UNITED STATES OF AMERICA
BEFORE THE
FEDERAL POWER COMMISSION

EL PASO ALASKA COMPANY, *ET AL*	)	DOCKET Nos. CP75–96 *et al*
	)	
ALCAN PIPELINE COMPANY	)	DOCKET NO. CP76–433

RESPONSE TO ENVIRONMENTAL INFORMATION REQUESTS LETTER OF JULY 23, 1976 BY THE ALBERTA GAS TRUNK LINE COMPANY LIMITED AND THE ALBERTA GAS TRUNK LINE (CANADA) LIMITED

References to the "Company" in the following responses mean The Alberta Gas Trunk Line Company Limited with respect to existing facilities and operations within Alberta and The Alberta Gas Trunk Line (Canada) Limited with respect to proposed additional facilities and operations within Alberta.

ENVIRONMENTAL INFORMATION REQUESTED FROM ALCAN PIPELINE COMPANY

DOCKET NO. CP 76-433

THE ALBERTA GAS TRUNK LINE (CANADA) LIMITED
AUGUST 10, 1976

Question Number	Response Included	Not Applicable to the Alberta Section
1		x
2	x	
3	x	
4		x
5	x	
6	x	
7	x	
8		x
9		x
10	x	
11		x
12		x
13		x
14		x
15	x	
16		x
17		x
18		x
19	x	
20	x	
21		x
22	x	
23	x	
24	x	
25	x	
26	x	
27	x	

Question Number	Response Included	Not Applicable to the Alberta Section
28		x
29	x	
30	x	
31	x	
32	x	
33	x	
34	x	
35	x	
36	x	
37	x	
38	x	
39	x	
40	x	
41	x	
42	x	
43	x	
44	x	
45	x	
46	x	
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51	x	
52	x	
53	x	
54	x	
55		x
56		x
57	x	
58	x	
59		x
60	x	
61	x	

Question Number	Response Included	Not Applicable to the Alberta Section
62	x	
63	x	
64		x
65	x	
66	x	
67	x	
68	x	
69	x	
70	x	
71	x	
72	x	
73	x	
74	x	
75	x	
76	x	
77	x	
78		x
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80	x	
81	x	
82	x	
83	x	
84	x	
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86	x	
87	x	
88	x	
89		x
90	x	
91	x	
92	x	
93	x	
94	x	
95	x	

Question Number	Response Included	Not Applicable to the Alberta Section
96	x	
97	x	
98	x	
99	x	
100		x
101	x	
102	x	
103	x	
104		x
105	x	
106	x	
107	x	
108		x
109		x
110		x
111		x
112		x
113		x
114		x
115	x	
116	x	
117		x
118		x
119	x	
120	x	
121		x
122		x
123	x	
124		x
125		x
126	x	
127		x
128	x	
129	x	

Question Number	Response Included	Not Applicable to the Alberta Section
130		x
131		x
132	x	
133		x
134		x
135	x	
136	x	
137	x	
138	x	
139	x	
140	x	
141		x
142		x
143		x
144		x
145		x
146		x
147		x
148	x	
149		x
150		x
151		x
152		x
153	x	

QUESTION 2

The applicant is requested to identify and tentatively locate all additional facilities which would be required to expand the capacity of the proposed system to an ultimate volume of 4.5 billion cubic feet per day (Bcf/d).

RESPONSE:

For an ultimate volume of 4.5 Bcf/d of receipts from Prudhoe Bay with the assumption that the same proportion of flows would be delivered to Empress and the A-B.C. border as in the application, the Company estimates that an additional expansion of 50 miles of 36" looping and 580 miles of 42" looping and 105,000 HP of compression will be required within Alberta. These additional facilities would follow the same route and generally use the same rights-of-way and sites as proposed for the smaller volume.

QUESTION 3

What consideration has the applicant given to the construction of a pipeline to connect Canadian gas supplies in the MacKenzie Delta with the proposed pipeline? Provide a detailed discussion of alternative routes to accomplish the connection.

RESPONSE:

The Company has filed with the National Energy Board for movement of MacKenzie Delta gas across the Province of Alberta as part of the "Maple Leaf Project" and hearings before that Board are currently proceeding. The Maple Leaf Project involves constructing an 81 mile 42" link from the southern terminus of Foothills PipeLines Limited connecting to the existing Alberta system near Zama Lake, then expansion of the Company's existing system by the addition of looping and compression sufficient to carry Canadian gas to Empress, Alberta.

The expansion of the existing system in Alberta will be designed to fit the combined requirements of the Maple Leaf Project and Alcan Pipeline Project with respect to volumes and timing. It should be noted, however, that either project could proceed independently of the other in its own time frame by simply adjusting the schedule of additional looping and compression required to match the circumstances.

Thus, since expansion for either the Maple Leaf Project or Alcan Pipeline Project is along the same routes utilizing existing systems to the extent possible, environmental considerations are similar for either project. No further consideration has been given to connecting Canadian gas supplies in the MacKenzie Delta to the pipeline proposed for Alaskan gas.

QUESTION 5

Identify equipment additions needed at existing compressor stations along existing Canadian pipelines which are proposed to be looped. Would these stations employ any new personnel? Identify additional acreage, sanitation, waste disposal and water requirements needed at these stations.

RESPONSE:

Compression horsepower additions to existing compressor stations are summarized in the following table:

Station Name	Number	Existing ISO H.P.	New ISO H.P.	Additional Land Acres
Notikewan	AL-1	4,000	4,000*	-
Cardinal	AL-2	4,000	4,000*	-
McLeod	AL-5	18,862	26,400	-
Lodgepole	AL-6	12,164	26,400	-
Rocky Mtn. Hse.	AL-7	12,164	26,400	-
James River	AL-8	4,000	26,400	-
Didsbury	AL-9	32,920	30,000	-
Beiseker	AL-10	28,500	30,000	-
Hussar	AL-11	46,440	30,000	-
Princess	AL-12	83,779	16,000	-

* Mobile Units

Along with these compression package additions will be the buildings to house them and minor additions of tools and work equipment where necessary. No additional acreage, sanitation, waste disposal and water facilities will be required.

It will not be necessary to employ additional operating personnel at these sites. Additional maintenance personnel who are based in central operating centers will be required at a rate of two to three persons per additional compressor unit.

QUESTION 6

What is the width of the present Canadian mainline rights-of-way? What additional width would be needed for looping construction activities and how much of this addition would be retained for the permanent right-of-way? Why must the Westcoast looping deviate around the Nicola-Mameet Indian Reserve? What is the present land use of the area to be used for the deviation, and how wide a right-of-way would be maintained on this deviation for the life of the project?

RESPONSE:

The widths of the existing Company mainline rights-of-way vary from 60 feet for a single line to 200 feet for multiple lines (up to four lines). These loops will be installed in the existing right-of-way. Additional width for looping required for Alaskan gas is 25 to 75 feet dependent on the configuration of the pipelines in existing rights-of-way. This width will be obtained as additional right-of-way or leased as working space in accordance with the wishes of landowners or applicable statutes or agreements.

Westcoast will respond to the question concerning the Nicola-Mameet Indian Reserve.

QUESTION 7

Where would the sale delivery points be located on the Canadian pipelines? What quantities of gas would be delivered and what, if any, additional piping and metering stations would be involved?

RESPONSE:

The sale delivery points located within the Alberta portion of the Canadian pipeline are set forth in Exhibit Z-5, Volume 1, pages 1.A.1-1, 1.B.1-1 and 1.B.7-1. There are no additional delivery points.

QUESTION 10

Provide a detailed map showing the probable location of all construction camps for the work crews. How many persons will occupy each camp and for what length of time? How large will each camp be and what facilities will be constructed or exist? What will be done with the camps when construction is completed? What are the possibilities of turning them over to the natives for use as housing? Will any oil pipeline construction camps be used, if so, how many and where are they located?

RESPONSE:

The exact number of construction camps cannot be exactly identified before construction bids have been received. However their probable locations are identified in the response to question 43.

Winter construction camps in this area will house up to 400 persons. One complete camp will consist of:

40	multiple sleeping trailer units
10	personal sleeping trailer units
2	kitchen trailer units
4	dining trailer units
4	washroom trailer units
1	drafting trailer unit
1	office and communications trailer unit
1	power plant complete with standby unit

Temporary facilities will be constructed for repair shelters. Warehousing will utilize approximately 10 trailer truck units. Trailer units will be a standard currently available in Alberta. Upon completion, the camp, being almost entirely mobile, will be disassembled and moved out. The contractor will either utilize the trailers for other projects or sell them.

QUESTION 15

Upon abandonment, how does the applicant propose to dispose of the housing and other buildings needed during construction and operation? What would be done to restore or develop the right-of-way and appurtenant facilities such as roads, airstrips and communications sites?

RESPONSE:

1. Construction

All structures for lodging and food services, field offices, storage buildings, recreation buildings and maintenance buildings for construction of the pipeline system in remote areas will be portable and, as such, these structures will be moved out on completion of construction.

Maximum use will be made of existing roads, rights-of-way and airstrips. Disposition of temporary roads will be in accordance with requirements and recommendations of the Alberta Forestry Service.

2. Operations

Any above ground facility which may be abandoned in the long term will be disassembled and disposed of in the most expeditious manner considering circumstances at that time. The sites will be restored as much as possible to original condition considering the nature of the surroundings at that time.

Of course, any structures or roads which will benefit the local inhabitants and authorities will be left for their use.

QUESTION 19

What additional land area would be required off the right-of-way on a temporary/permanent basis for such facilities as main distribution points for pipe, double-joint yards, pipe storage yards along the route, construction material and communication sites? For each facility indicate whether the required acreage would be temporary, what fraction (if any) would be permanent, and the locations for such facilities as pipe distribution points, double-joint yards, and communication sites.

RESPONSE:

The railroad is close to all sections of this line and will be the prime mover of material. Stockpile sites on the railroad right-of-way at High Level, Keg River, Manning and Brownvale will be used. South of the Peace River crossing supplementary stockpiles will be established at Eaglesham, Valleyview, Simonette, Kaybob, Peers, Drayton Valley, Rocky Mountain House, Olds, Hussar, Patricia, Jenner and Buffalo. These sites will be on existing railroad rights-of-way. Approximately 10% of the pipe to be unloaded at each site will be stockpiled. Ten percent of total pipe will be hauled to Rainbow Lake and stockpiled. Since the line will be strung directly from the rail cars, these small stockpiles are required to ensure a supply of pipe in the event that rail shipments are delayed.

Other material such as tape, primer, test leads, etc. will be warehoused in heated vans and hauled to the right-of-way daily or as required. This will be trucked directly from the suppliers in Edmonton and other southern supply points.

As the pipe will be fifty to eighty foot lengths field double-jointing will not be done and double-joint yards not required.

In summary, no additional off right-of-way land will be required for the facilities mentioned in the question as the required facilities already exist.

QUESTION 20

What types of communications systems would be used on the Alaskan and Canadian segments of the proposed pipelines? Provide maps of a scale of 1:125,000 showing the location of any new sites required, and a terrain analysis for each site. What type of access or connecting lines would be used to reach the communications sites located away from the pipeline route?

RESPONSE:

The response to Question 27 discusses in detail the Company's communications system. No new communications sites will be required for the proposed route. Radio links from proposed compressor sites to existing Alberta Government Telephones radio relay sites will provide the necessary communications links. No access or connecting lines will be necessary as the new towers or poles will be located at compressor sites. The new compressor sites, locations and tower or pole heights are:

H2 Sousa	N.E. 1/4, 16-110-4-W6	80 foot pole
H3 Haro	N.W. 1/4, 15-102-3-W6	low pole
H4 Meible	S.W. 1/4, 13-94-2-W6	250 foot tower
H5 Griffin	Sec. 25-82-26-W5	80 foot pole

QUESTION 22

What are the heights of the communication towers proposed along the pipeline? What are the probable locations of such towers in relation to helipads and other installations? What design features will be considered to provide safe separation of communication towers in relation to helipads, communication towers in relation to airstrips?

RESPONSE:

The Alberta Government Telephones radio relay sites required for communications exist already and have tower heights up to 400 feet high. Towers or poles up to 250 feet high will be erected at proposed compressor sites for communications links to the Alberta Government Telephone sites. No helipads or airstrips presently exist near these sites and none are proposed.

QUESTION 23

What clear zones (approach and departure) have been considered for airstrips along the right-of-way? What provision has been made for future lengthening of such airstrips to preclude relocation if greater lengths are deemed necessary to desirable (particularly in the future under operational conditions)? What landing aids are proposed to facilitate the safe landing of aircraft under adverse or marginal conditions or emergencies under varied conditions?

RESPONSE:

There will be no new airstrips required for the Alberta portion of the pipeline and the existing airstrips are governed by Ministry of Transport regulations with respect to this question.

QUESTION 24

Will the applicant develop and use a control procedures manual to facilitate air transportation communcations and safety?

RESPONSE:

The Alberta portion of the pipeline will not rely on air transportation for operating, other than scheduled pipeline patrols by charter aircraft equipped with Company radios linked to the Company communications system.

Charter aircraft traffic is governed by the Ministry of Transport for their communications and safety requirements.

QUESTION 25

What provision is being made for weather observation and reporting to facilitate safety in air transportation?

RESPONSE:

There is no provision made for weather observation and reporting as appropriate governmental agencies adequately gather and report this information in the areas concerned.

QUESTION 26

What provision is being made for aerial search and rescue, particularly downed aircraft in winter darkness, under high wind conditions, and under chill factor conditions whereby prompt recovery is absolutely imperative?

RESPONSE:

There is no provision made for aerial search and rescue as all aircraft emergency and rescue operations in Alberta are under the regulation of the Ministry of Transport. Any aircraft chartered by the Company would of course respond to emergencies if directed to do so.

QUESTION 27

Discuss the present monitoring and communications system used by Alberta Gas Trunk Line Limited (Alberta Gas) on their mainline system and indicate any additions or modifications to be incorporated with the installation of the proposed loopings.

RESPONSE:

A. The Communications System

An air-land communications system dedicated to the Company's sole use was leased from Alberta Government Telephones at the outset of the Company's construction and has expanded with the system growth. This system currently encompasses all areas of proposed construction within Alberta.

B. The Supervisory Monitoring System

The supervisory monitoring system operates in conjunction with the communications system by utilizing a slot of 400 cycles which is isolated by filters at a shifted tone of 1850 CPS. This system has two main components:

a) a real-time computer, and

b) hardwire and/or software remote units (RTU).

It performs these functions:

1) Controlling

a) Compressor stations - by starting or stopping units or changing load conditions of the station

b) Exchange and gate stations - by increasing or decreasing flow rates

2) Monitoring

All necessary pipeline and compressor parameters and meter stations data for safe operation and control of the pipeline system as well as alarms to indicate problems at field locations are monitored.

The system is on continuous scan with a scan time of approximately one minute.

Features of the supervisory system are:

a) Dual real-time computer system (100% back-up).

b) Modular software program. Simple to maintain and easy to expand without a change to the existing operating system.

QUESTION 27

RESPONSE Continued

c) The supervisory control system can be expanded by more than 100% with very minimal cost and without overloading the present operating part of it.

d) The same communication network is utilized for both voice and telemetry.

e) The least utilized circuits are located in the northwest area of our pipeline and are suitable for the proposed application.

QUESTION 29

Is it the applicant's intention to elevate any portion of the proposed pipeline in Alaska or Canada? If so, indicate the milepost interval and the reason for such an elevation.

RESPONSE:

The Company does not propose elevating the pipeline except for small portions of compressor station piping and normal above ground access points such as scraper traps. The areas of discontinuous permafrost are too short to require pipeline evalation.

QUESTION 30

What criteria would be used to decide whether a road crossing would be cased or uncased?

RESPONSE:

The initial design criteria used will be Canadian Standards Association Code Z-184 (latest edition). The current requirements of the Alberta Department of Highways and the local municipalities will also be followed.

QUESTION 31

Indicate in which areas of construction oils would be applied to working surfaces to control dust. Provide the composition and rate of application of the oils that would be used, describe possible impacts of oil application upon terrestrial and aquatic environments, and discuss alternatives to oil application.

RESPONSE:

Oil will not be used to control dust on the right-of-way. The northern four hundred miles of line will be laid during the winter and dust will not be a factor. The middle two hundred miles, which will be summer construction, are through an area which has substantial rainfall and heavy soil. Any potential dust problems will be handled by the use of water trucks. There are unlimited sloughs, lakes, rivers and streams through this area. If historical weather patterns remain constant, the only dust problems will occur in the southern two hundred miles of construction. This will not be a continuous problem but when the infrequent occasions do arise, water trucks will be used to control the dust.

QUESTION 32

Describe in detail the blasting and subsequent installation procedures that would be employed during construction of the proposed pipeline. Include the duration and magnitude of blasting activity, trench dimensions, backfilling procedures and any special measures which would be utilized to mitigate the impact of their operation on the environment, including the Alyeska pipeline.

RESPONSE:

The Company does not anticipate blasting on the Alberta section for the pipeline. The anticipated problems with rocks will be subsurface material which can be ripped or hoed out. Should blasting of short sections be required, all regulatory procedures will be observed and environmental damages mitigated.

QUESTION 33

Will sand dryers and separators be used to manufacture the select conditioned materials for backfill? If so, what amount of particulates would be given off?

RESPONSE:

Sand dryers and separators will not be used to manufacture select conditioned padding materials for backfill. During winter operations, the ditching and backfill operations will be done in close succession so that spoil bank freezing is kept to a minimum. Prior to backfilling, the frozen crust on the spoil bank will be walked down with tractors and broken up in this way. In areas where excessive freezing might occur, such as test points and tie-in points, borrow pits will be dug on the spoil bank side of the right-of-way. This loose material will be used to pad the line and backfill the entire line in certain areas. The frozen spoil pile will then be used to fill the borrow pits.

During summer construction, adequate padding material can generally be taken directly from the right-of-way. In cases where it cannot be acquired in this way, it will be hauled in from local borrow pits.

In areas of heavy gravel, padding material is obtained and placed by the use of backfill auger equipment.

QUESTION 34

Provide a detailed description of corrosion surveys and the methods of corrosion prevention and detection which would be used.

RESPONSE:

The pipeline will be protected from corrosion in accordance with the statutory requirements of the goverment of the Province of Alberta, Pipeline Act, 1975, together with the recommendations of the Canadian Standards Association Code A-184-1973 supplemented by the Company's codes and standards.

The external surfaces will be coated. Primer, asphalt enamel with inner and outerwraps or primer, polyethylene tape and outerwrap applied by conventional over the ditch methods are used in the proposed design. Other methods, particularly yard applied coatings, will be evaluated prior to construction. In addition, cathodic protection will be applied.

The design of cathodic facilities will be established using conventional cathodic survey techniques. Deep well anode or shallow groundbed will be installed as required by the cathodic survey.

The pre-construction surveys will comprise of the following:

1. Electrical Power Survey

   The pipeline right-of-way will be examined to locate access to AC power transmission facilities for the energization of the impressed current cathodic protection system. The location of a power source may be a major factor concerning the design and location of the cathodic protection installations.

2. Resistivity Survey

   Measurement of the electrical resistivity of the soil made along the pipeline route to select suitable groundbed locations. This data will enable the most favourable combination of groundbed position, size and power source. Soil resistivity measurements are made by the 4-pin method which involves driving four retractable steel pins into the earth in a straight line, equally spaced, with the pins spaced to enable the average soil resistivity at various depths to be determined. This testing will be done at different locations along the pipeline right-of-way using a "Vibroground" instrument. Transportation to these areas may be by helicopter.

QUESTION 34

RESPONSE Continued

3. Access

Suitable locations for groundbeds will be determined to satisfy the following:

(a) suitable power transmission facilities

(b) low soil resistivity

(c) accessible for routine inspection and maintenance

(d) free from third party metallic structures and their cathodic protection systems

In the absence of suitable power transmission facilities the use of thermomechanical generators will be considered.

The above surveys may be combined to minimize travel along the right-of-way. A helicopter may be used during the survey because of the type of terrain (muskegs, creeks) and the absence of roads.

The cathodic protection facilities will be monitored monthly and annually using remote monitoring techniques and site visits.

Over the line surveys would generally take place during the late summer and fall.

Internal inspection tools may be used to occasionally confirm the satisfactory functioning of the cathodic system.

QUESTION 35

How often and at what time of year would aerial and ground reconnaisance of the pipeline take place?

RESPONSE:

1. Aerial Reconnaisance

Weather permitting, the pipeline system will be patrolled by air each month as scheduled by the Field Operations Superintendent.

All abnormal conditions and hazards will be defined by location and condition in a written report to the Field Operations Superintendent.

Immediate hazards shall be reported by radio directly to the District Superintendent. These may include:

(a) Washouts of backfill, river bank, right-of-way, etc.

(b) Leakage

(c) Road work, seismic work, pipeline work, etc.

