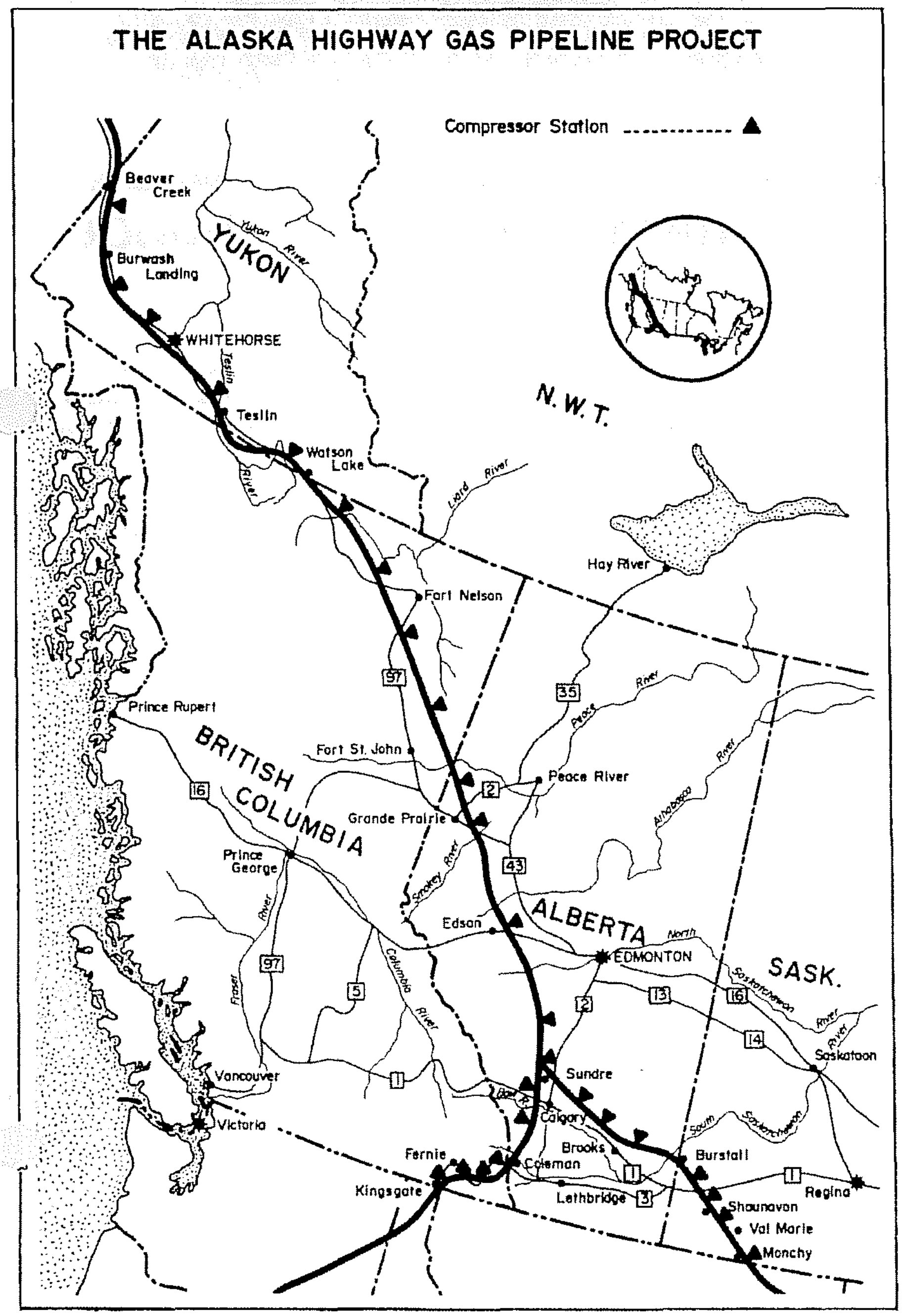
A REPORT OF THE NORTHERN PIPELINE AGENCY December, 198

PIPELINE

27 Compressor Stations Planned for Pipeline System



The foundation concrete is poured, several buildings are up and about 20 percent of the piping has been installed at the compressor stations under construction since August at Jenner, Alberta, and Piapot and Monchy, Saskatchewan. Grading is finished and construction scheduled to start in January, 1982 for a fourth station at Richmound, Saskatchewan.

