175 tons of steel.

Steel deliveries started in September, when coastal steamers landed plates on the wharf at Seven Islands. (Despite its name, Seven Islands is a village on the mainland.) The site chosen for the tanks was about 5,500 feet from the wharf. This location was picked because it would be near the loading dock, yet to be built. The water is too shallow at the Seven Islands' wharf to accommodate a tanker.

The problem then, was to move the steel from the wharf to the tank site. It involved building an entirely new road, and over this a tractor dragged the plates.

Meanwhile, foundations had been laid for the tanks and a 15-man crew started on the steelwork. Two tanks were completed October 20 and the third on November 14, but work was still being rushed on the fourth when the Imperial Smokey arrived three days later to deliver her cargo. The delivery went smoothly, largely because it had been well planned.

High-grade iron ore from the Quebec-Labrador fields can be worked with ease, according to Mr. G. H. Wheaton, manager of the construction and maintenance department, general sales. The mines department worked out details of the tanker delivery.

In September Capt. W. Osterholt of Mr. Wheaton flew to Seven Islands to survey the locale. Before their visit they heard that a barge was available and planned to anchor it offshore from the site and run a pipe line from it to the tanks ashore. The tanker would tie up to the barge and pump cargo through the pipe line.

But they found the barge high and dry ashore, so badly holed that repairs were impossible. Another barge, however, had also been prepared in advance. The tanker would be moored astern to two "deadmen" (log booms on the shore) and her bow would be kept seawards by two bower anchors.

Imperial had obtained a pipe large enough to lay three eight-inch lines, each 800 feet long, from the shore to the tank and a six-inch line from shore to the low water mark. To connect this line with the tanker the Company found 300 feet of five-inch flexible copper hose, plus buoys and markers, among surplus war goods at Montreal.

The copper hose rests on the bottom, with a cable attaching it to the barge. It could be raised when the tanker was ready to connect it.

The Imperial Smokey arrived in the Bay of Seven Islands before dawn on November 17. At daylight she moved close to shore. Four marker buoys had been placed to indicate the minimum safe depth for the ship. Rough weather for the two days previous made it impossible to place markers for the ship's anchors, but a moderating, offshore wind aided the operation and they were soon placed. An unusually high tide, however, complicated matters again. The shore markers started to drift and had to be re-located. All difficulties finally were overcome and the

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Fish Out Of Water
Shad are caught by horse-and-cart fishing in Nova Scotia

Tall tales are common among fishermen, but Nova Scotia has a story which should win any Liar's Club award except that it happens to be true. The tale runs like this: the fishermen drive a wagon and team of horses three miles from shore and—more unbelievable—climb a ladder to take fish from the nets.

The locale of this unique fishing ground is Cumberland Basin, at the head of the Bay of Fundy, where lobster-shaped Nova Scotia is attached to New Brunswick by the isthmus of Chignecto. The tremendous tides of Fundy, rising and falling as much as 30 feet, make the operation possible.

Today just one group engages in this fishery, but in bygone years several families in the tiny village of Minudie caught fat, silver-blue shad and gleaming salmon in the turbid, muddy waters of the Basin. The men say fish have been caught here with the horse-and-cart system for about 20 years.

Minudie shad, which average about 2½ pounds in weight, are highly prized in the area. The fish has firm white flesh which is delicious when either fried or baked, and is so fat that the frying pan needs no additional grease. Salmon are caught later in the season but in much smaller numbers.

The fishing season lasts from mid-May until September—a time of hard, unrelenting toil, of little sleep, of ever-present danger. The nets are cleared twice a day, at high noon or at midnight; at dawn, at dusk, or in any of the hours between. They are cleared whenever the tide drives from the Basin, before it floods back swiftly, rising 28 feet in six hours.

Only a storm keeps the fishermen ashore. Night, rain, fog, biting cold or scorching sun are all part of their calling, to be shrugged off and forgotten.

Hours before the receding tide leaves Cumberland Basin’s mud flats exposed, the fishermen sit down to a meal in Edmund Brine’s house in Minudie. Around the table with him gather Peter Brine, a veteran of the flas, Carl Burbine and his young cousin Neil. Cold pork, boiled potatoes, cookies and cake, washed down with robust tea is a typical meal.

When the last teacup has been drained, the men bring the horses—Queenie and Bob—from the barn and hitch them to a box wagon loaded with stakes, mallets, guy ropes and nets. The wagon starts to roll as the horses plod towards their first objective six miles away. This is the “camp”, a collection of weather-beaten huts huddled behind a dike which keeps the waters of the Basin from flooding a marsh at its shore.