2. Ground Reconnaisance

During the course of the corrosion control program, a large part and specifically all of the remote portions of the Company's pipeline system are patrolled on an annual basis by walking or using all-terrain vehicles. In addition, the entire system is patrolled on a five-year cycle during the flame ionization leak detection survey.

QUESTION 36

Describe inspection techniques to be used at river crossings to check for exposed pipelines due to scour. How frequently would such inspections be made? What procedures would be followed in the event the pipeline becomes exposed?

RESPONSE:

The Company's pipeline river crossings are observed monthly during the course of the aerial reconnaisance. All river crossings in Alberta are physically inspected annually during low spring or autumn flows. These inspections include: slope movement, slope deterioration, water-way erosion, main channel position, and cover over the pipe and weights. Aerial photos are also taken annually for additional supportive data. All data collected is recorded and compared with previous readings to determine rate of change in conditions.

If the pipeline becomes exposed the degree of damage and risk of further deterioration will be assessed to determine remedial action. For minor washouts the cover will be replaced and revetment applied. For major washouts the entire crossing may be replaced.

QUESTION #37

Describe in detail the techniques and procedures to be used to maintain and repair the pipeline during the summer season. How would the problems of repairing breakage and leakage be handled during this period?

RESPONSE

With respect to the the Alberta section, the Company's techniques for maintaining and repairing the pipeline vary little with the seasons.

Routine and emergency work in difficult access areas is achieved by using low ground pressure equipment. The Company's complement of this equipment is based at the following locations.

		CAPACITY IN TONS
EDSON -	1 Nodwell FN60	3 Ton
	Dawson 7 with Backhoe	20 Tons
	1 CF60 Nodwell	3 Ton
VALLEYVIEW -	1 Nodwell FN60	3 Ton
	1 CF60 Nodwell	3 Ton
	1 600 Flextrac	30 Tons
	1 Dawson 7	20 Tons
	1 John Deer Crawler with Backhoe	
	1 Case Crawler - Dozer	
HIGH LEVEL -	1 CF60 Nodwell	3 Ton
	1 Dawson 600 with Backhoe	3 Ton

Commercial leased helicopter support is available and utilized when necessary.

Sections 3.6 to 3.14 of the Company's Gas Transmission Operating and Maintenance Manual follow. These sections provide detailed procedures for pipeline maintenance and repair.

QUESTION 37

RESPONSE: Continued

3.6 EMERGENCY PROCEDURES

Trunk Line Emergency is a term used to signify a condition or situation which affects or prevents the normal operation of the pipeline system. These conditions require immediate attention to ensure restoration of normal service.

Emergency situations shall be reported to the Field Operations Superintendent immediately; all possible information pertaining to the situation and system operation shall be provided at that time.

The District Superintendent will alert field personnel as necessary and request the District clerk to notify the R.C.M.P. and producer companies affected.

The immediate area of the emergency will be cleared and made secure to eliminate all possible danger or hazard to personnel and the public.

The District clerk will provide an "Availability and Location List" of all personnel and equipment.

Gas Control will be advised immediately of the emergency situation.

3.6.1 LINE LEAKS OR BREAKS

The method of temporary control or repair and permanent repair procedures will be established according to the severity of the situation and with regard to the operating security of the system.

Evaluation by the District Superintendent and/or assigned personnel will be presented to the Field Operations Superintendent who will prescribe the method of control and repair to be followed. The repairs shall be in accordance with subsequent section of "Repair Procedures" contained in this manual.

In ALL cases, regardless of the severity of the leak, a "Pipeline Failure Report" (AGTL Form 301) MUST be filled out in its entirety by the District Superintendent or his appointee. These reports are to be maintained as permanent company records. An example is found in Appendix "C".

3.6.2 HYDRATE FORMATIONS

Hydrate formations may occur in an operating pipeline causing restricted flow. Early detection of a formation usually means it can be corrected quickly and easily.

Hydrate formations can be detected by a steadily rising static pressure with an accompanying steady drop in differential pressure readings. Station operators and Gas Control may compare local conditions with system conditions when this occurs and early correction action may be accomplished by:

3.6.2.1 ALCOHOL INJECTION

(1) UTILIZATON OF METER RUNS, BY-PASS
Headers at mainline valve assemblies and scraper barrels can be used for direct insertion of alcohol upstream of the hydrate formation. Close valves to isolate the run, header, scraper barrel or blow-down and fill as necessary (predicted on distance and severity), purge and repressure, then open valves to provide flow of alcohol into the flowing gas stream. This method can be repeated until the formation is dissipated.

(2) Alcohol injection tanks are available in the Districts for injecting alcohol under line pressure through 1-1/2" and 2" valves provided for this purpose on the line. These tanks are fitted with needle valves to provide prolonged and injection rates where required. Refer for valve location details.

(3) High-pressure pumps may be coupled directly to 1-1/2" and 2" valves for direct pumping of large volumes of alcohol into the line.

3.6.2.2 REDUCING PRESSURE

Factors of pressure, flowing gas temperature, hydrocarbon content all contribute to hydrate formation at predictable concentrations.

A graph indicating this relationship is shown on Figure 9. By altering the pressure to a lower level, dissipation may be accelerated and/or accomplished. Complete blow-down may prove necessary on each side of the formation in some cases.

3.7 VAULT MAINTENANCE

Regularly scheduled inspections shall be made of each vault housing pressure-regulating and pressure-limiting equipment to determine if it is in good physical condition and adequately vented. This inspection shall include the testing of the atmosphere in the vault for combustible gas. If gas is found in the vault atmosphere, the equipment in the vault shall be inspected for leaks and leaks found shall be

repaired. The ventilating equipment shall also be inspected to determine if it is functioning properly. If ventilating ducts are obstructed, they shall be cleaned. The condition of the vault covers shall be carefully determined to ensure that they do not present a hazard to public safety.

Procedures as described in the Safety section shall be adhered to whenever entry is made into a vault.

3.8 BLOWDOWNS

There are many pipeline activities which require blowing gas to atmosphere. These functions are normally scheduled, and the necessary records are prepared as required.

The blowdowns located at a mainline valve assembly are principally a maintenance facility or tool incorporated in the Trunk Line system, serving a dual purpose of:

1. Blowing gas to atmosphere
2. By-passing gas around the mainline valve when required.

WHILE BLOWING GAS TO ATMOSPHERE, ONLY THE ACTUAL PERSONNEL REQUIRED TO CARRY OUT THE OPERATION ARE TO BE ALLOWED ON SITE. Barricades or personnel are to be used to control road traffic when necessary, preventing traffic from approaching nearer than 300 yards to any area subjected to the danger of gas-air flow or gas accumulation. Vehicles shall be placed in a location which is safe and where radio contact can be utilized. The general area shall be inspected for fire hazards, wind direction shall be noted, and livestock and wild life shall be driven off. Residents of the immediate vicinity shall be notified.

Report readiness for blowdown and stand-by, unless previous instructions have been received.

Shutoff ignition of all automotive equipment, remove matches, lighters, etc. from person, extinguish cigarettes, etc.

The typical drawings located in the subsequent section on pipeline purging will furnish the location and nomenclature of the equipment mentioned in the procedure for blowing gas to atmosphere and also for operation of the by-pass.

Using the following procedure, a blowdown operation can be accomplished easily and safely:

(1) Prepare complete written procedure as per AGTL Form "Changes to AGTL Pipeline Facilities" in Appendix "C".
(2) Notify gas control after each step of operation is complete.
(3) Secure necessary tools:
    1 - 3# Hammer of sledge or unibolt break out tool.
    2 - 12" or larger adjustable wrenches as required.
    1 - 8" Pipe wrench as required.
    1 - Ear protection.
(4) Both blowdown valves must be fully closed. Loosen bleed plug in the

head of the unibolt closure on both sides. A safety lug held in place by the bleed plug prevents opening of unibolt closure before pressure is removed.

(5) When by-pass has bled down, remove bleed plug and safety lug.

(6) Remove bolts from nut member. (Place these in safe location.) Use unibolt break out tool to turn nut member. (Hammer can be used on lugs to turn nut member also.) Nut member now turns off lugs of closure blanking plug and falls down to stop lugs.

(7) Swing blanking plug on linkage, up and away from opening of blowdown. Where no linkage exists remove and place the blanking plug in a safe location.

(8) Install and take deadweight readings as required. Whenever possible, deadweights should be taken from the valve in the access well.

(9) Gather up and place tools in safe location.

(10) Upon receiving confirmation to begin with blowdown, affix ear protection.

(11) When line pressures are in the normal operating range and higher, the valve should be opened 1/3 on the indicator until the pressure has decreased approximately 200 pounds.

3.9 EXCAVATING

The location and cover of the pipeline and other buried fittings, lines or structures shall be established by hand exposure before any stripping or excavating work is done within the limits of AGTL right-of-way or property.

All backhoe, dozer, auger, clam and like work shall be witnessed by a helper who shall keep the machine operator advised of clearance to the pipe regardless of pipeline pressure status.

All gouges, dents, scratches, and/or pitting discovered shall be reported to the foreman.

Excavations shall be kept safe by fences, flares, barricades or other suitable methods to prevent damage to pipe and hazard or injury to persons or animals in the area, as long as the excavations remain.

Planning, inspection, and maintenance of open ditching or other excavating works shall be established as required in compliance with Workers' Compensation Board regulations, for protection of pesonnel working in ditch or excavation.

3.10 TIE-INS

Safe tie-ins to the operating pipeline system are usually made through "hot tapping" the existing pipeline under reduced pressure, or by isolating the pipeline section and using the lamb air mover to replace the pipeline gas with pure air.

The proper "hot tap" procedures are outlined in Engineering Standards HT01 and HT02 in Appendix "A".

QUESTION 37

RESPONSE: Continued

The Lamb air mover is used to eliminate explosive air-gas mixtures from the pipeline during tie-ins. The proper exhauster and tie-in methods shall always be used since gas may unknowingly accummulate due to a leaking isolation or block valve.

With the rough opening "hot cut" as discussed previously under exhauster operation, or the pipeline section open due to a blowout etc., the tie-in or repair shall proceed as follows:

1. Install exhausters on ends of section on blowdowns.
2. Start operation of exhauster at both ends of section. Prepare pup, fitting, etc.
3. Sniffer or explosimeter can be used to prove gas elimination in ditch and pipe ends.
4. Cut and/or bevel as required, ends of pipe for installation pup, fitting, or prefab section.
5. Start bead weld on one end of pup, fitting, etc.
6. Should difficulty arise with bead weld being pulled into pipe, reduce operation of exhausters to eliminate this.
7. Before final bead weld is begun, partially close both blowdown valves and further reduce operation of exhausters. This will allow valves to be closed quickly to prevent back flow of air when exhausters are turned off.
8. The final bead can now be started and simultaneously both blowdown valves are closed and exhausters are shut off.
9. A slight amount of air will enter the pipe for a short time through gap but will quickly stop flowing.
10. Weld can now be completed without danger of fire or weld puddle being pulled in or blown out.
11. Should there be a badly leaking valve near the tie-in where the tie-in is near the blowdown, this blowdown can be partially opened at a very low rate of flow, and the other blowdown on the opposite end slightly cracked while making the final bead.

All welding shall be in accordance with the Canadian Standards Association Code Z 184 on "Gas Pipeline Systems".

Work on additions to the pipeline should always be preceded by a prepared plan of action. This plan shall be registered on AGTL form "Procedure for Changes to AGTL Pipeline Facilities". A copy of the form may be found in Appendix "C". This form outlines the necessary notifications to be given prior to work date, the town and farm taps affected, etc., and a written description of how the outage for the tie-in is to be co-ordinated. The description is to include all times associated with the closing of valves and/or adding or deleting horsepower at various compressor stations to obtain the best system conditions prior to isolation for tie-in.

3.10.1 EXHAUSTER OPERATION (LAMB AIR MOVER)

The Lamb air mover is used to exhaust the gas or gas/air mixture from an isolated pipeline sectoin, and replace it with atmospheric air. This procedure eliminates the fire and explosion hazard previous to and during

tie-ins for maintenance, modification, or additions to an operating gas pipeline system.

The lamb air mover is in effect like a large vacuum mounted on the blowdowns at each end of the pipe section. The exhauster can be operated with compressed air or with natural gas supplied from the adjacent pressured section. An air access hole is cut in the centre of the pipeline section. This process is referred to as "Flame Cutting" or "Hot Cutting". The size of the air access openings are as follows:

EXHAUSTER OPERATION
AIR ACCESS OPENING SIZE

PIPE SIZE	HOLE SIZE
14" and smaller	10" or cut completely
16"	12"
18"	12"
20"	14"
22"	16"
24"	16"
26" - 30"	18"
34"	24"
36"	26"

Once the preliminary work of locating, excavating and bell holing, and stripping has been completed, the hot cutting preparation for exhauster operation may begin. Hot cutting is a very useful and safe procedure if the proper steps as outlined below are followed:

(1) Blowdown section.
(2) Close blowdown valves.
(3) Using proper adapters, install exhausters at each end of section on blowdowns.
(4) Select proper opening size from chart.
(5) Instruct personnel manning blowdown/exhauster to stand by for instruction on opening valves and controlling exhauster rates of flow.
(6) Personnel shall be stationed at work site with fire extinguishers.
(7) Drill a 1/2" diameter hole in the pipeline at the work site.
(8) With a deadweight hose supplying a slow steady gas supply past the blowdown assembly to one end of the isolated section, start a flame at the location of the 1/2" hole.
(9) Control the gas coming into the section to maintain a flame approximately 1" high.
(10) Rough cut a circular opening with the torch, controlling fire as necessary with the supply through the deadweight hose and packing off the cut with mud as it progresses.
(11) With cut complete extinguish fire, and open both blowdowns.
(12) Start exhauster operation at both blowdowns. Ribbons can be suspended in rough opening to indicate air flow into the line. This

flow should be controlled by regulating the exhauster operation to achieve equal flow in both directions.

(13) After operating exhausters for half an hour, check the pipeline gas with a gas detector at a flow test valve or other suitable opening.

(14) Prepare for the tie-in, making a rough cut and beveling pipe at desired location.

(15) Exhauster operation can be reduced at both locations but not shut off.

The lamb air mover can be used to provide positive ventilation in buildings, vaults, tanks, etc., where accumulated explosive vapors and odours exist. Compressed air would be used to operate the exhauster in this case.

3.11 TEMPORARY REPAIRS

Whenever an injurious gouge, groove or dent, leak or corrosion pit is found in a pipeline and it is not practicable to make a permanent repair at that time, an immediate temporary repair shall be made. An examination shall be made to ensure that no crack has developed from the defect. If a crack is evident, it shall be removed. Sharp gouges and grooves must be removed. Mechanical leak clamps which do not form an encirclement pressure vessel are permissible.

A welded patch is prohibited. The repairing of corroded pipe by depositing weld metal is not recommended.

3.11.1 INSPECTION

All temporary repairs should be repaired within a one-year period. Where special conditions prevent a permanent repair being made within the year period, sufficient periodic inspections shall be made to ensure that the defect, corrected by the temporary repair, has not extended. It shall also be inspected to ensure that the leak has not recurred or that the temporary repair device has not deteriorated.

3.11.2 FULL ENCIRCLEMENT SLEEVES

The welded full encirclement or bolt-on split sleeve shall have a strength at least equal to that required for the maximum allowable operating pressure of the pipeline being repaired. Full encirclement sleeves shall not be less than 4 inches in length and shall extend at least 2 inches beyond the extremities of the defect. The reinforcement sleeve shall be accurately fitted to the carrier pipe. Consideration shall be given to the concentration of bending stresses in single wall pipe between two adjacent repair sleeves due to their close proximity.

If the thickness of the sleeve to be welded to the carrier pipe is greater than the nominal wall thickness of the carrier pipe, the circumferential edges of the sleeve shall be tapered to the nominal wall thickness of the carrier pipe.

3.12 PERMANENT REPAIRS OF INJURIOUS GOUGES, GROOVES, DENTS, LEAKS AND CORROSION PITS

Injurious gouges, grooves, dents, leaks or corrosion pits shall be removed or reinforced. Whenever practicable to take the pipeline out of service the above mentioned objects shall be removed by cutting out a cylindrical piece of pipe and replacing it with pipe of equal or greater design strength. All repair welds shall be in accordance with the CSA Standard Z-184.

Retested pipe shall be used in these repair sections where in-place testing is not practicable.

3.12.1 FULL ENCIRCLEMENT SLEEVES

Another acceptable method to be used whenever it is not practicable to take the pipelines out of service is to use a welded full encirclement split sleeve applied over the previously mentioned defects. Where any part of the sleeve is welded to the carrier pipe, the operating pressure shall be reduced in accordance with the procedures outlined in the Hot Tap procedures in Appendix "A".

3.12.2 MINIMUM LENGTH OF REPLACEMENT PIPE

The minimum length of pipe to be used for the replacement of pipe containing a defect shall be at least 4 feet.

3.12.3 PERMANENT FIELD REPAIR OF CIRCUMFERENTIAL WELDS

All circumferential welds found to be unacceptable under the provisions as stated in the CSA Standard Z-184, section on "Standards of Acceptability", shall be repaired.

If it is practicable to take the line out of service, the weld shall be repaired in accordance with the requirements as stated within the CSA Standard Z-184, section on "Repair or Removal of Weld Defects".

3.12.4 FULL ENCIRCLEMENT SPLIT SLEEVES

If it is not practicable to take the pipeline out of service, the weld may be repaired by installing a welded full encirclement split sleeve in accordance with the previous section "Full Encirclement Sleeves".

3.12.5 CRACKS

Any weld containing a crack either in the weld or in the heat-affected zone of the parent metal shall be removed by cutting out a cylindrical portion of pipe containing the crack and replacing it with another cylinder of pretested pipe of equal or greater design strength.

3.12.6 ARC BURNS

Arc burns on pipe of not more than 42,000 psi specified minimum yield strength may be removed by grinding, providing that the resulting wall thickness is not less than the minimum prescribed in the CSA Standard Z-184 "Table of Least Nominal Wall Thickness for Steel Carrier Pipe".

Whenever an arc is struck on a pipe, it shall be struck within the bevel to be welded.

Whenever a ground clamp is applied to the pipe, it shall be of the proper design for that diameter of pipe. This will eliminate arc burns caused at the grounding point.

3.13 EQUALIZING

Equalizing is a simple procedure although like many seemingly uncomplicated tasks there are precautions that must be observed. These precautions are:

(a) Review the procedure, identify the valves and piping to be used for by-passing gas around main or side valves as required.
(b) Obtain pressure readings both sides of valve and log.
(c) Establish communication and confirm proposed procedure with Gas Control and also other personnel involved, (pipeline, measurement, producer, compressor or client).
(d) DEACTIVATE ANY AUTOMATIC OPERATED EQUIPMENT WHICH, THROUGH PRESSURE OR FLOW CHANGE, COULD AFFECT AND/OR UPSET PROGRESS OF PROCEDURE OR OTHER INTERCONNECTED SYSTEMS. (i.e. auto line break controls.)
(e) Open control valve to start equalizing the pressures.
(f) Monitor and report pressure drops and/or increases in systems, regulating degree of opening of valves as necessary or as instructed by Gas Control.
(g) NOTE AND REPORT ANY UNDUE VIBRATION OR OTHER ABNORMAL CONDITION THAT MIGHT CAUSE DAMAGE TO PIPELINE, SYSTEM OR ASSOCIATED EQUIPMENT, AND ELIMINATE CONDITION WHENEVER POSSIBLE.
(h) As pressure differential lessens the valve can usually be opened more.
(i) WHEN EQUALIZATION HAS BEEN ESTABLISHED ALL NECESSARY VALVES SHALL BE POSITIONED FOR RESTORING OR ESTABLISHING NORMAL FLOW AND CONTROL CONDITIONS.
(j) REACTIVATE ALL CONTROL SYSTEMS FOR NORMAL OPERATION.
(k) LOCK AND/OR SECURE ALL VALVE OPERATORS OR OPERATOR CONTROLS.
(l) Record the necessary readings of pressure and other data, etc., on the "Pipeline Operations for blowing down/purging/ pressurizing/ equalizing on AGTL Form 310, as included in Appendix "C".

3.14 PURGING

Air or an air/gas mixture within a pipeline must be displaced with 100% natural gas before the line can be pressured-up and placed into service.

Therefore, purging will be required when:

(a) A newly constructed and acceptable pipeline is connected for service.

(b) A section of existing line has been blown down and repaired or modified.

(c) A portion of a pipeline has been replaced due to a line failure, corrosion, etc.

Reference to particular valves (upstream, downstream, blowdown or by-pass) should always be according to the normal direction of gas flow within the pipeline. The location of the valve can thus be reliably stated, readily understood and proper valve sequencing followed as directed.

Typical valve assembly drawings are shown in Figures 10, 11, 12, and 13. Figure 14 shows the blowdown valve assembly, complete with gas detection set up.

Radio contact between Valve locations and Gas Control should be established prior to the commencement of the preparation for purge.