Gas to pump at highest operating pressure for any pipeline in Canada

Spaced along the 635 km (394 mi.) Eastern Leg of the Alaska Highway gas pipeline, these compressor stations are scheduled for completion next fall to meet the November 1, 1982 target date for the first flow of Alberta natural gas to the United States, through the new facilities built by the Alberta and Saskatchewan segment companies of Foothills Pipe Lines (Yukon) Ltd. When ready for service, these compressor stations will pump gas along the line at 8,690 kilopascals (1,260 lb. per sq. in.), the highest operating pressure for any gas pipeline in Canada, says Mark Kaustinen, the Northern Pipeline Agency's Manager of Engineering Surveillance. "The suction and discharge piping within each station complex has extremely heavy walls — over an inch in thickness — to handle such a high pressure," he explains.

With twenty years of experience in pipeline design, construction and supervision behind him, Kaustinen describes the compressor stations installed along the Eastern Leg of the Alaska Highway system as typical of large-diameter, high-volume throughput transmission stations. Each station averages about five hectares (12 acres) in area, consisting of a compressor building, a con-

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U.S. Waiver Package Gains Final Approval

The proposal to waive certain portions of the *Alaska Natural Gas Pipeline Act* to encourage private financing of the Alaska segment of the Alaska Highway gas pipeline cleared the final obstacle on December 10, when it was passed by the United States House of Representatives. The 229 to 188 vote — the last approval required for the waiver package to become law — modified the 233 to 173 count of the previous day which was disqualified on a procedural flaw.

Earlier, on November 19, the House Energy and Commerce Committee accepted the legislative amendments by 27 to 14; the House Energy Subcommittee by a majority of 12 to 9 on November 17; and the House Interior Committee by 32 to 7 on November 10.

The United States Senate also gave support to the measure by a vote of 75 to 19 on November 19, following the November 10 approval of the Senate Energy Committee by 14 to 1.

The Congressional decisions were based on hearings in both the Senate and the House, which concluded on October 26 and November 9, respectively. Submitted to Congress in mid-October by President Reagan, the waiver package allows the gas producers equity in the Alaskan portion of the pipeline, incorporates financing for the Prudhoe Bay gas conditioning plant into the overall cost of the project and makes provision for the commencement of billing customers before gas flows in the event that one portion of the pipeline is completed and other portions of the system are not yet ready for operation.

The waivers are central to the financing plan reached last May between sponsors and producers of the 1,180 km (730 mi.) Alaskan segment of the pipeline. With the waivers in place, the plan is ready to go before the U.S. banking community.

Pipeline Traffic Fits Pattern of Railway Change

by Julian Hawryszko

Pipe transportation by rail for the Alaska Highway pipeline project is contributing to a trend towards specialization of railway traffic in Canada.

Railways no longer monopolize transportation in this country. They serve more and more as haulers of heavy, bulky, low-value-per-tonne materials. Most of their business now originates in Western Canada, where bulk cargo such as grain, coal and lumber is produced.

Railways more specialized to remain economically viable in competitive market

Canadian railways not only face competition from other means of transportation, such as trucking, but also pressure to maintain competitive prices for Canadian products in world markets, as transportation is a significant part of the delivered price. To remain economically viable, the railways have had to become more efficient, competitive and, consequently, more specialized. The all-purpose boxcar is slowly being phased out by specialized cars. Covered hoppers, which are larger and easier to load and unload, are replacing grain carrying boxcars. Lumber is moving by bulkhead flatcars, and tri-level auto carriers, gondola cars and a variety of other flatcars are commonly used.

The pipeline project's contribution to car specialization has been the development of 27 m (89 ft.) "flats". In the early 1970s when proposals for moving Prudhoe Bay gas via a pipeline through Canada were first being proposed, Canadian National Railway determined that it had no cars that would move 24 m (80 ft.) lengths of large diameter pipe efficiently. CN proceeded to design and produce a suitable car to put into service on a test basis. When these cars were first developed, a number of shippers in the auto, forestry and steel industries found them ideal for special needs, prompting a CN official to remark, "If we had to begin shipping pipe today, we could not get the long flats back. They're committed to other shippers." CN now has over 400 flats available for pipe transport and Canadian Pacific Railway has about 100.