On arrival at the camp, the horses are turned loose to graze on rich marsh hay, while the men splice new guy ropes to replace those frayed by the surging tides in the Basin. Peter Brine throws tea into a
At the fishing camp the horses graze on marsh hay while the fishermen spin ropes to strengthen the nets. (L. to R.) Peter Brune, Wilfred, Carl and Neil Burchie; Harry and Vernon Brune.

kettle and when it boils the fishermen have a snack before the horses are hitched again. Edmund Brune takes a ladder from the side of the hut and loads it on the wagon.

As the men and horses climb over the rounded top of the dike, the southwesterly wind makes its full force felt, blowing up the Basin and bringing mist with it.

Ahead of the fishermen stretch desolate red mud flats, with a curving line of stakes disappearing in the mist about a mile from shore. The stakes mark the safe route which the wagon will follow to the nets, three miles from shore.

The first 900 yards are sticky gumbo, which clutches at the horses' hooves and the men's rubber boots but farther out the bottom firms, although the wind is blowing an inch or two of water over its wrinkled surface.

A mile from shore the mist closes in, blotting out the land. The men and horses plod on, following the guiding stakes, which are about two feet high and 15 feet apart. The wind, cold ashore, is biting on the exposed flats.

The tricky mist lifts suddenly and the long line of nets appears belled out by the strong wind. Sea-gulls scream around it, attracted by the fish. The men quicken their pace, for gulls can destroy dozens of fine fish, tearing them with powerful beaks.

As the distance lessens, silvery specks in the nets become shad, caught fast by their gills, and now swinging high in the wind. The need for the ladder is apparent, for the nets are set on birch posts 12 feet high. By reaching, a man can grasp the bottom of the net, but the top is beyond his reach.

This is the main string—18 nets, each 23 yards long, set firmly on its posts. The lower string of 10 nets is a half-mile farther down the Basin.

The first job is to repair damage. Two of the 23-yard nets at the lower end of the string are down, flattened by wind and tide, and are trailing into the muddy water of the Basin in a tangle of ropes and stakes. The three older men set to work while young Neil drives the team to the lower string.

No post-hole digging is needed here, for the three fishermen simply attach guy ropes to the birch posts and rock them back and forth. Even the sharpened end works into the sand and Edmund, working with the ladder, swiftly stretches new nets on the posts and makes them fast.

As he works, the tide turns, inching up the gently shelving flats. Neil returns from the lower nets with a great catch and now he and Peter go along the main string, shaking and pulling the nets and collecting the shad as they tumble to the sand. Some stick beyond reach and Carl, following them shoreward with the wagon, collects as many as he can reach.

Edmund, using the ladder, collects all the fish beyond Carl's grasp. A dozen shad, torn by the sea-gulls, are useless and are tossed aside.

The horse-drawn wagon acts as a mobile "ladder" and from it the fishermen are able to reach most of the shad caught in the nets.

Once the nets have been set up on the flats fishermen work tirelessly between tides to keep them in repair. Here with the aid of wooden mallets they drive stakes into the mud. Managed by strong winds and the fast incoming Bay of Fundy tide, Peter Brune struggles to take the twist out of the net while Edmund Brune lassos it firmly to a stout birch pole.

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When the string is cleared, Edmund runs a practiced eye over the fish in the wagon. "A hundred and fifty," he says. "A good catch." Queenie and Bob have a harder pull as they follow the line of stakes which mark the safe route toward shore. Behind, the tide is rising fast.

As they walk, the men straighten the stakes which are leaning or replace them with spares from the wagon. The stakes are important—they are the fishermen's only guide when night or fog cuts off other landmarks.

Edmund looks at the tiring horns. "That team travels 30 miles a day," he says. "It's six miles from home to the camp and three miles from the camp to the nets. That makes an 18-mile round trip twice a day. I'm going to get a truck. Then we can drive to the camp and leave the horses there.

"This way we get only a few hours' sleep a day. After the team gets home we have to split and salt the fish and pack them into puncheons (large barrels). After that there's the farm chores and when we finish them and eat it's almost time to start out all over again."

The wagon rolls slowly through the gumbo near shore, over the dike, and stops as the horses relax and munch marsh hay again. Neil is left to drive them home, and the others go on ahead. Hours later, it seems, the wagon comes slowly into the barnyard.

The fishermen go to work again, for the shad must be cleaned at once. "A good season," says Edmund. "A good season." Peter echoes as their knives split the fish. Next they rub cleaning white salt on the split shad and toss them into fat puncheons in the barn. Seven of the big barrels are full. Each holds about 400 fish, and each is worth about $100. The catch represents a month and a half of fishing.

As he works, Edmund casually discusses the dangers of his mode of fishing. Darkness, he says, keeps most men off the flats, but the fishermen seem used to its dangers. Formerly they used lanterns, but now they have an electric light from a dismantled car—and take along two batteries, just in case.