3.14.1 EQUIPMENT AND MATERIAL REQUIREMENTS

(a) Upstream Assembly:
Deadweight or test gauge, minimum inlet pressure data, "Pipeline Operation Report" forms.

(b) Downstream Assembly:
Deadweight or test gauge, 4-way tee assembly, 2-inch sampling cylinder, 0 - 100% methane detector, "Pipeline Operation Report" forms.

Prior to the start of any purge, watches at the upstream and downstream assemblies should be synchronized through Gas Control. This will ensure that all times recorded are relative to one another.

It is always a good idea to set up the gas detector on the gas to be used for the purge. Components in the gas vary from location to location and have a minor effect on the 100% reading. Adjustment of the detector prior to the purge will eliminate any minor discrepancies and the unit will record correctly.

3.14.2 PREPARATION FOR PURGING - MAINLINE (REFERENCE FIG. 10)

3.14.2.1 Upstream Assembly: Valve Positions - X, A and B closed.

1. Secure unibolt closures 1 and 2.
2. Open bleed screw in unibolt closure 2.
3. Using a deadweight or test gauge, determine and record the pressure in the section upstream of valve X.
4. Crack valve A and purge crossover between valves A and B.
5. Tighten bleed screw and pressure up crossover.
6. Turn valve A to full open position.
7. Attach a gauge to the downstream gauge connection or flow test valve using a flexible hose to eliminate vibration.
8. Contact the Gas Control department and inform them that the assembly is ready for the purge. Report valve

positions and upstream pressure.

9. Stand by for further instructions.

3.14.2.2 Downstream Assembly: Valve Positions - Y and D closed, C open.

1. Secure unibolt closure 4, closure 3 is removed.
2. Attach 4-way tee to gauge connection on up stream riser. Set up the pressure gauge and sample system as shown in Figure 14. The 2-inch gas sample cylinder shown is used to prevent contaminants, such as dust, water or methanol from entering into the gas detector.
3. Notify Gas Control that the assembly is ready for purging.
4. Standy by for further instructions.

3.14.3 PROCEDURE - MAINLINE

3.14.3.1 Upstream Assembly: Upon receipt of authorization from Gas Control to proceed,

1. Determine appropriate inlet pressure from Figures 15 to 20. This pressure is the suggested minimum inlet pressure and should be used as guide.
2. Crack valve B. Observe the pressure gauge and bring the pressure up to the required level as quickly as possible. Record the time of initial gas inlet.
3. Notify Gas Control of the time purge began and the purge pressure established.
4. Maintain constant pressure throughout the purge.

3.14.3.2 Downstream Assembly:

1. Open the sample valve on the blowdown and activate the gas detector.
2. Refer to the "Pipeline Operation Report" Form 310 and read and record the data as required. When reading the pressure, be sure valves to the gas sample line and purge line (Figure 14) are closed momentarily.
3. Record the time that 100% methane is observed in the designated space.
4. Continue the purge for a minimum of 5 minutes after 100% methane is indicated. The 100% reading must be continuous throughout this period.
5. Close valve C. (See Note Following.)
6. Notify Gas Control of the times associated with receipt of 100% methane and purge completion.
7. Begin "Equalization Procedure" as outlined in the previous section.

QUESTION 37

RESPONSE: Continued

NOTE: In the case of a new section of pipeline, where increase flow is requested ot ensure all post-construction contaminants, i.e. water, methanol, etc., are removed, the following intermediate steps can be taken:

(a) Request flow increase through valve B at upstream assembly.
(b) Record times and corresponding blowdown pressure at 5-minute intervals.
(c) When satisfied that line is clean close valve C.

3.14.4 PREPARATION FOR PURGE - LATERAL (REFERENCE FIG. 11)
The following method will be employed when purging from the mainline into the lateral.

3.14.4.1 Lateral Side Valve Assembly:
Valve positions - Valves A and B closed, Valve X open.

1. Using a deadweight tester or test gauge, determine and record the pressure in the section downstream of check valve.
2. Attach a gauge to the gauge connection or flow test valve using a flexible hose to eliminate vibration.
3. Contact the Gas Control department and inform them that the assembly is ready for purging. Report valve positions and mainline pressure.
4. Stand by for further instructions.

3.14.4.2 Meter Station Block Valve Assembly:
Valve Positions — Valve Y and D closed, Valve C open.

1. Secure unibolt closure 3, closure 2 is removed.
2. Attach 4-way tee to the gauge connection riser No. 2. Set up the pressure gauge and sample system as shown in Figure 14. The 2-inch gas sample cylinder shown in used to prevent contaminants such as, dust, water or methanol from entering into the gas detector.
3. Notify the Gas Control the assembly is ready for purging.
4. Standy by for further instructions.

3.14.5 PROCEDURE - LATERAL

3.14.5.1 Lateral Side Valve Assembly: Upon receipt of authorization from Gas Control to proceed,

1. Determine the appropriate inlet pressure from figures 15 to 20; this pressure is the suggested minimum inlet pressure should be used as a guide.
2. Crack valve A and quickly bring the pressure up to the required level. Record the time of initial gas inlet.
3. Notify Gas Control of the time the purge began and the purge pressure established.
4. Maintain this pressure throughout the purge.
5. When the purge is complete, crack valve B and purge blowdown riser.
6. Secure unibolt closure 1.

3.14.5.2 Downstream Assembly:

1. Open the sample valve on the blowdown and activate the gas detector.
2. Refer to "Pipeline Operations Report" Form 310 and read and record data as required. When reading pressure, be sure valves to the gas sample line and purge line (Figure 14) are closed momentarily.
3. Record the time that 100% methane is observed in the designated space.
4. Continue the purge for a minimum of 5 minutes after 100% methane is indicated. The 100% reading must be continuous throughout this period.
5. Close valve C. (See Note Below.)
6. Notify Gas Control of the times associated with receipt of 100% methane and purge completion. (See Note Below.)
7. Begin equalization procedure as outlined in the previous section.

NOTE: In the case of a new section of pipeline, where increase flow is requested to ensure all post-construction contaminants, i.e. water, methanol, etc., are removed, the following steps can be taken:

(a) Request flow increase through valve A at lateral side valve.
(b) Record times and corresponding blowdown pressures at 5-minute intervals.
(c) When satisfied that line is clean, close valve C.

Proceed with equalization procedures as previously described.

3.14.6 GENERAL COMMENTS

It is imperative that standard purging procedures be followed as outlined and all pertinent data be recorded. The original purge data sheet as filled out in the field should be maintained in the District office files. Typed reproductions should then be sent to departments requiring the information. The data should be distributed as soon as possible following completion of the purge. This is particularly true for the Measurement department as the data is required for their monthly gas balance. The form used in this operation is AGTL Form 310 - "Pipeline Operation Report"; an example is located in Appendix "C".

Besure that Gas Control and both teams involved with the purge at the upstream and downstream assemblies are fully aware of conditions relating to the purge at all times. Do not operate any valve unless you are ABSOLUTELY SURE. One person in the field should be designated responsible for the purge and all operations cleared by him prior to initiation.

Any information not specifically called-out on the form, which you believe to be pertinent, should be included in the space provided under the heading "Comments".

QUESTION 38

The applicant is requested to discuss procedures to be taken when gas leaks occur under river ice cover, which may lead to the fracturing of the ice cover and release and/or ignition of the gas.

RESPONSE:

It is very unlikely that leaks or breaks will occur in the river crossing sections because of the care taken in design and construction of these sections.

Should a leak or break occur which would lead to the fracturing of the ice cover the gas loss and fire, if any, will be arrested by the automatic closing of the line break operators on the upstream and downstream valve assemblies.

Repairs to such a leak or break will be made in either a permanent or temporary mode depending upon the magnitude of the damage.

QUESTION 39

How will gas line leaks be detected in the winter when vegetation is not useful in indicating the area affected by natural gas?

RESPONSE:

The pipeline will be initially inspected shortly after going into service with flame ionization detection equipment. Thereafter, large leaks or breaks are readily detected in any season. Small, pin-hole leaks are difficult if not impossible to visually detect when the ground is covered with snow or the vegetation is browned by the winter. Spots of ice and snow remaining on the right-of-way late into the spring are indications of such leaks. Air patrol spotting of such indications can be verified by ground leak detection methods.

QUESTION 40

During seasons other than winter, how would heavy equipment be transported to the damage site in the event of a major pipeline failure?

RESPONSE:

The transportation of heavy equipment during seasons other than winter is not a problem in Alberta as highways are normally used and railways can be utilized during spring break-up. Additionally, special permission for road travel may be obtained in emergencies during spring break-up. The Company owns and operates many low ground pressure vehicles of various capacities for off right-of-way access in all seasons and conditions.

QUESTION 41

If repair work is required in the winter months, how would the affected pipeline be excavated? How long would excavation take? What would be the down time expected to repair a break?

RESPONSE:

When repairs are required in frozen ground during the winter months, excavation is achieved by rippers mounted on heavy tractors and by other equipment designed to dig the frozen ground. This equipment is either owned by the Company or available within the province from contractors.

Down time required to repair a break will vary because of location, size of rupture, and weather conditions. All line breaks are repaired on a priority basis under established procedures whereby every use is made of Company and nearby contract equipment. Experience has proven break repairs in the northern part of Alberta can be completed within 24 to 48 hours after detection.

QUESTION 42

Provide a map at a scale of 1:125,000 and detailed information on the location of all refuse disposal sites, showing the reasons for choosing them. How many of these sites will be using sanitary landfills and where are these located? What quantity and quality of refuse will be dumped at each site? Discuss in detail any detrimental impact which could result either directly or indirectly from these dumpings.

RESPONSE:

The Company has considered refuse disposal in a general way in its design and cost estimates. At each construction camp, a refuse disposal site will be established. There are a large number of existing refuse disposal sites within Alberta and along the proposed route. A detailed discussion of the use of existing sites and establishment of new sites cannot be undertaken until design is complete. It is certain however that the choice of sites, the use made of them and the quantity and quality of refuse dumped will be carefully planned and implemented and monitored by appropriate Alberta regulatory agencies so that there will be no detrimental impact.

QUESTION 43

Would construction camps be needed for construction of the Canadian mainline loopings? If so, where would they be located, how much acreage would they require and how would the facilities be removed. Specify sources and treatment facilities to be used at camp sites to provide potable water.

RESPONSE:

Construction camps will be required at Rainbow Lake, Bassett Lake, Keg River side valve, Hotchkiss Forestry Road and west of Dixonville.

The camp at Rainbow Lake will be located at an existing site near the airport and will be serviced from town facilities. It will be moved out down the main highway.

The camp at Bassett Lake will be used during the winter and removed north along the right-of-way to the main highway. A water well will be drilled to supply the camp and also to supply the future needs of a planned compressor station. There is a ten-acre site cleared at the Bassett Lake site and the camp will use this area.

At the Keg River site, the camp will be set up in an existing yard and use water from a gas plant facility.

The camp on the Hotchkiss Forestry road will be set in an existing seven-acre cleared area. Water for toilets, bath, washing, etc. will be taken from the creek at this location and run through a water softener. Drinking and cooking water will be hauled from the town of Manning. The camp will be removed out the main forestry road to the MacKenzie highway.

The camp west of Dixonville will be set up on a farm which is three miles east of the right-of-way. Water will be obtained from the farmer's well. The camp will be removed on the all weather road to the MacKenzie highway.

Additional sleeping facilities will be required in the towns of Eaglesham, Valleyview and Fox Creek. Dining facilities for half the crew will be obtained in these towns as well. All these facilities will be hooked-in to existing town services.

QUESTION 44

How will used petroleum products, such as lube oil, be disposed of at construction camps and compressor stations? What measures would be used to prevent leaks of such products? Discuss the possible impacts of such leaks.

RESPONSE:

Used oil at construction camps will be collected and stored in drums or tanks until sufficient quantities are gathered for hauling to a government approved disposal site or to a refinery for refining.

Compressor stations have an oily water drain system connected to a holding tank which is pumped out periodically and trucked to be reinjected in a crude oil field or reprocessed at a plant. These systems have proven to be successful with no problems with leaks or spills.

Proper housekeeping will be enforced at all collection sites.

QUESTION 45

The applicant has not provided any specific information concerning the treatment of raw sewage which would be generated by the construction and operating personnel. How would raw sewage from these personnel facilities be treated? Provide a detailed description of the sanitary treatment facilities for the personnel including location, type, flow, capacity, effluent quality, sludge accumulations and sludge disposal methods and locations. Show all calculations used to determine expected raw sewage flows due to personnel. Would raw sewage treatment facilities developed for construction be retained and used for treatment of the sewage from the operating personnel? If not, describe in detail the system which would be used, provide a breakdown of the flows into the new treatment system, and provide a justification why new facilities would be built. Estimate the quantities of waste to be disposed of during the various phases at each site. Will there be an additional oxygen demand placed on the streams draining sanitation sites? What will be the impact on the biota of the receiving streams?

RESPONSE:

The detail requested in this question is not available at this time regarding specific flows, capacity, water quality and locations and calculations cannot be presented.

Construction camps where they are required, would have one of four types of sewage disposal treatment facilities. These are:

1) Retention ponds for holding the secondary sewage material for a period of one year before disposal into a water course.

2) Holding tanks which would be emptied periodically by a tank truck and the material hauled to a suitable municipal disposal system.

3) Septic tank system for primary and secondary treatment prior to the liquid being disposed of into a tile grid.

4) A package disposal unit, several types of which are presently available on the market.

Sludge material from the last two systems described would require disposal in either a suitable municipal system or by incineration. The Company does not permit its construction contractors to dump raw sewage under any condition or to discharge the effluent from any sewage system into a surface drainage system.

QUESTION 45

RESPONSE Continued

For the use of operating personnel, compressor stations have a permanent sewage disposal system which is designed in accordance with the Government of Alberta Plumbing and Drainage Regulations. Specifically, the Private Sewage Disposal guidelines are used. Normally, station facilities would be sized for two operators with an expected maximum of six personnel. To size a system, a daily sewage flow of 15 gallons per person is used. However, the minimum allowable septic tank capacity is 400 Imperial gallons which is the size normally used. For a long term average of two users, the sludge accumulation is expected to be 80 Imperial gallons for five years. Sludge removal would be performed by a contractor who specializes in such work and sludge would be properly disposed of by the contractor.

The liquid effluent from the septic tank would be disposed of by a method of ground absorption such as:

(1) a sub-surface weeping "tile" disposal field,

(2) a leeching cess-pool,

(3) a filter bed,

(4) an evaporation mound

The design and sizing of the chosen disposal method is described in the Regulations and is subject to the approval of the Plumbing Inspection Branch. At no time, is raw sewage or septic tank effluent drained into streams or surface drainage systems.

QUESTION 46

Page 4-13 of Exhibit Z-1, Vol. 1 States, "Baseline air quality and meteorological data (including atmospheric dispersion characteristics) will be documented . . ." For the proposed route(s) in Alaska and Canada:

a) List the meteorological parameters and air pollutants to be measured.

b) Describe the sampling and monitoring techniques which would be used for each of the above.

c) What would be the frequency and duration of sampling for each of the above.

d) What would be the length of the sampling program?

e) Would similar sampling programs be conducted to all of the proposed compressor sites? If not, what modifications would be made?

f) Would similar sampling programs be conducted at existing compressor sites in Canada where additional compressors would be installed?

g) Please submit any data which has already been collected at the monitoring sites.

h) If monitoring has not commenced, how long before construction at compressor sites would the monitoring programs be initiated?

RESPONSE:

The Clean Air Act of Alberta requires that the ground level concentrations of NO_x do not exceed 0.21 PPM during a one hour period, 0.106 PPM during a twenty-four hour period and 0.03 PPM for an annual arithmetic mean. Regulations for SO_2 ground level concentrations are also considered. As all fuel used is "sweet" SO_2 is not a problem.

Thus the main concern is ground level NO_x monitoring with checks for any traces of SO_2.

a) Meteorological parameters to be measured:
   i. Wind speed
   ii. Wind direction
   iii. Air temperature

   Air pollutants to be measured:
   i. Ground level NO_x levels

QUESTION 46

RESPONSE Continued

b) A trailer containing the following instruments has been used in the past and will be used as required in the future.

i. Teco model 14B NO_x Analyzer
ii. Dominion Instruments 540° wind system
iii. Leeds and Northrup type "H" recorder

These instruments are supplied with samples by a vacuum pump which delivers outside air to the analyzing equipment.

c) The trailer would be located at various sites until the accumulated results are obtained.

d) The sampling program length would be governed by results from each previous set of samples. As many gas turbine units are the same it is not usually necessary to sample the same units in different locations. Consequently, the sampling program will not be too extensive if several similar units are actually constructed.

e) The sampling programs would be similar at all proposed compressor sites except where a site is in a heavily treed area in which case more locations for the trailer would be tried.

f) Sampling programs will be carried on in Alberta if and when required by applicable Provincial regulations.

g) The appendixed Western Research and Development Ltd. report dated July, 1975 presents data already collected at the Company's Princess Compressor site.

h) Monitoring of wind conditions could start about three months prior to construction at sites where wind data is not available.

QUESTION 46

RESPONSE: Continued

AN EVALUATION OF AIR QUALITY IN THE REGION OF THE PRINCESS COMPRESSOR STATION

Prepared for:
The Alberta Gas Trunk Line Company Limited

Prepared by:
Western Research & Development Ltd.

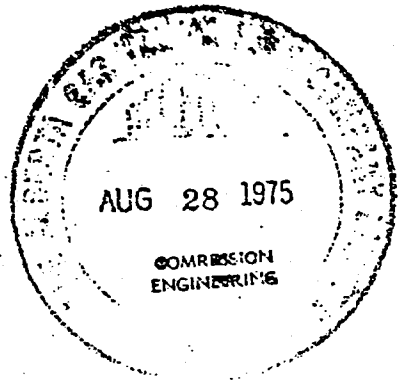
July, 1975

QUESTION 46

RESPONSE: Continued

Western Research & Development Ltd.
Subsidiary of
Bow Valley Industries Ltd.

Box 6710, Postal Station "D", 1400, 630 Sixth Avenue SW, Calgary, Alberta, Canada T2P 2V8 (403) 231-1211



August 27, 1975

Alberta Gas Trunk Line Co. Ltd.
500 - 4th Avenue S.W.
CALGARY, Alberta

Attention: Mr. G. Lavold, P. Eng.

Dear Mr. Lavold

Attached please find a report entitled *An Evaluation of Air Quality in the Region of the Princess Compressor Station.* Any comments that you might have would be welcome.

Yours sincerely

Douglas Leahey, Ph.D.
Group Leader, Meteorology

DL:mh
Attachment

cc: Mr. Leo Bouckhout
Supervisor Environmental Affairs
Foothills Pipe Lines Ltd.
1600 - Bow Valley Square II
205 Fifth Avenue S.W.
Box 9083
Calgary, Alberta
T2P 2W4

Laboratory: 3, 1313 - 44th Avenue Northeast, Calgary, Alberta, Canada T2E 6L5 (403) 276-8806

RESPONSE: Continued

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RESPONSE: Continued

1. INTRODUCTION

The Alberta Gas Trunk Line Company Limited operates a large compressor station near the hamlet of Princess, Alberta. The site is located about 20 miles northeast of the town of Brooks.

Western Research & Development Ltd. was requested to evaluate the changes in ground-level air quality with respect to the nitrogen oxides (NO_x) and sulphur dioxide concentrations that might result from the operation of the station. Particular reference was to be made to the large Princess "D" compressor.

RESPONSE: Continued

2. EMISSION DATA AND STACK PARAMETERS FOR THE PRINCESS "D" COMPRESSOR STATION

Table 1 presents the building and stack parameters together with emission data for the large Princess "D" compressor station. The emission data are based on a stack survey performed when the station was operating at about 55 percent capacity by Western Research & Development Ltd. in May, 1975.

The NO_x stack concentrations shown in the table are only 25 ppm. This is very low.

It is important to note that the stack height is small compared with the building height. The ratio of stack to building height is only 1.3.

QUESTION 46

RESPONSE: Continued

Table 1

BUILDING AND STACK PARAMETERS AND EMISSION DATA
FOR THE PRINCESS "D" COMPRESSOR[1]

Building height	(ft)	33
Length of building diagonal	(ft)	88
Stack height	(ft)	43
Exhaust gas flow rate	(SCFS*)	4434.6
Exit gas velocity	(ft s^{-1})	60.2
Exit gas temperature	(°F)	678.0
Emissions of NO_x	(SCFS*)[2]	0.11
Concentration of NO_x	(ppm)	25.0
Emissions of SO_2	(SCFS*)	0.02
Concentration of SO_2	(ppm)	5.0

* At 70°F and 14.7 psi

[1] Operating at 55 percent capacity.

[2] Expressed in terms of the equivalent amount of NO_2.