Due to the virtual absence of Canadian rail rate regulations, the railways must compete for pipeline traffic with other routes and other modes of transportation. At least 75 pecent of the railways' traffic, excluding grain, is carried at rates negotiated between carrier and shipper, called "agreed charges". The legislation permits carriers and shippers to act in their own interest in a competitive environment.

On one hand, pipeline transport may be considered "small change". CN and CP move a combined total of four million carloads annually, while pipeline traffic will comprise about 21,000 carloads over three years. However, if maximum use is made of rail transport, the bill for service will be in the order of $100 million.

Pipeline's economic impact significant on northern railways

The pipeline project's economic impact on the northern railway systems will be significant. Traffic on both the White Pass and Yukon Railway and the segment of the British Columbia Railway from Fort St. John to Fort Nelson is much greater southbound. For example, in 1980 BCR moved 10,000 freight-carrying cars southbound and only 2,500 northbound. Pipeline traffic would be northbound, helping to create a balance with more full trains moving in both directions and thus establish a more efficient, commercially viable enterprise.

On the national scale, both CN and CP require additional funds to finance expensive upgrading through the Rocky Mountains. The traffic created by the pipeline could provide part of this revenue. However, the traffic the railways could obtain is facing competition by possible alternative routings via the Panama Canal or U.S. rail lines.

Julian Hawryszko is Manager of Logistics for the Northern Pipeline Agency and a specialist in transportation economics.

Techniques for Successful Revegetation

The "Hodder Gouger" digs small basins in the soil and simultaneously plants the seeds.

Specialized techniques for restoring vegetation to the right-of-way following pipeline construction were used this fall in areas of native prairie and rangeland along the Alaska Highway gas pipeline's Eastern Leg through southeastern Alberta and southwestern Saskatchewan.

"The region has one of the driest climates in the country. Vegetation is sparse and the soil in many areas is subject to wind erosion," remarks Bonnie Gray, an environmental scientist with the Northern Pipeline Agency. The existing plant cover, particularly in sandy areas, helps to counteract erosion by stabilizing the soil surface, she explains. "When this surface cover is removed or disturbed during pipeline construction, the soil is left bare and severe wind erosion can result in a relatively short time. In extreme situations, this can even expose buried pipeline, so it's important for soil conservation and for pipeline security to re-establish this cover as soon as possible." Moisture is the limiting factor in revegetation success in these areas, Gray notes. "The natural variability in precipitation may mean that in any one year enough water is not available to successfully get seedlings growing."

The Agency's environmental terms and conditions require each segment company of Foothills Pipe Lines (Yukon) Ltd. to restore any area disturbed by pipeline construction to its previous state of natural productivity. Gray says the company's environmental people recognized that successful revegetation in the dry prairie environment called for the development of specialized techniques. Foothills Pipe Lines (Sask.) Ltd. undertook a sand stabilization and revegetation test program in 1980 — a year before Eastern Leg construction began — to determine the best seed mixtures, methods of seeding and fertilization, and means of mitigating the effects of pipeline construction under dry, windy conditions where there is considerable chance of failure in revegetation. Although the test program was conducted in Saskatchewan, Gray says the techniques also apply to revegetation along the right-of-way in southeastern Alberta.

As a result of experiments by Foothills (Sask.), approximately 18 km (11 mi.) of the Eastern Leg right-of-way in Alberta and eight km (five mi.) in Saskatchewan have been re-seeded with a "Hodder Gouger" — a machine developed in Montana several years ago for strip mine reclamation and used for the first time in Canada as part of Foothills' revegetation program. Pulled behind a tractor, the Hodder Gouger digs small depressions in the soil and at the same time deposits a seed inside each one. Gray says, "The seed is sheltered from the wind in a basin where moisture is more likely to accumulate to aid growth."

Another successful technique was the use of "straw crimping", which was researched and subsequently applied on steep coulees and riverbanks where spring runoff and water from occasional storms concentrate and erode the dry soil. "The soil is spread on the ground and then straw is crimped into the surface to help anchor the soil and the seed and give the seedlings a chance to germinate and establish themselves," explains Gray.