There have been some narrow escapes from death on the flats and light is all-important in darkness or in fog. Edmund, who has had several brushes with the fast-rising tide, puts it like this:

"When you're lost on the flats it isn't like being lost in the woods. You can't sit down and wait until the fog lifts or daylight comes to get your bearings. You've got to move fast—and hope you're moving towards shore. The tide at our nets rises as much as 20 feet. If you lose your way you haven't a chance.

"One foggy night," he continues, "I decided to take a shortcut back from the lower string of nets. I thought I'd pick up the line of stakes and save a walk of 500 yards. It didn't take long to find I was lost and I knew the tide was coming in fast.

"It was up to my knees when I discovered I'd gone around in a circle but just a few minutes later I managed to find the upper string. I got ashore all right, but it was too done for comfort."

Soon the last shad, cleaned and salted, is in the puncheons, but there is still more work to be done. Carl brings a net, bearded with dried marsh grass, from the barn. They string it up in the barnyard and attach it with tourns made of twigs—"wadukas"—to the fishermen. Working in unison, Edmund and Carl launch the gane from the net, driving it so that its meshes will again catch shad and, later in the season, eels.

"That chase finished, the men are ready for supper. 'Simon we fish at all hours,' Peter explains, 'you eat five times a day. Perhaps people will believe that, even if they think going fishing with a team of horses and catching shad with a ladder is just one big fish story'"
Ontario's Biggest Gas Well

The discovery of an important new gas well in southwestern Ontario is a result of Imperial's current exploration program

SOUTHWESTERN ONTARIO took the spotlight in the oil news in August when Imperial Oil brought in what appears to be the largest gas well in the history of the province.

Imperial Payne No. 1, located approximately 1.5 miles to the north and west of Imperial's Kincheloe gas field, was being drilled as a part of the Company's exploration program in southwestern Ontario. Around 12:30 in the afternoon of August 3rd, the heavy cable tool drilling string was pounding away, and had encountered some gas. Suddenly the drillers found they were making no more progress. They had broken through a layer of hard rock and had found gas of such volume and pressure that it literally cushioned the blows of the string of drilling tools, which weighed almost three-quarters of a ton.

The operation of withdrawing the tools from the hole was started. At a point about 300 feet from the top of the well the flow of gas took over control of the string. With a roar, it hurled the string a distance of about 30 feet in the air, knocked off the control head which had been installed to control the gas flow. Without this equipment the drillers had a "wild well" on their hands.

Installing a new control head on the well was a tough, ticklish task. The roar of the escaping gas made audible communications impossible 100 yards away. The work was further complicated by the fact that the gas, expanding as it reached the mouth of the well, acted as a refrigerant and coated all metal parts with ice the instant they were inserted in the gas stream. In spite of these difficulties a new head was successfully stabbed on the pipe and the well was brought under control shortly after seven o'clock that evening.

A series of tests has indicated an open flow potential as high as 40,000,000 cubic feet which would make the well the largest in Ontario's history. Engineers estimate they may be able to produce it at a rate in the neighborhood of 5,000,000 cubic feet per day.

The record is believed to be held by a well which was brought in in the early 1900's in the vicinity of Petrolia at a rate of 30,000,000 cubic feet and which exhausted itself in a few months. It is hoped the Payne well will have a prolonged life, but it will not be possible to evaluate its potentialities until further drilling has been done in the area and until the well has been operated for a reasonable period.

In western Canada, current production is running at the rate of 22,500 barrels a day. It is estimated that the present potential in Alberta is more than 90,000 barrels a day, and that by the end of the year the potential production will be upwards of 100,000 barrels a day. The present production rate is governed by seasonal demand, the oil cannot be produced more economically than the present.

In a brief presented to the Alberta Conservation Board in July, Imperial recommended that in the interests of efficient recovery of oil in the Leduc field, the allowances for the D-3 zone wells be cut from 150 to between 75 and 100 barrels a day immediately, and to 50 barrels a day when the Leduc oil sector has been fully drilled out. For the less productive D-2 zone, the company recommended that allowances be reduced from the present 100 barrels a day to between 40 and 50 barrels a day immediately, and that a further cut be made to between 25 and 30 barrels a day on full development. In its brief, Imperial stated its opinion that present allowable production rates were extremely high, and pointed out that some wells have already experienced a drop in pressure. The object of conservation practice in an oil field is to regulate production so that the largest possible amount of oil can ultimately be withdrawn. In a pool like Leduc too rapid withdrawal will reduce pressure or gas drive excessively, and thus reduce ultimate recovery.

In a later statement the board said that as other operators had asked for more time to make further studies of the Leduc and Redwater fields, the board did not intend to issue orders governing maximum withdrawal rates at present, providing production did not get too far out of line.