QUESTION 46

RESPONSE: Continued

3. WIND CLIMATOLOGY

Plume dispersion characteristics will depend upon wind velocity. There are no detailed long term wind data available from the Princess area. The nearest location for which there are detailed wind data is at Coronation, Alberta, located approximately 100 miles north of Princess amid very regular terrain. Because of the relatively flat terrain which exists in southeastern Alberta, Coronation winds should be fairly representative of conditions at Princess.

The wind roses presented in figures 1 and 2 give average wind data for the "summer" (April - September) and "winter" (October - March) halves of the year. The length of the barb associated with each direction indicates the total percent frequency with which winds blew from that direction during the 10-year period 1957 - 1966 inclusive. The percent frequency of three indicated wind speed classes is shown by the thickness and length of the barb. Thus, for example, Figure 2 shows that north-northwest winds with speeds greater than 18 mph occurred during the "summer" half of the year about two percent of the time. The percent frequency of calms is given in the centre of these figures.

The two wind roses are quite similar with northwesterly winds being the most common. Easterly winds occur more frequently in the "summer" than in the "winter". It is interesting to note that southerly winds are more common during the winter half of the year.

Figures 1 and 2 indicate that strong winds are relatively rare. On an annual basis, wind speeds exceed 25 mph only 1.7 percent of the time. The low frequency of strong winds is illustrated in Figure 3 which shows the percentage of time that the wind was from the given directions at speeds of 25 mph and greater. As shown, wind speeds of this magnitude are mostly associated with northwesterly directions.

A further analysis of the wind data indicated that wind speeds exceeded 40 mph approximately 0.03 percent of the time. There were no recorded hourly average wind speeds greater than 46 mph.

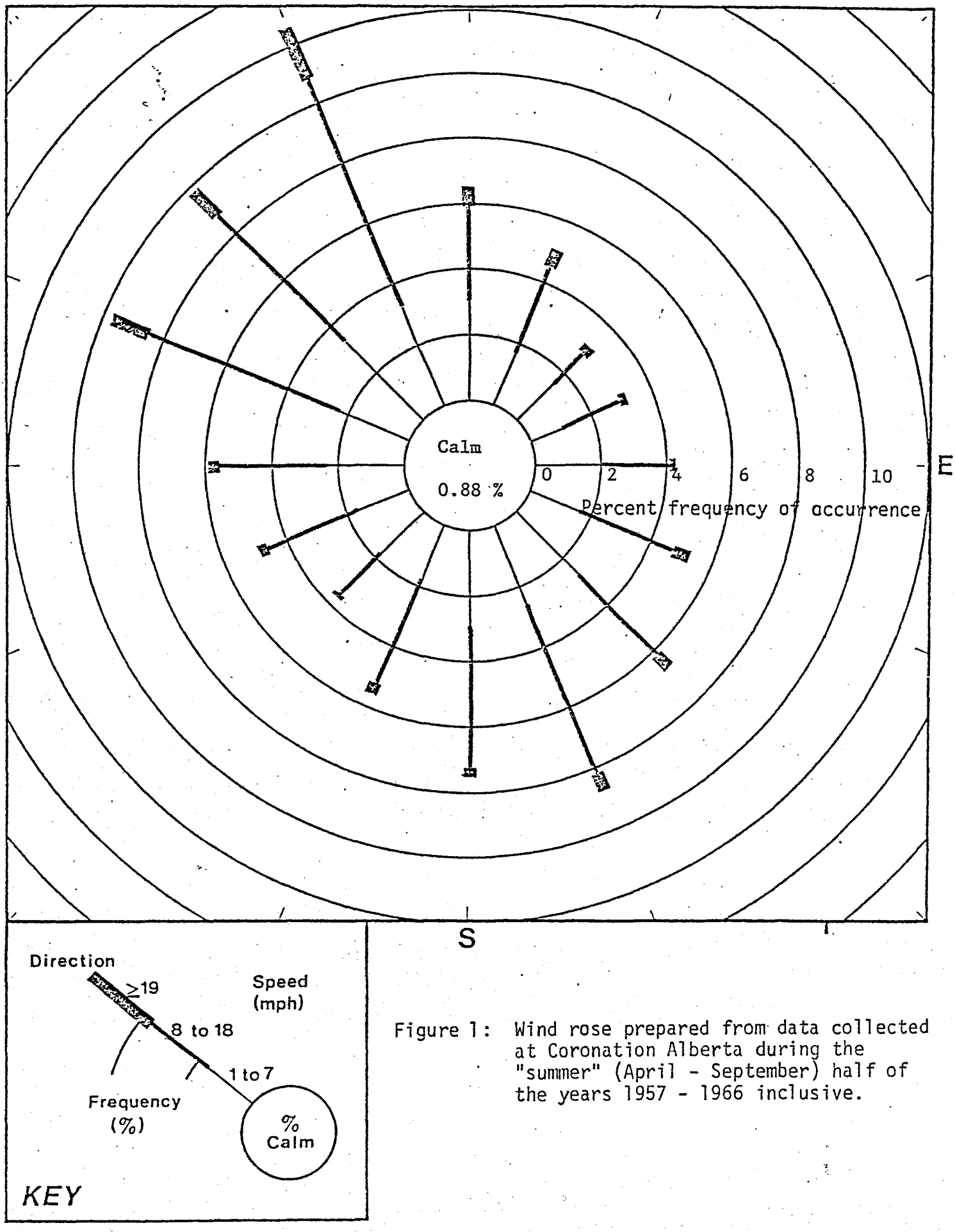
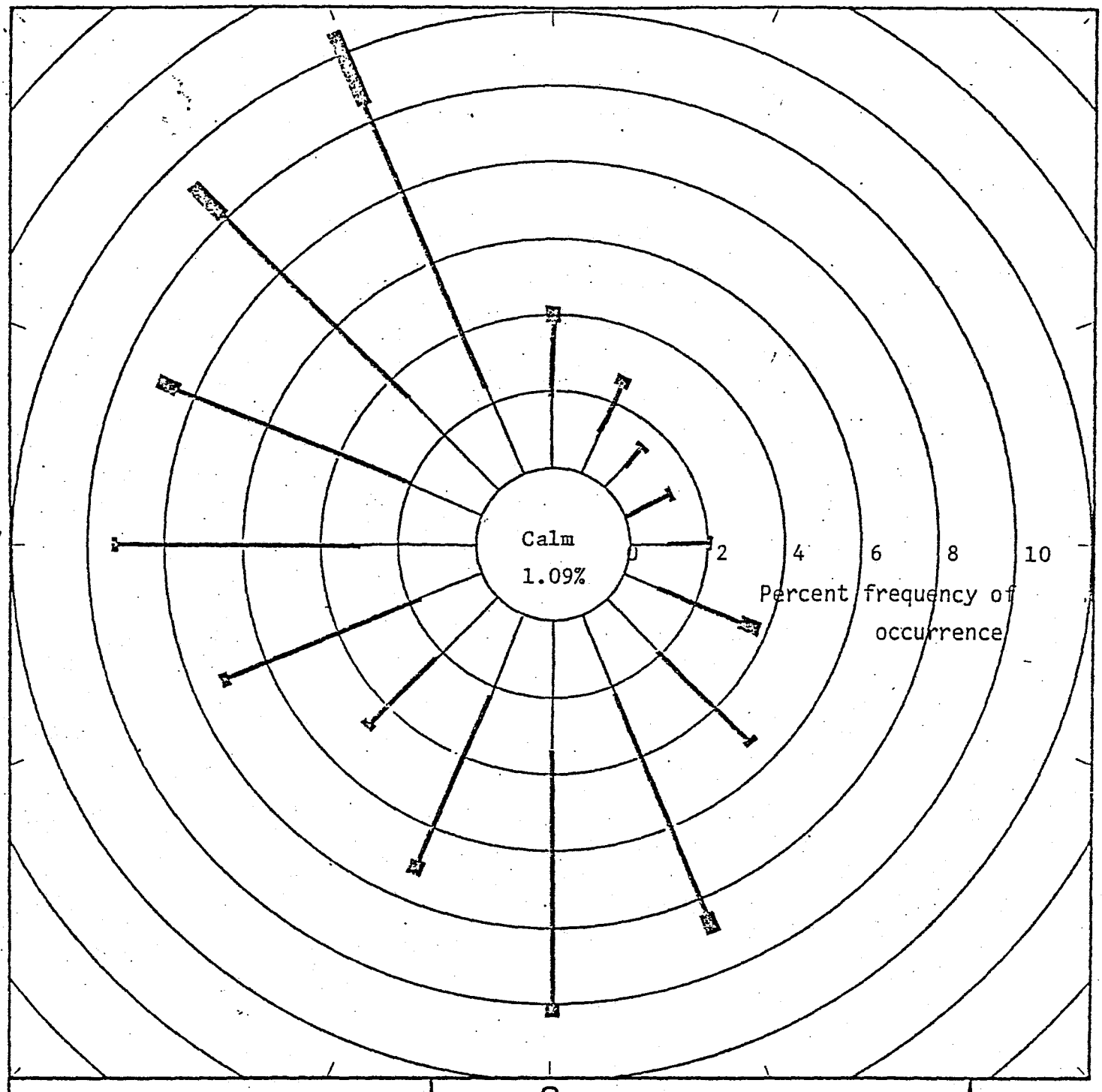


Figure 1: Wind rose prepared from data collected at Coronation Alberta during the "summer" (April - September) half of the years 1957 - 1966 inclusive.



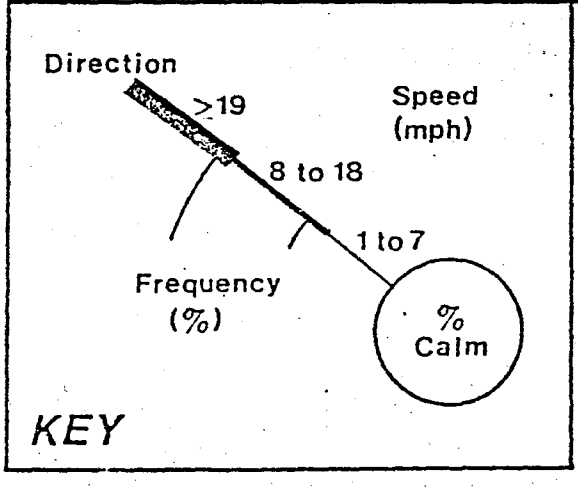


Figure 2: Wind rose prepared from data collected at Coronation Alberta during the "winter" (October - March) half of the years 1957 - 1966 inclusive.

QUESTION 46

RESPONSE; Continued

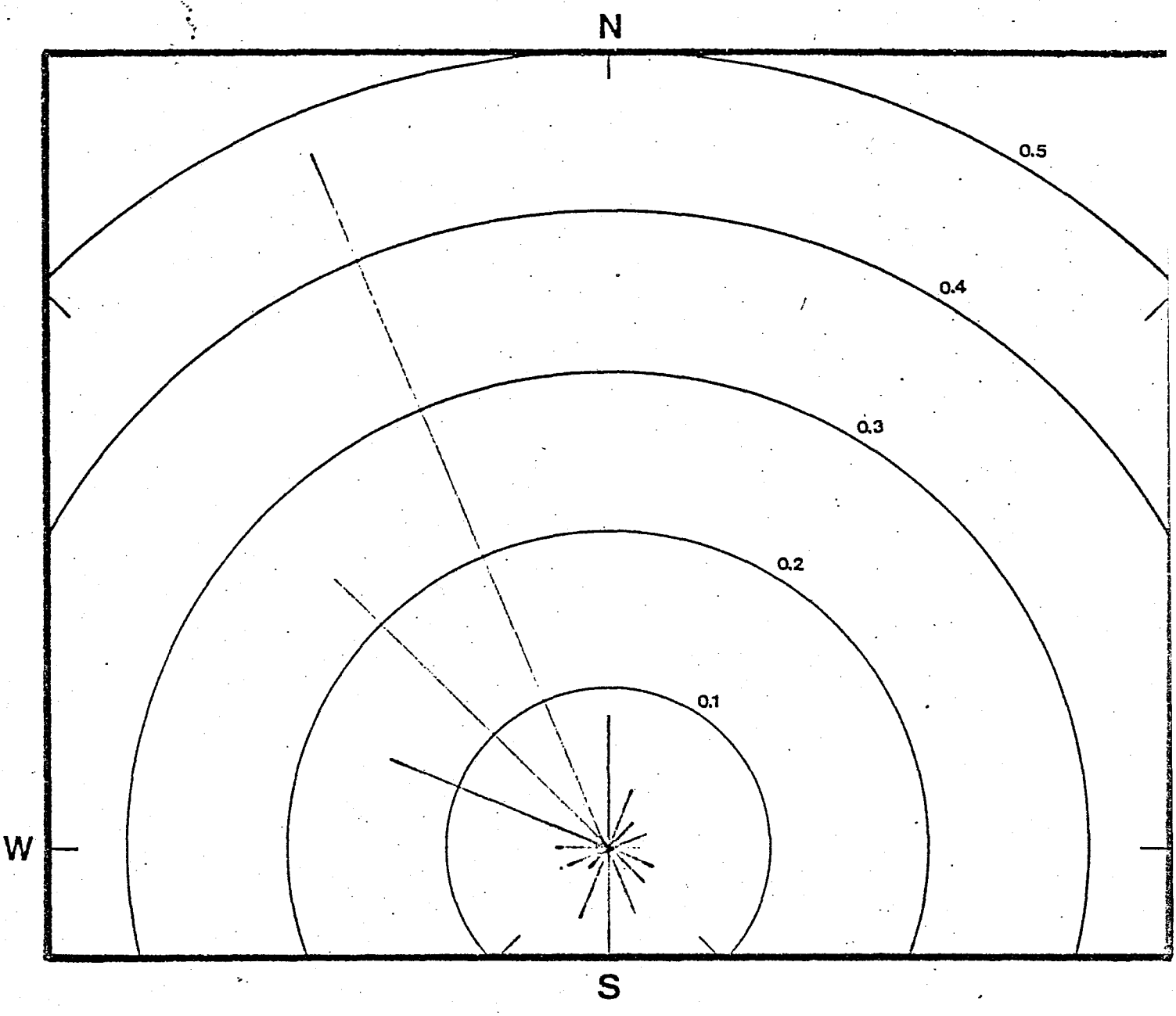


Figure 3: Frequency of occurrence as a function of wind direction for wind speeds of 25 mph and greater. Data were collected at Coronation during the years 1957 - 1966 inclusive.

QUESTION 46 RESPONSE: Continued

4. ESTIMATIONS OF GROUND-LEVEL AIR QUALITY

There are three atmospheric flow conditions that are often considered in stack design. These are: a) chimney downwash, b) building downdrafts, and c) neutral atmospheres with high wind speeds. The stack for the Princess "D" compressor station should be designed so that air quality problems for these three atmospheric conditions are avoided.

4.1 Chimney downwash

Downwash is produced by vortices shed from the leeward side of a chimney. Effluent may be entrained into these vortices, drawn down the chimney side and deflected to the ground.

The downwash phenomenon usually occurs at high wind velocities. Problems associated with downwash may be avoided by having an effluent velocity in excess of the wind speed at all times.

The stack exit velocity of the compressor "D" station when operating at 55 percent capacity is approximately 60 ft s^{-1} (41 mph). This should be sufficiently large to avoid downwash problems in the Princess area during the summer when average hourly wind speeds exceed 40 mph only about 0.03 percent of the time.

During the winter months the compressor station will be operating closer to full capacity and the exit velocity will be about 110 ft s^{-1} (75 mph). This high exit velocity will be sufficient to ensure that downwash problems are avoided during these months when average hourly wind speeds generally do not exceed 46 mph.

4.2 Building downdrafts

Effluent emitted from stacks may be entrained into highly turbulent wakes generated on the leeward side of buildings. Stacks located near buildings must be designed to avoid high ground-level pollutant concentrations that

might occur as a result of this entrainment. Experience has shown that a turbulent wake may extend to 1-1/2 times the building height. A stack must be designed such that its effluent is emitted well above this wake in order to ensure an absence of downdraft problems.

In the event of plume entrainment, the resulting maximum ground-level concentrations may be estimated from the following equation (Gifford, 1968):

$$\chi = \frac{Q \cdot 10^6}{\pi U \left(\sigma_y^2 + \frac{0.67A}{\pi}\right)^{1/2} \left(\sigma_z^2 + \frac{0.67A}{\pi}\right)^{1/2}} \qquad (1)$$

Where: χ = maximum ground-level concentration (ppm);
Q = rate of contaminant emissions ($ft^3\ s^{-1}$);
U = mean wind speed ($ft\ s^{-1}$);
σ_y, σ_z = the horizontal and vertical diffusion coefficients respectively (ft);
A = the effective building cross-sectional area normal to the wind (ft^2).

According to Strom (1968), the most adverse building downdraft effects occur when the wind direction is normal to the building diagonal.

It is important to observe that, according to theory, the Princess "D" station's small stack to building height ratio should result in building downwash problems.

4.3 Neutral atmosphere with high winds

The maximum ground-level concentration of a given plume constituent which might result from atmospheric dispersion is usually evaluated with a Gaussian model (Appendix A) as applied to neutral atmospheric conditions and high wind speeds. As the wind speed increases, plume rise decreases and consequently the ground-level concentration of a given plume contituent tends to increase. Beyond a critical wind speed, plume rise becomes negligible and calculated ground-level concentrations tend to remain nearly

QUESTION 46 RESPONSE: Continued

constant as wind speed increases or they may even tend to decrease. For large sources, this critical wind speed usually occurs at about 30 mph.

Diffusion calculations have been performed under neutral atmospheric conditions with the assumption that the plant plumes have Gaussian distributions with standard deviations as given by Pasquill (1961).

Plume rise for use in the Gaussian model for the flat terrain conditions which characterize the Princess area was taken as the amount predicted by the "2/3 law" plume rise formula which is applicable to large heat sources. Large heat sources are defined as those emitting in excess of 6,000 kcal s^{-1}. The Princess "D" compressor station, when operating at about 55 percent capacity, emits in excess of 12,000 kcal s^{-1}. It thus easily qualifies as a large heat source.

In accordance with the recommendations of Briggs (1971), it was assumed that plume rise would terminate at a distance of 3.5 X* from the source. The X* quantity is a function of heat flux from the stack. A conservative value of 1.2 was selected for the proportionality constant contained in the "2/3 law" formula. This is 3/4 of the value recommended by Briggs (1972). A detailed discussion of the 2/3 law is contained in Appendix B.

QUESTION 46 RESPONSE: Continued

5. RESULTS OF AIR QUALITY OBSERVATIONS

A ground-level air quality monitoring program was conducted at Princess from April 28 to May 31, 1975. A mobile trailer instrumented with devices for measuring NO_x concentrations and wind velocities was situated within about 200 feet of the compressor station building. On a few occasions, during wind speeds of approximately 30 mph, relatively poor air quality was observed.

Chimney downwash should not have been a problem because the stack exit velocity was appreciably larger than the wind speed. Theoretical calculations using the theory of section 4.3 show that in the absence of building downdrafts, ground-level NO_x concentrations should be very low. Application of Equation (1) indicates however, that building downdrafts could adversely affect air quality.

It appears as though building downdrafts could present an air quality problem at the Princess compressor station. Consideration should therefore be given to increasing the stack height such that its effluents are emitted above the region of wake turbulence.

QUESTION 46 RESPONSE: Continued

REFERENCES

Briggs G. A. (1971) *Some Recent Analyses of Plume Rise Observations* in Proceedings of the Second International Clean Air Congress H. M. Englund and W. T. Berry, Editors - Academic Press, New York and London 1029-1032

_____ (1972) *Chimney plumes in neutral and stable surroundings* Atmospheric Environment pp 507-510

Gifford F. A. (1968) *An outline of theories of diffusion in the lower layers of the atmosphere* pp 65 - 116 Meteorology and Atomic Energy David H. Slade, editor - available as 710-24190 from Clearinghouse of Federal Scientific and Technical Information, Springfield, Virginia 22191

Pasquill F. (1961) *The estimation of dispersion of windbourne material* Met. Magazine 90 pp 30-49

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QUESTION 46

RESPONSE: Continued

APPENDIX A

THE GAUSSIAN MODEL FOR PREDICTING DIFFUSION FROM A CONTINUOUS POINT SOURCE

The well-known Gaussian distribution has been assumed as a continuous source diffusion model by Sutton (1932), Frenkiel (1953), and many others. Rectangular co-ordinates are used in the model with the x co-ordinate in the direction of the mean horizontal wind $\bar{U}$, z in the vertical direction and y in the lateral.

The usual simplifying assumptions are:

(i) Diffusion in the x direction is neglected in comparison to transport by the mean wind.

(ii) Within the plume, the pollutant is considered to have a Gaussian distribution with lateral and vertical standard deviations $S_y(x)$ and $S_z(x)$ respectively.

(iii) The turbulence is considered to be homogeneous and stationary.

(iv) The ground is considered to be a perfect reflector of the pollutant.