"Foothills' revegetation test program indicated that topsoil stripping in areas of native prairie was actually less successful than simply allowing the surface of the working area of the right-of-way to be compacted by vehicles and equipment, leaving the vegetation mat intact Gray points out. "Although this was possible only on very flat terrain where grading was not required to prepare a level travel surface for heavy construction equipment, it reduced the area requiring revegetation to the trench itself and provided effective erosion control on the rest of the right-of-way by leaving the surface undisturbed."

Solonetzic soils — comprised of a thin saline topsoil overlying a very hard, thicker clay layer — and saline and alkaline soils are common throughout Saskatchewan and present other special problems for revegetation, continues Gray. "Plant growth under these harsh chemical conditions is difficult. Only a limited number of species, such as foxtail barley and alkali grass, are sufficiently salt-tolerant to be successful," she says. "The pipeline was rerouted to avoid the largest saline sloughs in Saskatchewan."

Solonetzic soils are found in the Frenchman River Valley and in areas south of the Cypress Hills. Gray explains, "The topsoil layer supports vegetation and standard practice would indicate that this layer should be stripped and the topsoil preserved. However, Foothills found that this layer is too thin to preserve successfully, and experience shows the fertility of the soil can actually be improved if, during the course of ditching, the clay layer is broken up and mixed with the topsoil."

Revegetation on the Eastern Leg in both Alberta and Saskatchewan was completed in November,1981. Gray says the initial success of the program will be judged next spring and summer during the first season of hot, dry, windy weather.

News in Brief

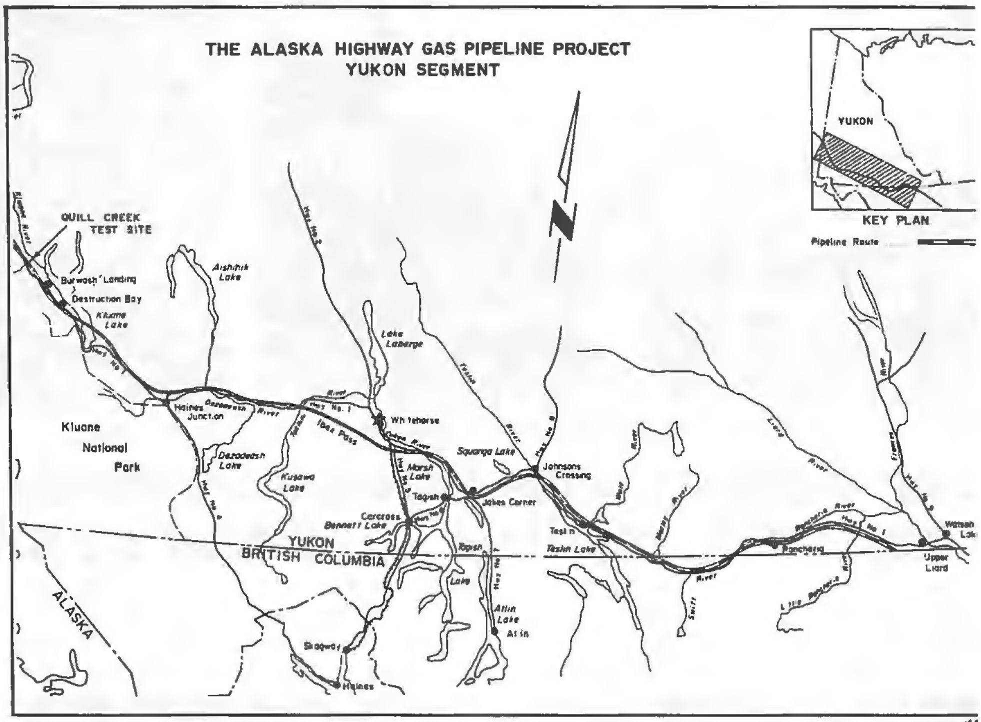
Foothills Pipe Lines (South Yukon) Ltd. has forwarded to the Agency documents related to the potential environmental impact of construction of the Alaska Highway gas pipeline in Yukon. These submissions are part of a series of information packages requested by the federal Environmental Assessment and Review Panel (EARP) as addenda to the company's 1979 Environmental Impact Statement.

The submissions cover such topics as the use, storage and disposal of fuel and hazardous materials, plans for protection of fish and wildlife harvesting, the mitigation of slope instability and frost heave and thaw settlement and the development of construction scheduling in relation to fisheries and wildlife.