As of October 15, there were 327 producing wells in the Leduc-Woodbend area, and 205 producing wells in the Redwater field. The Leduc-Woodbend area accounted for 41 per cent of Alberta's current oil production and the Redwater field for 35 per cent.

Two Imperial wildcats made oil news recently. Imperial Simms No. 1, located three and one half miles southeast of the Redwater field, found oil late in September. The well may indicate a possible extension of the Redwater field or perhaps may be the first of a new field. Drilling and coring is in progress to determine the thickness of the producing zone.

Early in September Imperial Normandville No. 1, located about 20 miles south of the town of Peace River, found an encouraging show of oil at a depth of 6,700 feet. Casing has been set and the well will be put on production tests shortly.

Clarence A. Eames 1881-1949

Clarence A. Eames, former vice-president and director of Imperial Oil Ltd., died on Aug. 5th in Toronto after a brief illness.

Mr. Eames, who retired in 1945, had been a director of International Petroleum Co. Ltd., and Anglo-American Co. Ltd., London, Eng. as well as vice-president of Imperial Oil. He was known as an expert in foreign trading and in the transportation of petroleum products.

His career in the oil industry began in 1898 when he joined the Atlantic Refining Co. as a junior clerk. Later he became New York representative of the Anglo-American Oil Co. and subsequently was elected a director of that company.

He joined Imperial Oil in 1921 and became vice-president in 1933. As a director of International Petroleum Co. for nearly 20 years he was keenly interested in South America.

During World War II, Mr. Eames was chairman of the transportation committee of the Oil Controller's department.
Personalities in the News

W. O. Twaits Receives New Appointment

W. O. Twaits, formerly manager of the co-ordination and economics department in Toronto, has been transferred to the producing department, western division, Calgary, in the capacity of management assistant. Mr. Twaits began with Imperial in 1933 after graduating from the University of Toronto. Four years later he was transferred from the manufacturing accounting department to the technical and research department. In 1939 he became assistant budget controller of the manufacturing technical committee and later controller. He was transferred to Toronto in 1945 as assistant economic co-ordinator and two years later was appointed manager of the co-ordination and economics department.

John F. Fairlie Succeeds W. O. Twaits

John F. Fairlie has been appointed to succeed W. O. Twaits as manager of the co-ordination and economics department. Mr. Fairlie is a graduate of the Royal Military College, Kingston, and of the University of Toronto. He joined Imperial in 1935 at Montreal refinery. The following year he was transferred to Sarnia and worked with what is now the engineering and development department. During the war he served overseas as a Royal Canadian Artillery officer. Returning to Imperial in 1945, he began a two-year training course with the co-ordination and economics department of Standard Oil Company (N.J.). On completion of the course, he was made assistant manager of the co-ordination and economics department.

Leslie Carl Hunt Receives 40-Year Button

Leslie Carl Hunt, who was recently presented with a 40-year button, was born in Chatham, Ontario, and began his career with Imperial Oil in the old cooper shop at Sarnia refinery. His first job was carrying water for the men who made the wooden barrels but he soon became proficient in the other operations of the cooper business. When the cooper shop was dismantled in 1930 Mr. Hunt was transferred to the barrel wash plant.

William Letham Receives 40-Year Button

William Letham, supervisor of the stock section in the B.C. marketing division office at Vancouver, recently completed 40 years' service with the Company. Born in Glasgow, Scotland, Mr. Letham joined the Company at Winnipeg in 1909 as a barrel clerk. In 1913 he was transferred to Vancouver and was appointed to his present position in 1943. Mr. Letham served with the Royal Air Force in World War I.

Thomas J. McDowell With Company 40 Years

Thomas J. McDowell, chief stock clerk of the B.C. marketing division, recently received his 40-year button for service with the Company. Born in Ballymena, County Antrim, Northern Ireland, Mr. McDowell joined Imperial Oil at Winnipeg. He held several accounting positions in the Winnipeg office and in 1930 was transferred to B.C. During the First World War he served overseas with the Royal Flying Corps.

J. P. Rennie Receives D.F.C. at Investiture

At a recent investiture in Edmonton, James P. Rennie, representative of Imperial's public relations department in Alberta who was a navigator in the R.C.A.F., received the Distinguished Flying Cross medal for outstanding war service with 550 Bomber Squadron. Jim Rennie, who was born in Edmonton, is a veteran newspaperman. He worked as a reporter with the Edmonton Journal and later became city editor. After his discharge from the R.C.A.F. he served in Europe as war correspondent for the Southam press. He joined Imperial Oil in 1947.

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Fluid mud is an important factor in drilling operations. This mud engineer is mixing chemicals to give the mud the special properties needed when drills meet different rock formations.