Within these assumptions, the continuous point source diffusion formula can be derived:

$$\frac{\bar{u}\,X\,(x,y,z)}{Q} = \frac{1}{2\pi S_y S_z}\, e^{-\frac{y^2}{2S_y^2}} \left[e^{-\frac{(z+H)^2}{2S_z^2}} + e^{-\frac{(z-H)^2}{2S_y^2}} \right] \quad (a)$$

Where:

X = time average value of the concentration

Q = rate of emission from a continuous point source

H = effective height of the plume above the terrain

Any consistent set of units may be used.

The problem in using equation (a) arises in predicting the values of S_y, S_z and H.

Strictly speaking, the Gaussian diffusion model applies only under very regular terrain conditions. Batchelor (1949) conjectured, however, that the Gaussian function may provide a general description of average plume dispersion because of the essential random nature of turbulence by analogy with the central limit theory of statistics. Lin and Reid (1963) also point out that the turbulence generated wind fluctuations which result in plume dispersion approximate a Gaussian distribution fairly closely. Moreover, experimental studies by Hay and Pasquill (1957), and Barad and Haugen (1959), indicate that the Gaussian plume formula should have a wide area of practical applicability in the atmosphere.

RESPONSE: Continued

REFERENCES: Appendix A

Barad, M.L. and D.A. Haugen (1959) *A Preliminary Evaluation of Sutton's Hypothesis for Diffusion from a Continuous Point Source* J. Meteor. 16 (1), pp 12-20

Batchelor, G.K. (1949) *Diffusion in a Field of Homogeneous Turbulence I. Eulerian Analysis* Australian J. Sci. Res. 2 pp 437-450

Frenkiel, F.N. (1953) *Turbulent Diffusion - Mean Concentration Distribution in a Flow Field of Homogeneous Turbulence* Advan. Appl. Mech. (3) pp 61-107

Hay J.S. and F. Pasquill (1957) *Diffusion from a Fixed Source at a Height of a Few Hundred Feet in the Atmosphere* J. Fluid Mech. 2 (Part 3), pp 299-310

Lin C.C. and W.H. Reid (1963) *Turbulent Flow Theoretical Aspects* Handbuch der Physik Vol. 8, Part 2, pp 438-523

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APPENDIX B

THE 2/3 LAW PLUME RISE FORMULA FOR NEUTRAL ATMOSPHERES

In the last ten years, there have been many studies of plume rise from large heat sources. There seems to be a general consensus (eg. Slawson and Csanady, 1967; Briggs, 1965; Bringfelt, 1969; Carpenter et al., 1971; Hewett et al., 1971; Thomas et al., 1970) that these buoyancy-dominated plumes rise in a neutrally stratified atmosphere according to the "2/3 law."

$$h = \frac{C\, x^{2/3} F^{1/3}}{u} \qquad (b)$$

Where: C = a dimensionless constant
x = downwind distance
F = bouyancy flux
u = mean wind speed along direction of plume

For hot, dry effluents whose mean molecular weight is close to that of air, the bouyancy flux may be defined as:

$$F = \frac{g}{\pi}\left(\frac{T_s - T_a}{T_a}\right) Q_T$$

Where: g = acceleration due to gravity
T_s = absolute temperature of the stack gases
T_a = absolute temperature of the air
Q_T = rate at which total effluent is leaving stack

This definition of F assumes that the effective density of the stack gases is approximately constant and equal to that of the air which is a valid assumption away from the immediate vicinity of the stack.

For sources of known heat release such as flare stacks, the bouyancy flux F may be defined as:

$$F = \frac{g}{\pi} \quad \frac{Q_H}{C_p \rho T_a}$$

Where: Q_{Ht} = rate of heat release
C_p = specific heat of air at constant pressure
ρ = density of dry air

The above equation may be applied with any consistent set of units.

It may be shown that the "2/3 law" expressed in equation (b) has a sound theoretical basis which incorporates energy, momentum and mass conservation laws.

There have been many empirically derived values for the dimensionless constant C, ranging from 1.2 to 2.6. After reviewing the literature, Briggs (1972) recommends that a conservative value of 1.6 be adopted.

Studies have been performed in Alberta in order to determine plume rise behaviour from two large heat sources: the Edmonton Power Clover Bar generating station and the Petrogas sulphur plant at Balzac. The first study was undertaken by Western Research & Development, while the second was done by Mr. Vinodh Kumar as a master's thesis in Mechanical Engineering at the University of Calgary. Both studies showed that plume rise was well-approximated by the 2/3 law when C = 1.6. Results of these two plume rise experiments have been communicated to the Alberta Department of the Environment.

Following a recommendation by Briggs (1971), Equation (1) was applied for values of $x<3.5\ x^*$. For downwind distances greater than this amount, however, x was assumed to have a constant value equal to $3.5x^*$ where:

$$x^* = 14m\ (F/m^4/sec^3)^{5/8} \text{ when } F<55\ m^4/sec^3$$
$$x^* = 34m\ (F/m^4/sec^3)^{2/5} \text{ when } F>55\ m^4/sec^3$$

REFERENCES - Appendix B

Briggs, G.A. (1965) *A plume rise model compared with observations* J. Air Pollut. Control Assoc. 15 pp 433-438

_____ (1971) *Some Recent Analyses of Plume Rise Observations* in Proceedings of the Second International Clean Air Congress H.M. Englund and W.T. Berry, Editors - Academic Press, New York and London 1029-1032

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QUESTION 47

What would be the rate of fuel consumption for the gas turbines driving the gas compressors and the propane compressors at each site in Alaska and Canada? What would be the rate of water vapor emissions from these sources?

RESPONSE:

The rates of fuel consumption for the gas turbines driving the gas compressors at each compressor site are given in Exhibit Z-5, Volume I, Section 1.B.7. Row eight on each of the flow diagrams gives daily consumption.

Typically less than 20 PPM of CO is observed in gas turbine exhausts and therefore complete combustion may be assumed. It is then possible to estimate the amount of water vapour produced by applying the stoichiometric equation for the combustion of methane:

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

In addition using the gas data given in Section 2.B.5 of the exhibit referenced above, it is possible to calculate the water vapour emissions as approximately 105 pounds of water produced per MCF of consumed fuel gas.

QUESTION 48

Page 4-13 of Exhibit Z-1, Vol. 1 states, "Once the station becomes operable, monitoring and inspection programs will be conducted on a regular basis . . ."

a) Would air pollutants be monitored at each site in Alaska and Canada? If so, list those to be monitored?

b) Describe the sampling techniques and the frequency and duration of sampling.

RESPONSE:

a) NO_x will be monitored at sites as described in the answer to Question 46.

b) This is described in the answer to Question 46.

QUESTION 49

Page 4-10 of Exhibit Z-1, Vol. 1 states, "Abatement procedures including stack silencers, vegetative screening and/or earthen barriers will be site specific depending upon location, topography or sensitivity of large mammal species inhabitating the area."

a) What criterion would be used to determine the maximum acceptable noise levels for a specific compressor site?

b) Would background noise surveys be conducted at any compressor sites? If so, describe the techniques frequency and duration of data collection.

RESPONSE:

a) Considering that all of the compressor sites are in areas where people are not very far away it is unlikely that noise levels will be governed by environmental criteria but probably by government regulations which are discussed in the answers to questions 50 and 51.

b) Depending on governmental and environmental requirements background noise surveys would be conducted if necessary. If this is the case a consulting group would be used. As each consulting group utilize different approaches to their testing procedures the details would not be decided until a firm was selected.

QUESTION 50

For each of the proposed compressor sites in Alaska and Canada:

a) What would be the mean and maximum noise levels at the site boundaries resulting from normal operation of the station?

b) What would be the maximum noise levels at the site boundaries resulting from gas blowdown and emergency events?

c) What would be the frequency and duration of gas blowdown?

d) Which compressor sites would have blowdown silencers?

e) Provide a description of all noise suppression devices.

RESPONSE:

a) At the present time, the only applicable code is that imposed by the Alberta Energy Resources Conservation Board which specifies that the noise emitted by any resource facility must be limited to an effective level of 50 dBA at night and 65 dBA in daytime measured ten feet from the nearest residence on the side adjacent to the noise source. All Company compressor stations meet this criteria through the use of noise abatement procedures now incorporated into all Company compressor stations.

Noise measurements have been taken in the vicinity of a number of compressor stations operated by the Company. These include both turbine driven centrifugal compressors and gas engine driven recriprocating compressors. Engine horsepower varies widely up to a maximum of 35,000 hp. The noise levels vary over a wide range and reflect the effectiveness of the silencing measures taken at the station rather than the engine horsepower.

The proposed new compressor sites are to be larger than present Company stations. The new sites will be approximately 1200 feet long and 1200 feet wide. All equipment on site will be located at least 350 feet from the station boundary. With these distances between the site boundary and major noise sources in addition to improved silencing techniques, it is reasonable to expect noise levels even lower than those measured at existing stations. Maximum noise levels at the site boundary of stations are expected to be 50 dBA to 55 dBA with a mean of about 51 dBA.

QUESTION 50

RESPONSE Continued

b) In the event of an emergency causing a gas blowdown, a maximum noise level of approximately 105 dBA would be expected at the site boundary for a maximum of two to five minutes.

c) Blowdown times at existing Company stations vary from a minimum of 20 seconds to a maximum of 150 seconds. However, the maximum sound level occurs at the start of the cycle and lasts only a few seconds.

The frequency of blowdowns normally varies with the time from originally commissioning the facility. During initial startup of the stations when the equipment is first tested, more blowdowns occur and may number five or six for this period. The frequency of the blowdowns decreases as operating experience is accumulated and a blowdown may occur only once every six to twelve months during normal operation.

d) The Company normally does not install blowdown silencers as most of its stations are in remote locations. However, in the event that a compressor site is near a community, a residence or environmentally sensitive area, then blowdown silencers would be utilized.

e) The noise sources to be controlled at each compressor station include:

(i) gas turbine inlet and exhaust
(ii) turbine and compressor casing noise inside the building
(iii) external oil coolers, bleeds and vents
(iv) yard piping

The noise arising from gas turbine inlet and exhaust will be controlled by the use of silencers supplied under contract by the gas turbine manufacturer. The power turbine casing noise will be limited by the use of insulating jackets on the equipment. In addition, the walls of the compressor building will be acoustically treated with fibreglass, acoustical insulators and a perforated metal liner for maximum noise attenuation.

Externally mounted oil coolers, bleeds and vents will be provided with low speed fans, mufflers and silencers to limit noise levels. All yard piping that is not below ground will be insulated.

QUESTION 51

Have noise levels been monitored at the existing compressor sites which are to be fitted with additional compressors? If so, provide the results of these surveys.

RESPONSE:

The Company currently has an ongoing noise survey program. To date, noise readings have been largely taken within compressor station boundaries to ensure compliance with Provincial Board of Health Regulations. As of January 1, 1974, the following are the noise level and duration regulations:

Period not exceeding:	
16 Hours	- 80 dbA
8 Hours	- 85 dbA
4 Hours	- 90 dbA
2 Hours	- 95 dbA
1 Hour	- 100 dbA
1/2 Hour	- 105 dbA
1/4 Hour	- 110 dbA
1/8 Hour	- 115 dbA

Future studies will include the collection of more boundary and offsite data than has been the case to date.

The following table is a summary of representative spot noise readings taken at three sites where additional compression is proposed.

Station	Date	Location	Reading dbA
Didsbury	Jan/75	Control Room	66
		Lunch Room	55
		Shop	54
		Inside Unit Building	105
		Inside Meter & Regulating Building	81
Rocky Mountain House	Dec/74	1/2 mile S.E. of station	45
Princess	Dec/74	Inside Yard	73
		Controls Shop	66
		Control Room	63
		8 feet outside Unit Building	88
		Inside Unit Building	108

Surveys have not been carried out at McLeod River, Lodgepole, Beiseker, Hussar and Clearwater.

QUESTION 52

What increase in noise levels would result from the compressors to be installed at existing sites?

RESPONSE:

Additional compression installed at an existing site should cause only a small increase in the overall level. This should be in the order of 3 dB to 5 dB.

All of the sites presently have one or more gas compressor packages installed. In addition, these stations already have the noise suppression devices mentioned in question 50 (e). Assuming the additional compression would constitute a noise source equal in magnitude to the existing facilities, acoustical theory predicts the noise level to be 3 dB higher than before.[1] Other auxiliary equipment including coolers, piping, scrubbers could add another 2 dB. We anticipate no major noise problems will be encountered at existing sites.

1. Beranek, Leo L., Noise Reduction. McGraw Hill, 1960. pp. 51-55.

QUESTION 53

Describe in detail the special design and construction measures which would be utilized in areas of high seismic activity or soil movement.

RESPONSE:

Due to the nature of geological formations existing in the province of Alberta the Company foresees no need for special pipeline design to minimize the effects of seismic activity or soil movement.

QUESTION 54

Has any special consideration been given the angle at which the pipeline would cross active faults? If so, discuss. Discuss in detail any other special designs or construction and operation procedures which would be used at fault crossings.

RESPONSE:

As no active faults have been identified along the proposed pipeline route through Alberta, the Company has not given any special consideration to the angle at which the pipeline would cross active faults.

QUESTION 57

What procedures would be implemented should placer deposits of valuable minerals be encountered during construction? Near Linda Creek (map D-8) there is a potential use conflict with placer gold mining operations. How would the applicant resolve this conflict and others of this type in Alaska and Canada?

RESPONSE:

There are no known placer deposits of valuable minerals which will be encountered during construction of the Alberta sections of the proposed pipeline. Should any deposits be uncovered the landowner and appropriate governmental agencies would immediately be advised. The deposits would then be evaluated and the pipeline route either moved or allowed to follow the original design if the deposits were not commercially significant.

QUESTION 58

Identify on a map the location and type of ground breakage and landsliding referred to on map D-13 of Exhibit Z-1, Volume 1.

RESPONSE:

Ground breakage and land sliding referred to on map D13 is not considered to be of the type which will lead to problems in the province of Alberta. The Company believes that it has delineated all areas of soil instability along the new pipeline proposed route and the right-of-way now in use.

QUESTION 60

Indicate those areas where the pipeline route crosses active slumps and other mass movement phenomenon. Describe the size and depth of materials involved.

RESPONSE:

Active slump areas have only been encountered along the pipeline route in Alberta descending from valley breaks to the valley floors of some of the major and minor water courses. All these areas which are adjacent to the pipeline right-of-way have been identified and avoided. Previous geotechnical work, ground and aerial observations and an on-going examination of core material from borings are identifying potential soil movement problems where corrective or avoidance procedures can be taken.

QUESTION 61

Avalanches and landslides are a virtual certainty over mountainous segments of the pipeline route and in many areas pipeline burial will not be significant protection. What design or construction methods will be used to shelter the pipeline in these areas?

RESPONSE:

The proposed route of the pipeline in Alberta does not cross mountainous terrain. Thus, avalanches and landslides are not a factor.

QUESTION 62

What is the maximum slope of the surrounding terrain in which the pipeline would be laid? Discuss the possibility of slumping or creep occurring in high slope areas which could damage the pipeline. What special design and construction features would be used in such areas? Discuss the procedures which would be used for erosion control and maintenance of slope stability.

RESPONSE:

The maximum slope of the surrounding terrain in which the Company's pipelines have been laid previously is about 40 degrees. Even in mixtures of sand, silty sands and clays, this slope is stable and can be revegetated provided ground and surface water can be diverted by catchment channels and berms away from the pipeline and off the right-of-way into the surrounding hillside which is generally stabilized by a thick root mat. Further measures to stabilize such hillside rights-of-way are the following:

1) the retention of the old root mat as much as possible
2) the use of sand bag breakers to prevent ground or surface water from following the pipeline ditch, and
3) the maintenance of ground water piezometric pressures as much as possible to avoid ground water flow into the pipeline right-of-way.

On long slopes, pipeline creep would be reduced by the use of anchors on the pipeline. On vertical slope areas, stakes will be driven into the ground both across and down the slope as indicators of any earth movement. Brush from trees and shrubs will be worked into the ground using the available construction equipment thus providing further surface stabilization of the soil against run-off erosion. Following this, revegetation by the addition of seeding and fertilizers will provide vegetative mat to reduce rain drop and run-off erosion.

QUESTION 63

In those areas underlain by substantial amounts of ice, describe the occurrence of uplift and/or subsidence due to changes in the volume of ice. What effect could this have on the proposed pipeline?

RESPONSE:

The route of the pipeline in Alberta only crosses areas of discontinuous permafrost and consequently, the occurrence of uplift and/or subsidence due to the changes in the volumes of ice is not a factor in the Alberta section.

QUESTION 65

Will the thermal influence of the operational pipeline extend to the surface? If so, how long a time span before this occur? How long until an equilibrium is achieved? What influence will it have in offsetting the degradation resulting from disturbance of the vegetative mat? Could there be a wind erosion problem in the interval between backfilling the trench and revegetation?

RESPONSE:

There have been no detrimental effects from thermal influence on the operational pipe line south of the Sousa compressor station. During construction of the Company's existing system wind erosion was non-existent between backfilling the trench and revegetation.

The new pipeline right-of-way west of the Sousa compressor station to the Alberta - British Columbia border extends through the southern limits of discontinuous permafrost. Permafrost at these latitudes is shallow and its equilibrium above the line will be affected. It will likely thaw within the first year of operation of the line and will not re-establish. Soil temperatures will be affected by seasonal temperatures and hence, a true equilibrium will not likely establish. Some subsidence will occur but this will be compensated by the berm over the pipe. Wind erosion in the interval between backfilling and revegetation is unlikely because the disturbed area will not exceed 20 feet and will be protected from wind by the vegetation on both sides of the right-of-way. In addition, much of the area has a high water table.

QUESTION 66

Will the operational pipeline alter the depth of the active layer? Could the ground freeze to the surface and alter the drainage patterns enough to impound water or divert water away from natural drainages?

RESPONSE:

The pipeline proposed by the Company will not carry chilled gas and therefore will not alter the depth of the active layer. The permafrost near the pipe may be melted as discussed in the answer to question 65. During winter, surface soils a short distance downstream from the compressor stations are expected to freeze. The pipeline berm at times other than winter is expected to alter extremely local drainage patterns but breaks in the berm will allow water to pass through thus preventing impoundment.

QUESTION 67

Provide detailed discussion of measures to be used to minimize frost heave associated with the freezing of soil around the pipe in thawed backfill, in river crossings, and in other areas with unfrozen or thawed soils.

RESPONSE:

Frost heave has not been evident in the Company's pipeline located in the Rainbow Lake area. The proposed route from Sousa west to the Alberta-British Columbia border is similar to that at Rainbow and consequently no frost heave problems are expected.

QUESTION 68

In the process of freezing, does the ground surrounding the pipeline create pressure on the outer walls? If so, how much pressure? What percentage of the pipe's compressibility does this represent?

RESPONSE:

See the response to question 67.

QUESTION 69

Is thaw related subsidence confined to the area immediately under the surface disturbed by construction operations, or can it radiate outward from the disturbed area due to increased thawing or crumbling of the vegetative mat and soil into the thawing area?

RESPONSE:

Subsidence will be confined to the disturbed area and will be compensated by the berm over the pipe. Beak 1975[1] studied the effect of a warm oil pipeline (south of Hay-Zama Lake) on discontinuous permafrost and found no severe problems. This resulted from the lack of permafrost at the depth of the pipeline. A similar situation would prevail with a warm gas pipeline through the area.

1. Environmental Impact Statement (AGTL South) 1975
Beak Consultants Limited, Calgary, Alberta.

QUESTION:70

Would there be any long-term thermal monitoring in the vicinity of pipeline to detect changes in the active zone? If so, how would this monitoring be done?

RESPONSE:

There would be no long term thermal monitoring in Alberta to detect changes in the active zone as research to date (Beak 1975)[1] in the southern portion of the discontinuous permafrost zone found no severe problems associated with warm pipelines and permafrost.

1. Environmental Impact Statement (AGTL South) 1975
Beak Consultants Limited, Calgary, Alberta.

QUESTION 71

How will surface drainage away from the pipe be accomplished? What preventative measures are proposed to avoid additional erosion of the active layer that might result?

RESPONSE:

The right-of-way will be restored as near as possible to its original condition, with all cuts backfilled and all fill areas removed. Steep hillsides will have water courses plowed across them to prevent water from running down the entire hill. There will also be sack breakers built around the pipe from the bottom of the ditch up to grade level to force any water to the surface which may be following the pipe. All creeks, streams and seasonal water courses are cleaned out after construction to prevent water from backing up after construction. In areas where wind erosion could be a problem, an effort will be made to reduce grading operations to a minimum so as not to break-up the ground surface.

Surface drainage will be permitted to pass over the pipe by means of intentional breaks in the berm. Sufficient breaks will be provided so as to distribute flows and prevent large volumes (capable of causing severe erosion) from passing over the pipe at any one place. Where heavy flows cannot be avoided, such as in stream bottoms, the berm will be levelled.

QUESTION 72

What methods would be used to control erosion in permafrost terrain where side hill cuts and/or fill are required. Include a brief description and sketches explaining the methods and their use.