Other submissions refer to the examination of routing alternatives in the Swift River/Rancheria Valley, Kluane Lake and Marsh/Squanga Lakes regions, revegetation planning, aesthetics, location of facilities such as compressor stations, campgrounds and recreation, contingency plans for emergencies, alternative pipeline construction design modes, design concepts to deal with stream flow and the design and use of culverts. Following review by the Agency, and revision by the company if necessary, the material will be forwarded to the EARP panel for consideration.

Foothills (South Yukon) is in the process of completing the last of its submissions dealing with noise, waste disposal, icings or superimposed layers of ice, watercrossings and other projects.

Foothills (South Yukon) submitted its addendum in February, 1981, concerning the company's proposed route of the pipeline through the Ibex Pass area south of Whitehorse and routing alternatives. Based on a hearing held last June in Whitehorse, the EARP panel recommended a route north and west of the city and that the Ibex proposal be dropped because of the potential effect of greater access to the area.



A joint meeting of the Yukon Advisory Council and the Northern British Columbia Advisory Council was held November 28 in Fort St. John, B.C. Ms. Leslye Korvola, a member of the Board of Directors of the Impact Information Centre in Fairbanks, Alaska, spoke to the group on the function of the centre which was set up by the City of Fairbanks during construction of the Alyeska oil pipeline to provide information on impacts resulting from the project.

The Union of British Columbia Chiefs (UBCIC) has completed a five month project for the Northern Pipeline Agency which involved preliminary consultations at the local Indian community level, regarding general route alignment of the Alaska Highway gas pipeline through northeastern B.C.

Foothills Pipe Lines (Yukon) Ltd. began its Operations and Maintenance Training/Employment program for northerners on October 1. From over 250 applications, the company recruited 21 people for on-the-job technical training in Alberta with Nova, an Alberta Corporation, and in British Columbia with Westcoast Transmission Company Limited. The program is set up to eventually have interested persons from Yukon and the Mackenzie Valley District fill technical positions once the Alaska Highway gas pipeline becomes operational in Yukon. Between 125 and 150 permanent positions, including office and field staff, will be created to run the line.

Approximately 470 residents of Yukon and the Mackenzie District the Northwest Territories have so far re plied to a pipeline construction employ ment interest and skills questionnaire dis tributed throughout the areas last sprin by Foothills Pipe Lines (South Yukor Ltd. Based on the results, the compan is compiling an inventory of those peo ple seeking pipeline jobs, the type c work they are interested in, the skill they possess and what training they wi require.

***Maps and Dreams*, a book by Hug Brody** documenting concerns of th Indian people of northeastern British Co lumbia with respect to the Alaska High way gas pipeline project and encroachin industrial and economic developmen has been published by Douglas McIntyre of Vancouver. It is available i bookstores and libraries in major centres

The book is based on Brody's thre years of experience living with the north eastern B.C. native people and fror socio-economic research funded by th Department of Indian Affairs and North ern Development (DIAND). The wo encompasses the hearings held in com munities throughout the region in lat 1979 on the Agency's environmental an socio-economic terms and conditions fo the pipeline project.

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trol building and an auxiliary building, he explains. "Everything is designed to run automatically by remote control from a central base, although one or two technicians are always on call on a rotating basis."

The actual compressor unit consists of a wheel or centrifugal booster, which operates at an optimum speed, continues Kaustinen. At the Jenner, Richmound and Monchy stations the boosters will be driven by aircraft-type jet engines, while an industrial turbine will be used at Piapot, he explains. "The gas is drawn from the mainline through the suction valve into the centre of the booster, compressed and sent back through the discharge valve into the line where it continues to flow downstream to the next station. In most cases, the engine or turbine is powered by gas from the pipeline. Purchased electrical power is required for the control system, motor control centres, air compressors and building and yard lighting."

Residue from compressor exhaust minimal and odourless

However, an auxiliary gas-powered electrical generator automatically starts up if the purchased power supply suddenly fails, Kaustinen points out. "Since the natural gas in the pipeline has been processed and stripped of pollutants such as sulphur, the residue from the jet engine exhaust is minimal and odourless."

Kaustinen adds that following compression, the gas enters a cooling apparatus to minimize thermal expansion within the pipe, as well as to provide for a more efficient system. "As the gas is pumped to a higher pressure, its temperature increases and the heat is transferred to the inside walls of the pipe," he explains. "When the gas is cooled, its volume decreases. Therefore, the pipeline can accomodate a greater quantity of gas at a lower temperature."

As much of the yard piping as possible is being shop or "prefab" welded before being transported to the field. Kaustinen notes, "The pipe within the station complex is not only thicker walled, but also has many more bends and turns than the mainline." To obtain a near perfect weld under ideal, heated conditions, a method called submerged arc welding is used, he continues. "The two pieces of pipe to be welded are clamped onto a

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Aerial view of compressor station under construction near Jenner, Alberta.

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roller which rotates while the stationary welding unit feeds a wire rod through a powdery substance called flux, into the groove between the bevelled edges of the pipe. As the metal of the rod melts and fuses with the metal of the pipe ends, the flux creates gases around the weld to shield it from oxygen in the air. The flux burns, becomes hard, brittle and breaks off." Kaustinen remarks how much steadier and quicker the submerged arc method is than a hand-made weld. "It goes on as smoothly as butter! Up to three welds were completed in a day by one submerged arc welding unit on the 1,067 mm (42 in.)-diameter station piping."

Most of the pipe at the compressor stations will be buried, says Kaustinen, partly because valves operate better at ground temperature than at subzero air temperatures but, more importantly, to mitigate noise pollution. "Gas rushing through pipes creates a high frequency whistling sound which is detrimental, if not annoying, to workers and nearby residents," he emphasizes. "To reduce further the amount of noise penetration, the walls of the buildings housing the compressor units will be well insulated."

The design of the compressor station buildings also takes into account the potential for frost heave, caused by moisture in the soil freezing, then expanding. "The buildings sit on steel-reinforced concrete pilings which go deep into the ground well below the frostline," explains Kaustinen. "Before the foundation is poured, a special collar of corrugated cardboard is placed around the top of each piling in order to create a gap or buffer zone between the piling and the foundation wall. If frost gets in, it will crush the cardboard but won't force up the concrete."

Kaustinen adds that if a particular station shuts down due to maintenance or malfunction, the system is designed to immediately isolate the station from the mainline by block valves. The gas simply continues to the next compressor station. "The stations located both upstream and downstream would then have to adjust their gas flow rates and turbine velocities accordingly, to reduce the bottleneck created by the station that shut down."

1,067 mm (48 in.) pipe for compressor stations is "prefab" welded using submerged arc method.

The interior work on the Eastern Leg compressor station buildings continues this winter and the heavy equipment will be installed next summer. "There's plenty of time to complete the job," observes Kaustinen. "I recall supervising construction for TransCanada PipeLines Limited on a station in northern Ontario in 1964. What a rush! We began on June 18 and by August 22, two months and four days later, it was running! However, the stations of the early 1960s were not nearly as sophisticated as those of the '80s."

Factors, such as variations in ground topography, pipe size, volume of gas expected to flow, operating pressure of the pipeline and the amount of friction inside the pipe which reduces pressure and flow of gas, help determine the location for each compressor station, says Kaustinen. "All the information is fed into a computer and the optimum site is calculated."

When the gas from Prudhoe Bay, Alaska is on stream, a total of 27 compressor stations will be in operation. Fourteen stations will operate along the length of the pipeline from the Alaska-Yukon border near Beaver Creek, south through Yukon, northeastern British Columbia and Alberta to James River Junction. Along the Eastern Leg, between James River Junction and Monchy, Saskatchewan, three stations are scheduled to be built to accommodate the Alaskan gas, in addition to the four stations now under construction that will operate initially to move Canadian gas. The pipeline's Western Leg, which was completed last winter and, since October, has been carrying Canadian gas to American markets through southwestern Alberta and southeastern British Columbia, has six compressor stations — all pre-existing facilities of Nova, An Alberta Corporation and Alberta Natural Gas Company Ltd.

Kaustinen points out that after the Alaskan gas is flowing, the entire pipeline system is designed to have another twelve compressor stations in operation to handle greater volumes if further gas production takes place at Prudhoe Bay, and when the proposed Dempster Lateral of the pipeline is built to carry Canadian gas from the Arctic.

Pipeline

The Northern Pipeline Agency was created by Parliament in April, 1978 to oversee planning and construction of the Alaska Highway gas pipeline project in Canada. Inquiries or suggestions regarding the Agency's publication, *Pipeline*, may be directed to:

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