RESPONSE:

There have been no problems associated with the warm pipeline and permafrost south of the Sousa compressor station and the Company anticipates a similar condition from the station west to the border. Thus erosion control will be the same as employed for the Company's operational system.

QUESTION 73

For each meandering stream crossed, discuss the probability of meander progression unearthing the pipeline over the life of the project.

RESPONSE:

Most of the necessary information will be made available by air photo interpretation. Adequate allowance will be made for possible future lateral migration of the stream channel due to meandering. For all preliminary design it is assumed that maximum scour depth could occur at any location throughout the width of the active flood plain. Where applicable, the width of the active flood plain will be specified, whether traversed by meandering or braided channels.

When crossing beneath a meandering stream with our pipeline, we shall choose a crossing point along a straight reach of the water course if this is possible. If this is not possible, we shall bury the pipeline to a depth of five feet below the meandering water course bed for some distance on each side of the present water course location. It is felt that each meandering stream will present its own particular problem and solution. It has been our practice to provide rip-rap along meandering stream banks to prevent encroachment of the pipeline right-of-way.

QUESTION 74

How would water be removed from the trenches during construction and what backfilling procedures would be used to prevent excessive water migration along the pipe?

RESPONSE:

During construction water from the trenches will be pumped to the spoil side of the right-of-way. The line is always plugged immediately behind lowering-in to prevent undo movement. This also serves to prevent water migration and in the infrequent areas where this will be a problem sand breakers will be used.

QUESTION 75

Provide a discussion and illustration of before and after construction of a typical road crossing, including all temporary and permanent erosion-preventive measures.

RESPONSE:

Pipeline crossings of main roads and highways are cased and crossed by the bore method while minor and local roads are crossed with heavy wall pipe by an open cut of the road bed.

Road crossings are located at level, dry places avoiding such areas as deep cuts, hill slopes, sloughs, ditch water and side hills.

Minimum design standards are:

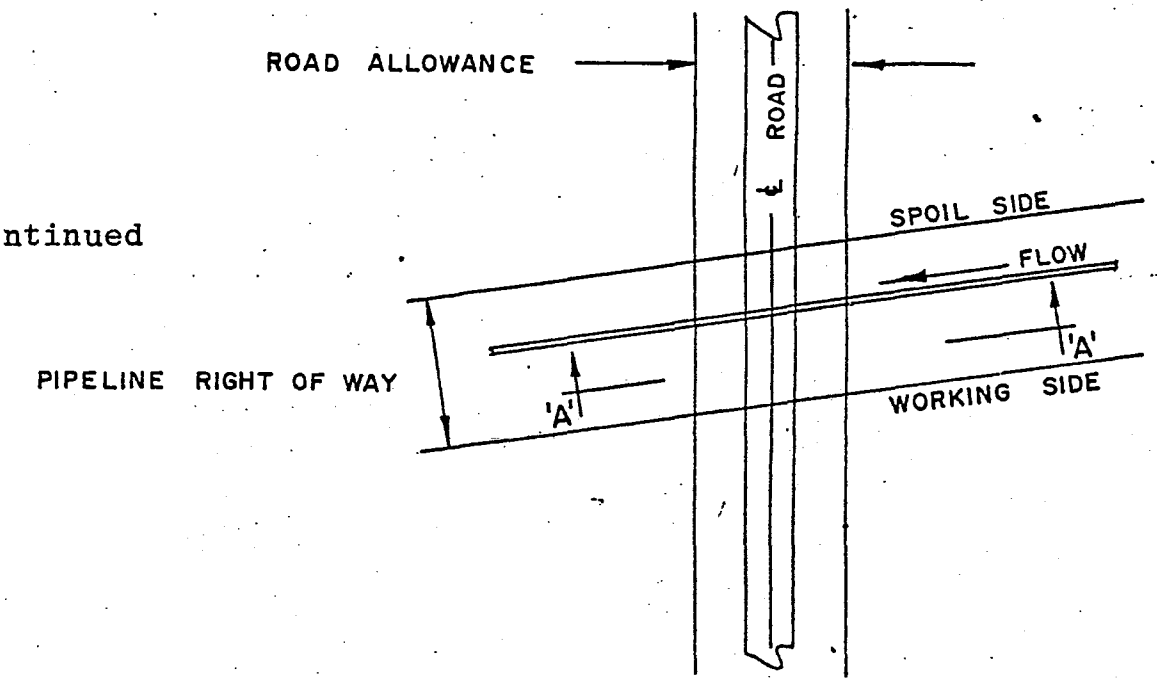
Ditch Cover	3'6"
Crown Cover	6'0"
Greatest Crossing Angle	70°

Profiles are given to the governing authority of all roads and highways so that any additional or special requirements are complied with during construction.

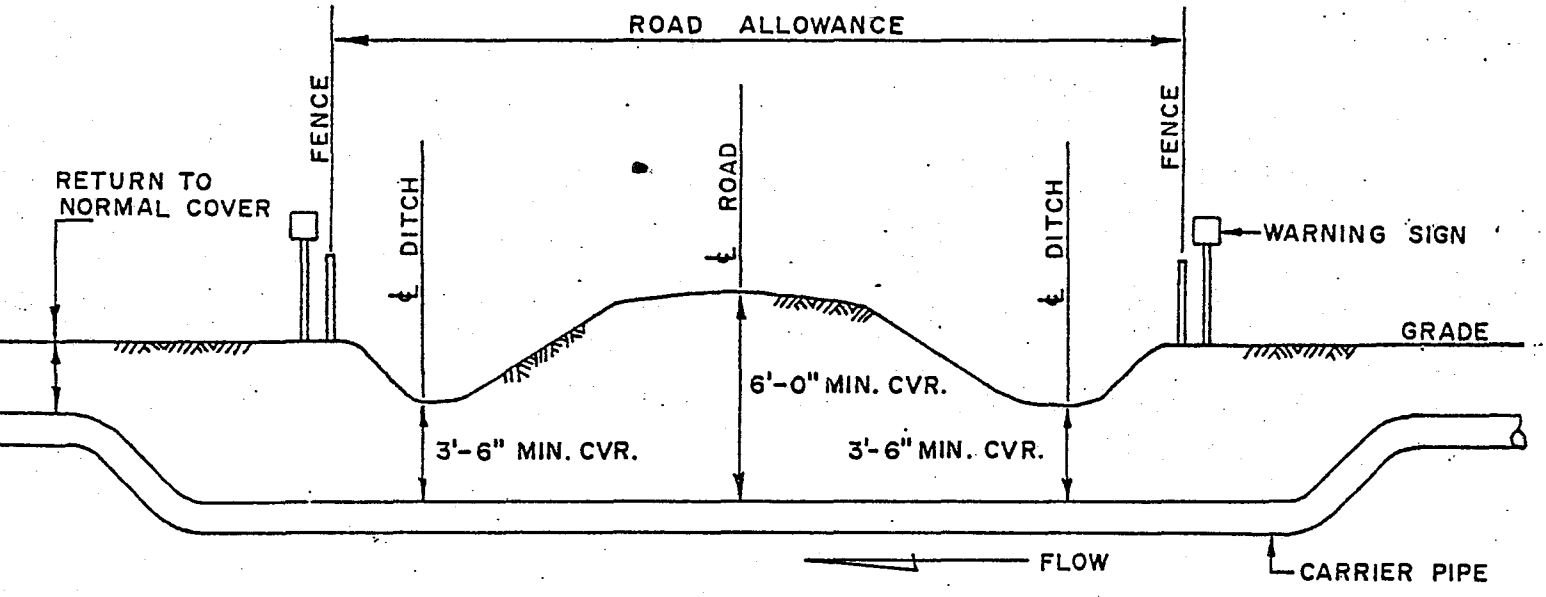
After construction, compaction and landscaping is done to return the road and road allowance to its original condition. The crossing is clearly marked with standard signs.

QUESTION 75

RESPONSE: Continued



PLAN VIEW



SECTION 'A'-'A'

TYPICAL ROAD CROSSING

QUESTION 76

How much excess or unusable backfill material and construction debris would require disposal during construction? How would the applicant dispose of it? How would it be protected from wind and water erosion until disposal?

RESPONSE:

Excess and unusable backfill material and debris consists of bush clearing, stumps, rocks, frozen spoil banks and daily construction material debris.

Clearing debris will be burned during this initial construction stage and unburnable material will be buried on the right-of-way. Rocks will be buried in areas of borrow pits and also used as rip-rap where required. Frozen spoil banks will be pushed in borrow pits and levelled.

Construction debris that is burnable will be collected each day and burned in pits dug for this purpose pursuant to environmental regulations. Scrap pipe will be salvaged and returned to Company pipe yards.

In cultivated areas, topsoil from the ditching areas of the right-of-way is conserved by windrowing it along the right-of-way boundary, adjacent to where the spoil pile will be. In this location it will not be subject to erosion from vehicular traffic and will be replaced after backfilling. Compressor station sites are handled in a similar manner.

QUESTION 77

Following construction, will a mound of earth be maintained on top of the buried pipeline along the route?

a) Will frozen, angular spoil be replaced as excavated or will it be secondarily treated to reduce air speces and subsequent melting and settling during the interval between construction and introduction of chilled natural gas into the pipeline system?

b) How will the ultimate height of the earth mound be determined?

c) If settlement or erosion occurs prior to stabilization of the right-of-way, does the applicant propose to repair the settlement or erosion? How would the repairs be effected?

d) Will drifting snow along the mound affect natural vegetation distribution and if so, where and what will happen?

RESPONSE:

Following burial of the pipeline a mound of earth normally known as a "roach" will be left along the center line of the pipeline. The roach will be maintained to provide adequate material during settlement. The roach is of the original top soil in cultivated areas and is constructed in such a manner that it will not inhibit the passage of normal farming equipment and thus allow the landowner to carry out his farming operations.

a) During winter construction the burial operation will be scheduled to follow close behind the ditching operation. Proceeding in this manner will prevent the spoil pile from freezing and allow for adequate compaction of the backfill. During burial the contractor is required to cover the pipe itself with a layer of backfill that is not lumpy or rocky. If this material is unavailable from the spoil pile it is hauled in. The contractor then carries out normal burial operations and is required to pack the ditch by continuously driving heavy equipment over the ditch line. Adequate compaction will be continuously monitored. In winter, it is best first to roach the line and have the contractor return in early summer to once again insure that subsidence has not occurred and if so, return the roach to its original condition. By having the contractor return in the summer, the frost has melted and spring rains have encouraged subsidence. Very few difficulties are anticipated after that, however, continuous line patrols will be able to visually collect any evidence of settlement and necessary repairs will be undertaken.

QUESTION 77

RESPONSE: Continued

b) The height of the roach will be directly related to the type of soil conditions encountered during construction, but will usually be about 12". Also relative to the height of the roach is the state of the backfill (i.e. frozen lumps or amount of rocks) and the landowner's instructions.

c) Settlement or erosion would be detected by ground patrol, air patrol or by local resident notification. Firstly, we will visit the site and determine how serious the settlement is. If of a minor nature and if it occurs on farm land with crops, then repairs will be discussed with the landowner and if he so requests, they will be effected after harvesting. This will only occur if the settlement is insignificant and if there is positively no dangers to the pipeline or its appurtenances. If the settlement is of a severe nature or if the landowner wishes it to be repaired immediately, the Company will effect necessary repairs immediately. For most damages of this nature, repairs would be done with rubber tired equipment so that access would cause a minimum of damage. Only if the subsidence is of a severe nature and immediate repair was necessary, would heavy equipment be used. Upon completing repair the soil will be cultivated and seeded on the instructions of the local landowner.

d) From past experience, the Company has encountered very little problem with drifting snow on the right-of-way. Much of the proposed line occurs in forested areas where wind is not a significant problem. The overall vertical height and the rounded sloping shape of the mound are such that no significant reduction in velocity on the lee side of the slope will occur, hence very little drifting. Any small drifts that were to occur would provide a supply of added moisture encouraging seed germination and growth.

Temperature changes resulting from slower melting would not significantly change species composition. Any change in species composition would be the result of natural species invasion, which would increase the species diversity, producing a more stable plant community over the right-of-way.

QUESTION 79

Discuss the impact of gravel removal from streams. Discuss the potential impact of material sites and the resultant increased suspended sediment load and siltation on aquatic systems. How can the potential disruption be alleviated by the choice of operating procedures?

RESPONSE:

The Company has not removed gravel from streams and rivers during construction and operation of its system and will not do so at any time in the future in Alberta. Therefore, increased sediment loads in streams and rivers from gravel removal will not occur.

QUESTION 80

The applicant has estimated gravel requirements at about 7 million cubic yards for the workpad and haul road in Alaska. How was this number estimated? Please indicate over what milepost intervals each construction mode would be used in Alaska and Canada (See Exhibit Z-2, Section 1). What portions of the route, if any, would not require a fabricated workpad? Are there any portions of the Alyeska workpad that would have to be reconditioned prior to use in this project? At what milepost intervals would reconditioning be required and how extensive would these repairs be? What would be the quantitative effect of these repairs on the gravel requirements? Indicate what borrow sites could be used and the estimated reserves at each.

RESPONSE:

Winter construction is proposed in areas along the Alberta route where muskeg inhibits the movement of heavy machinery. Workpads requiring large quantities of gravel have not been anticipated at this time. However, gravel will be required at all above ground sites. Developed gravel pits for road construction throughout all construction areas are abundant and will be utilized.

QUESTION 81

How many miles of access roads would need to be constructed for the Alberta Gas mainline looping project? Estimate gravel requirements needed for these roads and indicate the sources from which gravel would be obtained. Identify any new gravel and other material storage areas needed for the Alberta Gas looping project and the acreage required.

RESPONSE:

The only new access roads in the Alberta portion of the project will be access roads to the seven new compressor sites. These new roads will total approximately 26 miles and about 117,000 cubic yards of gravel will be used (at a maximum rate of 4,500 cubic yards per mile).

No new gravel or other material storage areas will be required as gravel will be obtained from Alberta Department of Forestry, municipal, or commercial gravel pits already established.

QUESTION 82

What is an estimated extent of disturbed albedo around gravel pads and roads (i.e., around a typical compressor station pad)? What area would be affected at borrow pits?

RESPONSE:

The Company does not consider albedo disturbance resultant from the removal of the vegetative mat at gravel pads, roads, etc., to be a problem since it is expected that only discontinuous permafrost will be encountered and even that will be to a shallow depth.

QUESTION 83

Provide a list of the agencies which have the responsibility for designating and approving borrow sites for gravel.

RESPONSE:

It is not anticipated that any new gravel pits will have to be developed. If it becomes necessary to develop new gravel sources, approval will be obtained from one of the following:

1. Alberta Department of Lands and Forests
2. The local authorities (ie: Counties, Municipal Districts, and Improvement Districts)
3. The landowner

QUESTION 84

How will materials sites (pits, quarries, etc.) be restored or reclaimed?

RESPONSE:

Normally materials sites will be restored by sloping and grading and hydro-seeding. Some sites may be reclaimed for use as equipment storage sites, wildlife or cattle watering holes, or water reservoirs for highway maintenance or fire fighting.

QUESTION 85

Does the applicant intend to utilize workpads constructed of snow and/or ice on any portion of the proposed route? If so, provide milepost intervals, method of construction of the workpad, the amount of water required, and its source.

RESPONSE:

Construction within the Province of Alberta will not involve workpads constructed of snow and/or ice. The snow cover will be removed and the surface allowed to freeze along the working side of the pipeline right-of-way in accordance with procedures for winter construction developed and used by the Company since 1965.

QUESTION 86

If a water/methanol solution is used for hydrostatic testing would a leak or spill of a water/methanol solution in fish overwintering or spawning areas be expected to exceed the medain lethal dose for any fish? If so, what preventative measures would be expected to be taken in the event of a testing, what temperature differential would be expected between the hydrostatic testing material and the water of fish overwintering and spawning areas at the time of testing? Would a spill or leak of this warm hydrostatic test water have any effect upon the overwintering or spawning of the fish? What effect would spills have on water quality and biota in general?

RESPONSE:

A water/methanol solution will not be utilized but will be substituted with a warm water medium for testing. The test fluid will be maintained at a temperature between $0^{o}C$ and $2^{o}C$, not significantly different from the natural temperature conditions of the water. Such a temperature differential, even under concentrated conditions, would have a negligible effect on either the flora or fauna within the watercourse. Further, under fall/winter conditions, virtually no temperature stratification occurs, resulting in constant density conditions throughout the entire depth. Because of similar densities rapid mixing should occur. The resultant small increase in oxygenation also produces a favourable condition for the overwintering or spawning of fish. The magnitude, however, of either positive or negative effects would be negligible or non-existent.

QUESTION 87

Assuming that the mound of earth over the pipeline will affect local drainage and the applicant proposes measures to redistribute surface flows,

(a) Will this redistribution of local drainage tend to develop plant communities which have a preponderance of plant species requiring wet environments on the upslope side of the mound of earth and plant species requiring dry environments on the downslope side?

(b) How far back from the mound would shifts occur in the existing natural vegetation?

(c) Would a linear distribution of wet, dry plant communities along the mound focus attention on the pipeline, and if so, how would aesthetic values be affected?

(d) Does the proposed design of surface drainage through the mound of earth over the pipeline have any potential for formation of icing or ice dams which in turn would impound waters on the upslope side of the pipeline? If so, would impoundment have an adverse impact on plant species?

RESPONSE:

(a) The redistribution of local drainage by the pipeline berm will be of short duration. Generally, little evidence will remain of the berm one year after construction because of the settling of the soil. Thus, ponding behind the berm will be of short duration and of insufficient time for hydrophytic communities to develop on or up slope areas. Moreover, much of the northern portion of the proposed route is along existing right-of-way through lowland. In well drained areas, the pipeline berm is again not expected to alter local drainage for even a short period and would not alter the distribution of plant communities nearly to the extent of natural processes such as beaver ponds. Further, where drainage diversion is suspected to occur, berm breaks will be inserted.

(b) Shifts in the natural vegetation are not expected to occur to a significant degree for the reasons outlined above.

(c) The proposed pipeline is to be constructed along the existing right-of-way which has been maintained by the the Company. The right-of-way through the forested areas is not aesthetically displeasing as it is difficult, in many areas, to distinguish a pipeline from the many seismic lines interlacing this northern region.

QUESTION 87

RESPONSE: Continued

(d) Local drainage across the berm is expected to be minor except in streams and river valleys. Here the pipe is buried a minimum of 5 feet below the water course and no berm is placed over pipeline.

QUESTION 88

On page 3 - 38 of exhibit Z-1, Volume 1, the applicant indicates that the pipeline and frost bulb "would have considerable effect subsurface water supplies and movement". The applicant is requested to indicate what the magnitude of the effect would be under the conditions to be expected along the entire route in Alaska and Canada with and without specific mitigating measures.

RESPONSE:

Since the Company intends to operate a warm pipeline within the province of Alberta, no consideration of frost bulb formation need be considered.

QUESTION 90

What action, if any, would be taken should a large sidehill icing condition occur? How could icings have a detrimental effect on the pipeline, valves, or compressor stations? Are there areas where gas pipeline-initiated icing would be hazardous to the Alyeska pipeline?

RESPONSE:

Only sporadic zones of discontinuous permafrost will be encountered in the Alberta section of the proposed pipeline. No problems with large sidehill icing conditions have been experienced on the Company's operational line in similar terrain.

QUESTION 91

Would frozen streams be used as ice roads? If so, designate which streams and determine whether glaciering would occur. If glaciering is anticipated, what provisions does the applicant propose to use to alleviate glaciering?

RESPONSE:

It will not be necessary in Alberta to use creeks or streams as ice roads, so the problem of glaciering is not anticipated. Existing corridors have adequate road access.

QUESTION 92

The applicant is requested to provide the information below for each area where water would be obtained?

(a) For standing bodies of water:

1. Total volume of withdrawal.
2. Percentage of water body volume withdrawn.

(b) For flowing water:

1. Average discharge over the projected period of withdrawal.
2. Percentage of average discharge which would be used.

RESPONSE:

(a) The anticipated route does not pass near any standing bodies of water such as lakes that would be used as a water source.

(b)

River	Approximate Average Annual Discharge Rate (c.f.s.)	% Withdrawal
Chinchaga	1,135	0.26
Peace	53,367	0.0056
Smoky	13,041	0.023
Little Smoky	1,761	0.17
Athabasca	9,083	0.033
McLeod	1,370	0.22
Elk	400	0.75
Brazeau	1,000	0.30
North Saskatchewan	7,140	0.042
North Saskatchewan (Second Crossing)	4,160	0.072
James	300	1.000
Red Deer	880	0.30
Little Red Deer	88	3.40
South Saskatchewan	7,540	0.04
Notikewin	593	0.51
Waskahigan	216	1.40
Simonette	1,090	0.28

It is unlikely that more than 5% of any river's flow would be used.

QUESTION 93

The applicant is requested to provide the locations of all water sources, the use of which would result in the depletion of the water source, or the elimination of fish from critical overwintering fish areas. The applicant is also to discuss in detail measures which would mitigate these "unavoidable adverse changes" (page 5 - 3, Exhibit Z -1, Volume 1) including a discussion of the necessity of hydrostatically testing all sections of the proposed pipeline.

RESPONSE:

Stream and river crossings along the proposed route were inspected during the winter of 1974 - 75 by BEAK 1975.(1) Depths of water below ice, flows and dissolved oxygen were measured and fish species were reported as well. The Company intends to test the line hydrostatically using water taken only from streams and rivers where flows are sufficient so as not to deplete the supply or where conditions preclude over-wintering of fish populations. In addition, the water will be stored and reused when adequate volumes are not available for testing subsequent sections on the line. Storage would be in pits, tank trucks, or the next pipeline section to be tested. The water would be maintained at above freezing temperature when in the line or trucks.

Several small creeks and un-named wandering watercourses may be utilized during high water. It is not anticipated that anything over 5% of the discharge flow would be used. This will occur on a very small scale because the Alberta portion of the route has more than enough major waterways crossing the pipeline that can be utilized as fill points. Suction strainers on the fill line are utilized to prevent the entrance of debris and fish. At the end of the fill line, filters are also used to collect the silt and any smaller forms of debris that may have passed the original strainer. The Company pioneered the use and the concept of hydrostatically testing large diameter pipeline during winter construction.

The new pipeline from the Sousa compressor station to the Alberta - British Columbia border and all new loops will be hydrostatically tested.

1. Environmental Impact Statement (AGTL South) 1975
Beak Consultants Limited, Calgary, Alberta

QUESTION 94

Discuss specific hydrostatic testing techniques to be used. What techniques would be utilized for maintaining the quality of the source and for preventing erosion, siltation, fish kills or other ecological damage when the water is discharged upon completion of the testing. What method would be used to prevent hydrostatic test water from freezing during the testing process? Discuss the effect of hydrostatically testing pipeline sections which are in contact with permafrost.

RESPONSE:

The quality of the water source for hydrostatic testing of the pipeline would be assured by using as a source, clear stream or river water and if necessary, passed through a series of graded filters or settlement basins. Or, discharged water from a section of pipeline previously hydrostatically tested might also be used. The two principal desirable quality features of the water being used for testing are: that it have nearly neutral pH and have no suspended solids to precipitate out during the period of test. When the test water is discharged upon completion of the testing program it will enter a prepared impermeable pit where a sample will be taken and analysed prior to the discharge of this testing water to any ditch, water course or field. The water used in hydrostatic testing of the pipeline would be warmed to about 36°F to prevent its freezing during winter time testing. Since any of the regions to be crossed by the proposed pipeline containing discontinuous permafrost are shallow and will involve winter construction, no freezing problems are anticipated.

The Company's standard specification for testing pipelines using a liquid test media is attached to form part of this answer.

QUESTION 94

RESPONSE: Continued

SPECIFICATION FOR TESTING PIPELINES USING A LIQUID TEST MEDIA

1:00 INTRODUCTION

This procedure pertains to testing with non-compressible liquids only. Water shall be the test medium unless otherwise approved in writing by the Supervising Engineer. When the use of any other fluid test medium is contemplated, any necessary variations to the following test procedures will be issued by the Company's Engineering Department prior to commencement of the test. The variation will include such procedures as how to handle vapours from the test media.

The purpose of this testing procedure is to obtain a safe strength and leak test to established minimum standards for all transmission lines with sizes 10-3/4" O.D. and larger being tested to a minimum of 100% of S.M.Y.* and a maximum of 105% of S.M.Y. at the high point in each section.

* S.M.Y. = Specified Minimum Yield

2:00 SELECTION OF TEST SECTIONS

2.01 Obtain a profile of the line to be tested. This may be done by means of a level circuit or an altimeter survey. Plotting of the profile should be to a scale of:

1" = 200 Feet Vertical
1" = 2,000 Feet Horizontal

2.02 Calculate the allowable range of pressure in any one test section of pipe using the method set forth in item 5.01. The difference in the pressure due to the hydrostatic head between the highest and the lowest point in the test section should not exceed 6% S.M.Y. unless approved by the Supervising Engineer. In sections with extended lengths of extreme grades, these limits may be extended on approval of the Supervising Engineer. Convert the difference between the high and low pressures into equivalent feet of water head. Where this difference, in feet of water exceeds the change in elevation on the profile, in feet, a new test section is required. Limiting

RESPONSE: Continued

pressures at test heads shall be adjusted for elevation differences from high and low points in the section.

2.03 On the line profile, determine the minimum number of test sections required by using the differential water head established above. In most cases, the test sections should be laid out with at least one cut located close to a suitable water supply. A test section should be composed of only one size of pipe. In some cases, variations in wall thickness and pipe with a varying specified minimum yield strength may also have to be considered when the test sections are determined. The location classes as set out in the CSA Z184 Code must be considered when establishing the minimum test pressure. In a pipeline where there are great differences in elevation, it may be necessary to split into sections at more than one water source to reduce the pumping head and decrease the filling time. If there are no additional sources of water available, it may be necessary to use booster pumps. Under normal circumstances, the Company will specify only the minimum number of test sections. It will be the responsibility of the testing contractor to add additional sections as he may deem necessary, subject to the Company's approval. Each test section shall lap the adjacent section sufficiently to permit the tie-ins after test to be made in tested pipe.

3:00 TEST HEADS

3.01 All test heads are to be designed and constructed by the Company in accordance with the latest edition of the CSA Z184 Code. No pipe or fitting on the test head shall be stressed beyond 72% of its S.M.Y. strength based on nominal wall thickness when subjected to the maximum test pressure and a joint of 40 - 50 feet of transition pipe of Class II construction or better, shall be utilized between the test head and the line pipe. All fittings and pipe which show evidence of damage (i.e. dents, gouges, bent nipples, deep wrench marks, faulty valves, etc.) shall be replaced. All nipples connected directly to the test head shall be "double extra heavy". All fittings

RESPONSE: Continued

and valves must have an ASA 900# rating or better. Each test head shall be thoroughly inspected before it is used on any test section. The test heads and adjoining pipe must be firmly blocked so that they can not move when subjected to thrusts from pumping, dewatering and depressuring.

3.02 When testing against a main line block valve in lieu of a test head, the maximum test pressure shall not exceed 1,450 p.s.i. against 400 lbs. and 2,175 p.s.i. against a 600 lb. pressure A.S.A. Class valve unless prior written consent has been received from the Supervising Engineer of the Company stating specifically a higher approved test pressure.

4:00 FILLING WITH WATER

4.01 All valves and appurtenances must be checked, prior to filling the pipeline, to ensure that they are in proper working order. Valves must also be checked for proper positioning. Fittings must be greased and checked for tightness before filling.

4.02 The quality of water which is pumped into a pipeline must be suitable to the Company. Water containing silt, suspended material or harmful corrosive components shall not be used unless it can be treated satisfactorily by the use of filters or chemical additives. The source of water and fill equipment shall be sufficient to permit continuous filling at a minimum approved rate (increasing with pipe diameter). The water intake shall be screened and located at a depth that will not permit air to be drawn in with the water.

4.03 When filling any section, a sphere or pig must be run immediately in front of the water. Whenever a sphere is used it must be inflated to a minimum diameter 3% greater than the inside diameter of the pipe. In cases where the terrain is such that filling, will take place on a substantial decline, a back pressure of air must be maintained on the pig or sphere to prevent if from running away from the water.

4.04 When all sections are filled, entrapped air must be blown off at available access points.

QUESTION 94

RESPONSE: Continued

Air bleeds shall be located on the profile at a minumum number of selected intermediate high points in a section and installed prior to filling. The air bleeds shall be 1" plug valves - ASA 900# screwed.

5:00 THE PRESSURE TEST

5.01 Test Pressure Calculations

5.01.1 For pipe sizes of 10-3/4" O.D. and larger:

The minimum test pressure shall develop 100% of the S.M.Y. strength or greater. The maximum test pressure shall develop 105% of the S.M.Y. strength at the high point in the section or yielding as described in Section 5.02.2 whichever is less providing the maximum pressure on 400 lb. ASA fittings or valves shall not exceed 1,450 p.s.i. and on 600 lb. ASA fittings or valves shall not exceed 2,175 p.s.i.

The pressures are calculated using the formula for hoop stress:

$P = \frac{2tS}{D}$ where P = pressure that will develop 100% of the specified minimum yield strength of the pipe (psig).

t = nominal wall thickness of the pipe (inches).

S = specified minimum yield strength of the pipe.

D = nominal outside diameter of the pipe (inches).

5.02 Procedure

Ensure that warning signs are placed along the right-of-way at all public crossings and at all points where there is exposed pipe or an appurtenance. Detailed records of all leaks or

QUESTION 94

RESPONSE: Continued

breaks shall be maintained and repairs or replacements shall be made in accordance with the standard construction specifications.

Prior to starting the test, check all fittings for tightness. Install bull plugs and blind flanges except where guages, recorders, or pumps are to be connected. The pressure pump and connections must be checked before the test commences to ensure that they are capable of handling the job and withstanding the pressure to which they will be subjected.

5.02.1 A temperature recorder shall be installed on each test section a short distance back from the exposed pipe at one end of the test section and the sensing element placed against the coated pipe and then backfilled sufficiently before test for soil temperature to stabilize.

5.02.2 Procedure for testing to develop 105% of the S.M.Y.

The initial stage of the test is to raise the pressure to the pressure required to develop 90% of the S.M.Y. strength. Plotting is required during this stage to establish the elastic line to be used for the yield plot. Note should be made of starting and completion times. A pressure recorder, temperature recorder and a dead weight gauge must be operating during this time. Upon completion of the initial stage, the pressure pump will be shut down for a minimum of one-half hour while a leak test is run. During this period, all fittings on the test section should be checked for visible leaks.

Following satisfactory completion of the leak test, the second stage (yield plot) may commence. Automatic plotting by use of an approved "Mel-O-Graf" may be substituted for manual plotting. The following are required to make a manual yield plot;

QUESTION 94

RESPONSE: Continued

(a) Pressure pump - with a capacity which will give a 5 p.s.i. increase in a time range between 30 seconds and 2 minutes.

(b) Pump meter or stroke counter indicating cumulative volume with accuracy equivalent to one-hundredth of a barrel.

(c) Dead weight gauge with accuracy to one-tenth of a pound per square inch.

(d) Graph paper (8½" x 11" sheets with 100 squares per square inch have proved satisfactory).

(e) A minimum of four men are required at the pumping site:
- pump operator (and meter reader)
- dead weight gauge attendent
- note keeper
- plotter

(f) It is essential that there is sufficient water available to complete the test without stopping the pump.

A constant pumping rate should be maintained, however, some adjustments may be required at the beginning to obtain a suitable rate. As each 5 psig. increment is indicated on the dead weight guage, the attendant calls out the pressure and the meter reader calls out the cumulative volume. The note keeper records these readings in table form while the plotter transfers this data to a graph of pressure versus cumulative volume. Plot the pressure vertically, preferably to a scale of 1" - 10 psig. The horizontal scale (volume) must then be adjusted to give an approximate 2:1 slope to the resulting graph.

The pressure-volume plot will form a straight line until the elastic limit of a portion of the pipe is reached. It will then curve gradually to the right of a projected straight line.

QUESTION 94

RESPONSE : Continued

Pumping should continue until a pressure is reached which produces a deviation from the straight line proportionality of 0.2% of the volume of the section being tested, or until a pressure sufficient to develop 105% of the S.M.Y. strength at the high point in the section is reached.

There shall be no pressure cycling in a single test except as required as a result of a repair or retest.

After the maximum test pressure has been reached, the pressure must be permitted to stabilize for a period of at least one hour prior to commencement of the 24 hour test period. If the pressure drops over 10 psig. during the first two hours of the 24 hour test period without a corresponding drop in temperature, the line must be repressured to minimum test pressure and the 24 hour test period recommenced or commence looking for a leak. If the test pressure at the high point in the section drops below 100% of the S.M.Y., the "on test" test pressure must be re-established and the 24 hour test restarted. Upon completion of the "squeeze", disconnect the pump and install bull plugs and blind flanges where required. Check all fittings on the section for visible leaks.

Any measurable pressure change that takes place during the 24 hour test period must be accounted for by a temperature change. The leak test "squeezing", stabilization period, and 24 hour test, should all be recorded on the same chart, provided that it is neat and that the final test does not run longer than 36 hours, otherwise, new pressure and temperature charts should be installed for the final 24 hours. Sometime during the final 24 hours, the test must be witnessed by a Pipeline Inspector from the Department of Mines and Minerals of the Province of Alberta.

QUESTION 94

RESPONSE: Continued

6:00 DEWATERING

6.01 De-Pressuring: (until approximate static pressure has been reached)

As soon as possible, after the test has been completed, the pressure shall be bled from the section. Care must be exercised when removing bull plugs or blanking plates to avoid injury or damage caused by a pressure build-up due to a leaking valve. Extreme care must be taken when blowing down. No valve larger than two inches shall be used. Only responsible employees of the Company, or supervisors of contractor, shall be permitted to open a blowdown valve, after test. Blowdown valves shall be opened slowly and blowdown continued at a rate that does not develop severe vibrations. Under normal circumstances, no fittings of any type will be attached to the blowdown valve during blowdown. If fittings or drain lines are attached they shall be adequately braced and tied down to prevent movement.

Only under specific approval of the Supervising Engineer and under direct supervision of a qualified Company Engineer, will a deviation from this procedure be allowed.

6.02 Draining and Cleaning

Prior to dewatering, all drain lines and the test heads to which they are attached shall be firmly tied down and braced to prevent movement. Care shall be taken so that water is disposed of without washing out or flooding adjacent areas. An initial run with a sphere and a pig driven by compressed air shall be used to remove the water from the line. The flow rate shall be controlled to prevent movement of the test head and drain lines. Subsequent to the two initial runs, additional runs with a pig or sphere shall be made until, in the opinion of the Company, no more water can be removed by this method.

6.03 Methanol Wash

A methanol wash shall be run through the pipeline after dewatering. The methanol is to be run between two spheres using compressed air. The following quantities are the minimum amounts of methanol to be used.

QUESTION 94

RESPONSE: Continued

Pipe Diameter	Imperial Gallons of Methanol Per Mile of Pipe
6-5/8" O.D.	18
8-5/8" O.D.	22
10-3/4" O.D.	27
12-3/4" O.D.	32
14" O.D.	36
16" O.D.	40
18" O.D.	42
20" O.D.	45
24" O.D.	50
30" O.D.	72
36" O.D.	90
42" O.D.	120

If no methanol is recovered at the end of the run, the wash shall be completely redone. Any alcohol mix reaching the end of the section shall be led off to a sump by a drain pipe and disposed of.

7:00 FINAL TIE-INS AND CLEAN-UP

When the dewatering (or methanol wash) is complete, all tests heads shall be removed and the test sections tied in. Only tested pipe will be used for tie-ins. The Government Pipeline Inspector must be notified 48 hours before the tie-in welds are made. All tie-in welds are to be X-rayed. All tie-ins and clean-up must conform to construction specifications. When the sections have been washed with methanol, precautions must be taken during any cutting or welding to assure that an explosive mixture condition does not exist.

If this condition is probable, the line should be treated similar to one containing gas at atmospheric pressure.

8:00 WINTER TESTING

Hydrostatic testing can be performed in the winter providing certain precautions are taken. All pipe in open ditch must be covered and heated sufficiently to prevent freezing before filling is commenced. Cover shall be such that it will support snow and will not be affected by high winds.

QUESTION 94

RESPONSE: Continued

Heated water shall be used for filling each test section. The heating unit or units shall be capable of continuous operation at a minimum of 10 million B.T.U. per hour. The minimum temperature at the discharge end of each test section will be 36°F.

Fill pumps used must be capable of filling the pipeline with heated water at a rate of 850 gallons per minute against a head of 350 p.s.i.g. If reciprocating pumps are used, adequate surge bottles and high pressure flexible hoses shall be supplied to prevent movement and minimum vibrations at the test head. A flow meter to measure the fill rate must be supplied.

A minimum of three air compressors shall be used all of which are capable of 500 cfm at 100 p.s.i.g. and at least one capable of 500 cfm at 150 p.s.i.g. An air compressor must be stationed ready to dewater each section before it is filled.

A trailer or skid mounted building shall be used, measuring approximately 8' x 10' and equipped with heat and light. This is used to house the recorders and dead weights and work in during yield plots. All instrument piping must be filled with an anti-freeze solution.

The Company requires that a complete testing crew work 24 hours a day during testing.

If the earth temperature at the top of the pipe is less than 28° F. do not conduct a hydrostatic test unless additional precautions are taken, such as pumping heated water through the pipe until the temperature of the water at the outlet is 36° F., or using a test medium of lower freezing point or adding anti-freeze to the water.

9:00 RECORDS AND REPORTS

9.01 A complete record must be prepared in duplicate for each test section. It shall include copies of all pressure-volume graphs, data used to plot the graphs, times and dates for commencement and completion of line filling, pressuring, stabilizing all pressure and temperatures, blowdown and dewatering. All temperature data, temperature recordings, and details of any leaks, breaks,

QUESTION 94

RESPONSE: Continued

re-pressuring or re-tests required together with any other pertinent data, shall also be included.

The "original" data sheet, calculation sheet, and yield plot upon the completion of each test shall be mailed to the Company.

QUESTION 95

Indicate the width, depth, maximum discharge, minimum discharge, mean annual discharge, and approximate freezeup and breakup times at all proposed principal river crossings. Indicate the crossing method, crossing length, time of crossing, depth of cover, and lateral concrete coating length. Indicate the scour depth and the thickness of the thawed zone under the stream bed.

RESPONSE:

Hydrological and topographical data for the principal rivers crossed in Alberta is contained in the table attached and forming a part of this answer.

Information for the Peace, Smoky and Athabasca Rivers was obtained from "Geotechnical Evaluation - Hydrology" prepared by EBA Engineering Consultants. (1)

Information for the North and South Saskatchewan Rivers was determined from "Hydraulic and Geomorphic Characteristics of Rivers in Alberta - River Engineering and Surface Hydrology Report 72-1" prepared by the Research Council of Alberta (2) and from the Company's river crossing drawings.

All rivers in Alberta would be crossed by trenching across the river bottom and pulling or carrying in the pre-bent and coated section. The crossing would be concrete coated across the total extent of the river and flood plains and up to the high water mark. After the pipe is pulled in, it will be inspected by divers to make sure it is sitting undamaged along the bottom of the ditch. It is then hydrostatically tested to ensure that there are no leaks. Freezing does not occur in the stream bed of rivers in Alberta.

The time when crossings are made will not be conclusively determined until contracts are let, however, major rivers are normally crossed during low water (late autumn and early spring) and follow the guidelines of the Alberta Department of Environment.

1. Geotechnical Evaluation (Proposed AGTL Pipeline Project) Hydrology 1976. E.B.A. Engineering Consultants, Calgary, Alberta.

2. Hydraulic and Geomorphic Characteristics of Rivers in Alberta. River Engineering and Surface Hydrology Report 72-1 1972 R. Kellerhals, C. R. Neill, D.I. Bray Research Council of Alberta.

	WIDTH *	DEPTH *	MAXIMUM DISCHARGE (cfs)	MINIMUM DISCHARGE (cfs)	MEAN ANNUAL DISCHARGE (cfs)	FREEZE-UP TIME v	BREAK-UP TIME v	DEPTH OF COVER	SCOU DEPT
PEACE	1720'	36'	194,000	6,580	53,367	Nov. 4	April 24	10' **	-
SMOKY	1850'	35'	209,250	494	13,041	Nov. 5	April 18	15'	14'
ATHABASCA	585'	14'	66,200	828	9,083	Nov. 7	April 28	10'	8.7'
NORTH SASK. (FOOTHILLS)	900'	24' vv	169,000 vv	404 vv	7,140 vv	Nov. 7	April 23	10'	8' v
NORTH SASK. (EDSON)	675'	23'	105,900 vv	265 vv	4,160 vv	Nov. 7	April 23	10'	8' v
SOUTH SASK.	650'	23'	75,100	1,940	7,540	Nov. 18	April 5	10'	8' v

* When rivers are at maximum flows

** A depth of 10' is recommended because of the possibility of deep scours caused by sudden releases of high discharg from the Williston Lake Reservoir.

v Estimated

vv Estimated from reference material

QUESTION 96

What adjustments in location or what design measures would be used to avoid scour problems along the Sagavanirktok River and areas similar to it?

RESPONSE:

The Company believes that there are no areas within the Alberta portion of the project which are similar to the area along the Sagavanirktok River.

QUESTION 97

What would be the effect of an increased depth of burial of pipe on the size of the zone of disturbance at stream crossings?

RESPONSE:

An increased depth of burial at stream crossings would result in a larger zone of disturbance. The walls of the trench would require cutting back to a greater width in order that the trench would not sluff-in. Also, the additional trenching would cause an increased amount of siltation downstream of the crossing. The only instance when this would not be the case would be in the winter when a very small stream is totally frozen. The frozen zone would supply stability to the trench walls.

QUESTION 98

Indicate the season (s) during which proposed stream crossing construction occur for each of the principles streams.

RESPONSE:

As the majority of the fish species found in Alberta are fall spawners, the Company proposes to cross all the major and minor fish inhabited streams during the summer and early fall seasons, specifically between approximately May 31 and October 15, subject to specific regulations of the Alberta Department of Environment.

QUESTION 99

Indicate the erodibility and soil types of the riverbanks at all proposed principal river crossings. Would there be a greater potential for increased soil erosion during spring and summer construction activities at river crossings? If so, what specific factors would contribute to the increased erosion, how much additional erosion would be expected to occur and what erosion control measures could be implemented?

RESPONSE:

At all of the principal river crossings in the Province of Alberta, the erosion potential is high. The soil types are generally silty clays with a moderate to high water discharge potential. However, by judicious route choice down from the valley breaks to the river plateau as the Company has made in the past, the erosion potential can be minimized or completely eliminated. Further surface and sub-surface erosion can be reduced by methods which are described in other responses. There would be greater potential for increased soil erosion during spring and summer construction activities at river crossings due to higher surface and ground water discharge.

QUESTION 101

Would the organic layer and part or all of the topsoil on the right-of-way be conserved by pushing it to one side prior to pipeline ditching operations and then returned it to its original configuration when backfilling operations are complete?

RESPONSE:

Subject to the landowners wishes, in cultivated areas the top soil will be removed over the ditchline during the grading operation of construction. This soil will be moved over to the extreme spoil side of the right-of-way where it is protected from the rest of the construction activity. During the clean-up operation, the topsoil is then moved back over the ditchline and levelled out.

QUESTION 102

How will the insulating qualities of the vegetative mat be preserved during construction? Where the vegetation cannot be preserved with its insulative qualities intact, how will it be restored or replaced? Describe possible measures to prevent overgrazing by caribou. What are the potential primary and secondary adverse environmental impacts associated with revegetation?

RESPONSE:

Since the Company's pipelining activities will not enter the continuous permafrost region, the Company intends to degrade the discontinuous permafrost wherever it occurs, thus the insulating properties of the vegetative mat will not be required.

In the region crossed by the proposed pipeline route, the only species of the caribou existing are the Woodland and they are not in large numbers. Overgrazing of the northern pipeline in Alberta has not occurred in the past. The Company does not consider that there are any notable adverse environmental impacts associated with the revegetation.

QUESTION: 103

Discuss in detail all surface restoration and revegetation techniques which will be used. Explain precisely how each of these measures would prevent erosion.

RESPONSE:

Revegetation of provincial lands will be carried out according to specifications of the Alberta Department of Lands and Forests. The seed mixtures will be selected to be suitable for specific regions along the route. Seed is spread from helicopter while smaller areas are seeded by broadcasting or seed drills.

The topsoil will be replaced on the surface of disturbed areas and productivity will be equal to or greater than surrounding soils. Fertilizers will be added if required.

Native and agronomic species will be used to revegetate the right-of-way crown, borrow pits and other disturbed sites except in cultivated areas.

Between the time of disturbance and revegetation, unstable surfaces will be protected using rip rap, wash breakers or other mechanical means. Steep slopes can be reseeded using hydro seeders with binding agents which stabilizes surface soils while allowing germination and growth.

Where vegetation must be cleared, hand clearing will be used where mechanical means would be harmful to the vegetative mat such as on steep slopes and stream banks. Rip rap for protection of the right-of-way from slides will be constructed from timber cleared from the right-of-way.

In dry prairie regions where soils are susceptible to wind erosion and growth is slow, land disturbance would be kept to a minimum by following natural contours and revegetation efforts would be encouraged by using such techniques as hydroseeding and mulches.

QUESTION 105

Identify the location of muskeg areas that would be affected by Canadian mainline looping construction activity. When would construction in these areas take place?

RESPONSE:

Muskeg areas are encountered from approximately Township 35 to the northern and western boundary of the Province of Alberta. The majority of the muskegs will be crossed during the winter season when the surface is sufficiently frozen to support heavy equipment. Shallow, isolated muskegs will be crossed under summer conditions using corduroy techniques.

QUESTION 106

How would the companies continue the program of mitigation as outlined in Section 4, Volume I, Exhibit Z-1, after construction is complete? Would the applicant make a commitment to reseed and refertilize disturbed vegetated areas if the first seeding and fertilization efforts were not wholly successful? If unstable soil conditions such as are found on slopes and permafrost areas require supplementary or even completely different stabilization techniques subsequent to initial stabilization efforts, would the applicant undertake the appropriate additional measures? If, after the pipeline is constructed, it becomes apparent that one of the applicant's mitgating measures lacked the anticipated effect, or that an impact not anticipated during the applicant's environmental surveys had resulted from the proposed project, would the applicant follow the recommendations of the appropriate state, provincial, Dominion or Federal agencies in correcting the situation?

RESPONSE:

The Company will continue the program of mitigation as outlined in Section 4, Volume I, Exhibit Z-1 after construction is complete. Further the Company will reseed and refertilize the disturbed vegetated areas if the first seeding and fertilization efforts were not wholly successful. Also if unstable soil conditions such as are found on slopes and permafrost areas require supplementary or even completely different stabilization techniques subsequent to initial stabilization efforts, the Company will undertake the appropriate additional measures. On the other hand, the Company intends to avoid slope instability conditions wherever possible and to take the necessary remedial action prior to or during construction should it be necessary to cross such slopes. If after the pipeline is constructed, it becomes apparent that one of the Company's mitigating measures lack the anticipated effect or that an impact not anticipated during the Company's environmental surveys had resulted from the proposed project, the applicant would follow the recommendations of the appropriate provincial or federal agency in correcting the situation.

QUESTION 107

Do any of the parties to this application intend to use pesticides during any phases of the project? If so, specify when, where and the types of pesticides to be used. What will be the impact of the applicant's pesticide program on insects other than mosquitoes and biting flies? How will the invertebrates which are such an important part of the food chains be effected?

RESPONSE:

The Company does not intend to use pesticides during any phase of the project except insect repellents. Thus, no environmental impact is anticipated from this source.

QUESTION 115

On page 7-1, Volume 1, Exhibit Z-1, it states with regard to the arctic peregrine falcon:

> While it is doubtful that the proposed project would have a determining effect on the species, the applicant will take necessary measures to limit the potential impact of construction on the peregrine falcon.

Why is it doubtful that the proposed project would have a determining effect of the arctic peregrine falcon? What measures would be necessary to prevent the potential impact on the falcon? What measures would each of the companies involved in this project take to limit the potential impact? What impact could not be avoided despite the applicant's measures, and why would the applicant find the impact unavoidable? What is the "acceptable radius" from active peregrine falcon nests which will be avoided during construction? (See page 4-11, Volume 1, Exhibit Z-1.)

RESPONSE:

The proposed route within the province of Alberta does not impact any of the Arctic Peregrine falcon nesting areas. Consequently, no protective measures have been considered.

QUESTION 116

How close would the proposed pipeline come to known peregrine falcon and other raptor nesting areas along the Dezadeash and Liard Rivers and their tributaties? Would construction near raptor nesting areas be scheduled to avoid the nexting periods? What other areas along the proposed route in Canada have been identified as nesting sites for peregrine falcons, bald eagles, ospreys, and gyrfalcons?

RESPONSE:

The bald eagle is common at Bistcho Lake in northwestern Alberta and adjacent lakes in the Northwest Territories (Salter 1974 (1)but is not common further south. Bald eagles, golden eagles, ospreys, various hawks and falcons could potentially nest throughout the Keg River south to Grimshaw area. However, data is lacking on specific locations of importance. Golden eagles are fairly common along the Peace, Smoky and Little Smoky River drainage areas and they likely nest on cliffs along the river valleys. In prairie habitats, sparrow hawks, Ferruginous and red-tailed hawks and prairie falcons are the raptors which nest in southeastern Alberta. The impact of the proposed pipeline on raptors is expected to be quite low as the line will be built along the existing right-of-way. However, potential habitats along the right-of-way will be surveyed prior to construction of the new loops.

1. Salter R. E. (1974) Bald Eagle Surveys in Southern Mackenzie District and Northern Alberta, May, July, August 1973. In bird distribution and populations ascertained through Aerial Survey Techniques, 1972 W. W. H Gunn and J. A. Livingston (editors) Arctic Gas Biological Report. Volume II 157-169

QUESTION: 119

How would work crews be controlled to prevent harrassment or local overharvest of game animals? (See page 3-8, Volume 2, Exhibit Z-1.) Would work crews in Canada be subject to regulations regarding possession of firearms, feeding of wild animals, and fishing along the right-of-way? What are these regulations?

RESPONSE:

Employees of the Company, contractors and sub-contractors will not be permitted to carry firearms or in any way disturb wildlife indigenous to the regions being crossed by the proposed pipeline. The feeding of wild animals and game will be prohibited. Fishing will be permitted along the proposed construction area(s) and it would be the fisherman's responsibility to adhere to the local fishing regulations.

QUESTION: 120

On Page 5-4, Volume 1, Exhibit Z-1, it states that typical gas blowdown noise levels of a mazimum of 140 dB(A) at 100 feet could be reduced to 80 dB(A) with the use of a stack silencer. On Page 4-10 of the same document, it states that abatement procedures including stack silencers, vegetative screening and/or earthen barriers will be used at compressor stations depending upon location, topography, or sensitivity of large mammal species in the area. Describe the vegetative screening and earthen barriers used for noise abatement, and give an estimate of their resulting noise reduction capability as compared to the stack silencers. Would anticipated blowdowns be scheduled to avoid waterfowl nesting or other sensitive periods, and would blowdown silencers be installed in sensitive areas to help mitigate the impact of unscheduled emergency blowdowns?

RESPONSE:

The Alberta Noise Regulations state only that the maximum noise levels 10 feet from an occupied residence should be no greater than 65 dB(A) in the daytime and 50 dB(A) at night. The sites of the Company's compressor stations in Alberta will be chosen so as not to impact any environmentally sensitive areas by their noise radiation or line blowdown.

QUESTION 123

Provide the information obtained to date concerning the locations of fish spawning and overwintering areas that would be affected by any phase of the proposed pipeline construction and operation.

RESPONSE:

This detailed information is available from the fish habitat biologists with the Department of Fish and Wildlife in Alberta and will be obtained for the particular year of construction from this department.

QUESTION 126

Describe in detail the blasting procedures that would be employed during construction of the proposed pipeline. What precautions would be taken to avoid serious disturbances to any wildlife during blasting? Discuss in detail measures to be employed to mitigate the impairment of breeding success of bald eagles, golden eagles, trumpeter swans, and peregrine falcons by blasting. What precautions would be taken to avoid disturbances by any phase of construction to denning mammals?

RESPONSE:

Along the Company's proposed new right-of-way from Sousa compressor station site west to the Alberta-British Columbia border, it is not anticipated that any blasting would be required. In the past construction programs along the right-of-way proposed to be looped, no wildlife has been observed which would suffer adverse effects from the Company's construction procedures.

QUESTION 128

Most of the proposed pipeline construction in Alaska would be done between the months of April and October. This period coincides roughly with the major breeding and rearing period for most birds, fish and mammals in Alaska and Canada, and is also the period when the rivers and marshy areas are thawed. Compare the advantages and disadvantages of winter versus summer construction from the standpoint of impact to the environment.

RESPONSE:

The following discussion with respect to the Alberta portion of the proposal enumerates several advantages of winter construction.

Much of the proposed pipeline route north of Peace River runs through lowland areas with high water tables and patches of permafrost occur as far south as Peace River (Brown 1967)(1). Winter construction allows pipe to be laid across wet areas with a minimum of disturbance.

During winter, crossing points of tributaries in many northern drainages have reduced flows, low dissolved oxygen levels, and shallow depths which precludes overwintering fish populations. Disturbed silts will settle out closer to the zone of disturbance because of reduced flows. All migratory birds, particularly the most rare and endangered species will have left the area and subsequently are not disturbed by construction. Habitat loss is minor along an existing right-of-way.

Large mammals are restricted to winter ranges which can be identified and avoided during the late winter - early spring period.

Soils, particularly on slopes, are less subject to disturbance and undergo less erosion following construction.

Fuel and toxic chemical spills are more easily contained and hence there is less risk of these substances reaching water courses.

1. Brown R.J.E. (1976) Permafrost in Canada Natural Resources Council of Canada (Map), NRC 9769 (also Geological Survey of Canada Map 1246A)

QUESTION 129

What are the minimum aircraft altitude regulations that would be enforced, in what critical habitat areas would the regulations be in effect, and during what months would migration, denning, breeding, or calving require the use of the regulations? If low ceiling conditions exist, how can minimum altitude regulations be safely followed, particularly in mountainous areas? Is it likely that aircraft would be frequently forced to fly below the applicant's established altitude limits during critical periods and in critical areas (such as in the Atigun Canyon during lambing season)? Would bird nesting and staging areas be subject to minimum aircraft altitude regulation protection in a manner similar to that described for mammals? Provide the details of the regulations pertaining to birds.

RESPONSE:

It is the present Company practice to inspect pipeline rights-of-way by fixed wing aircraft on a monthly basis from an altitude of approximately 500 ft. Previous monitoring of an extensive system of rights-of-way in the northern portion of the province have produced an impact of only short term ungulate movement and only for the period during which the aircraft is within audible reach. Flying is essentially undertaken during fair weather conditions and none of the proposed routes cross mountainous areas. With regard to bird populations, a sensitive migratory staging area has been identified in the Hay-Zama region. During construction or maintenance of the pipeline any air travel would be well south of the lake staging region, travelling no further north than our pipeline right-of-way and hence avoiding the area of sensitivity.

QUESTION 132

Provide a summary that identifies each know environmentally sensitive or critical area along the proposed route, the time during which each area is most sensitive or critical, and the time during which each area would be affected by construction according to the proposed schedule. The exhibit should include among the areas discussed all muskeg and marsh areas, stream crossings, breeding areas, migration routes, staging areas, denning areas, wintering areas, feeding concentration areas, calving areas, and unique species associations. Where obvious conflicts appear between the period of sensitivity and the period of construction, discuss alternative timings or routings to avoid or mitigate the conflicts.

RESPONSE:

Environmental impact reports related to the proposed route in Alberta have been compiled by Beak Consultants' (1) and F. F. Slaney & Co. Ltd. (2).

A total environmental impact research was undertaken in order to identify any of the concerns such as those listed within the question. No unavoidable fish, mammalian, or avian critically sensitive areas were found to exist. This research confirmed that the proposed design of the pipeline (timing of construction and routing) alleviated or mitigated any apparent concerns.

(1) Environmental Impact Statement (AGTL South) 1975
Beak Consultants Limited
Calgary, Alberta

(2) Preliminary Environmental Report Volumes I, II, III
F. F. Slaney Company Limited
Vancouver, British Columbia

QUESTION: 135

Identify all residences, businesses, and other structures which would need to be relocated due to the construction of the proposed Canadian looping facilities.

RESPONSE:

No residences, businesses or other structures will need to be relocated by the proposed Alberta looping construction.

QUESTION 136

How will the Company control the activities of its personnel? Will firearms be allowed in camps? Will the use of all terrain vehicles be strictly controlled?

RESPONSE:

The Company's inspectors and supervisors and the contractor's supervisors will be responsible for controlling activities of personnel. Firearms will not be permitted in camps.

All terrain vehicles are common in Alberta and their use is regulated by the provincial government. The Company will be strictly enforcing these regulations. Off right-of-way travel will not be permitted without permission from the landowners.

QUESTION 137

Certain portions of the proposed construction, such as haul road maintenance, would be conducted even in the winter. What measures and precautions would be taken to insure the safety of the workers in the event of severe weather?

RESPONSE:

The Company and local contractorshave experience with severe weather conditions. All construction and company transportation vehicles will be equipped with radio communication equipment, chains, shovels, flashlights, tools, spare equipment, blankets and necessary survival gear.

The Company will ensure that the contractors will instruct their personnel in the techniques of cold weather and wilderness survival. All regulations of the Alberta Workers' Compensation Board will be followed.

QUESTION 138

Describe safety measures to be followed in the storage of explosives and acids.

RESPONSE:

The Company does not propose using explosives or acids during construction and operations. In the event some blasting is required the Company and contractors will conform to the regulations of the Alberta Workers' Compensation Act specifically the Regulation 26/76 entitled Safety Regulations Governing the Storage, Handling, Preparing, and Firing of Explosives.

QUESTION 139

In the event of a pipeline rupture, how much time would elapse before the block valves would be completely closed? What is the maximum volume of gas which could escape if a rupture occurred? At what intervals would the block valves be spaced along the proposed system? Include a description of all types of valves used along the proposed pipeline system. Would block valves be buried or exposed?

RESPONSE:

(a) Automatic power operators will be installed on block valves which will activate upon a pressure drop resultant from a rupture. Once activated a ball valve will close in 1 minute and a gate valve in 2 minutes. The total elapsed time to completely close the valve depends on the rate of pressure drop and is normally less than five minutes.

(b) The maximum volume which would escape if a rupture occurred would depend on the following factors which at present are unknown - the length of section, the pressure at which the line failed, the time elapsed in closing of the valves, temperature and specific gravity of the gas.

(c) Spacing of block valves depends on location according to the Canadian Standards Association - Standard Z-184, and according to class locations but will not be more than twenty miles.

(d) The type of valves to be used will be either gate or ball valves.

(e) All main block valves will be buried with above ground blowdown and cross-over valves.

1.0 SCOPE

This specification covers operating devices for valves in natural gas pipeline service which derive their primary energy from line-pressure. These operators will be subject to an extreme range of seasonal temperature.

2.0 GENERAL SERVICE CONDITIONS

2.01 Fluid Handled - Natural Gas

2.02 Specific Gravity of Gas - 0.63

2.03 Ambient Temperature - minus 50°F to plus 100°F

2.04 Maximum Operating Pressure - 1,440 psig unless otherwise noted on the Purchase Requisition.

2.05 Maximum pressure differential across the valve - 1,440 psi.

2.06 Maximum Opening and Closing Times shall be as follows:

Gate Valves - 2 minutes
Plug Valves - 1 minute
Ball Valves - 1 minute

2.07 Unless otherwise noted on the Purchase Requisition, the valve to be operated will be installed in a horizontal run of pipe.

3.0 MATERIALS

3.01 Materials for line-pressure operators shall be suitable for utilizing pipeline gas that may contain hydrogen sulfide, line hydrates and/or line condensate.

4.0 DESIGN AND CONSTRUCTION

4.01 Operators shall be designed and constructed so as to be operative under the line pressures and temperature conditions as defined in Paragraph 2.0 above.

4.02 Operators shall be fitted with controls for local manual operation.

4.03 Operators shall be fitted with piping, torque limiting device, and limit stops. Limit stops shall be such that valve "creep" is prevented. Operators shall be fitted with a clearly distinguishable position indicator.

4.04 Line-pressure operators shall be fitted with a hand-wheel or other device suitable for auxiliary manual operation of the valve.

4.05 Operators shall be fully enclosed for dust and moisture protection and shall be fitted with a locking device suitable for use with a standard padlock.

4.06 Operators shall be ready for installation on the valve specified in the purchase requisition and shall be complete with the mating flange necessary for this purpose. Lubricators and filters will be furnished by the operator manufacturer.

4.07 Operators shall be equipped with automatic features as specified in the Purchase Requisition.

4.08 The manufacturer shall design all pressure vessels to be supplied with the operator in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII (latest edition), and shall meet all the requirements of the Boilers Branch of the Department of Labor of the Government of the Province of Alberta. The manufacturer shall supply a copy of the certificate showing approval by the Boilers Branch.

4.09 The manufacturer shall supply electrical devices that are required which are approved by the Canadian Standards Association for use in Class 1, Division 1, Group D areas, or otherwise approved by the Electrical Protection Branch of the Province of Alberta for use in these locations. All electrical devices shall bear the C.S.A. Stamp of Approval.

5.0 DATA AND CERTIFICATES

5.01 The manufacturer shall submit with his bid:

(a) Explanatory drawings and a description of his operator including operating times,

maximum and minimum pressures required for operator actuation, maximum torque requirements under manual or power operation, revolutions to open by auxiliary handwheel or other device, lubrication requirements, etc.

(b) References to present users of his operator in similar service and copies of any test results.

5.02 After placement of the order, the manufacturer shall furnish:

(a) One transparency of each certified drawing. Certification will be by the manufacturer and apply to the specific operator ordered. The drawings shall include:

Outline Dimensions
Mounting Details
Component Detail Drawings

(b) Six (6) copies of the operating repair manual and parts list, keyed for component drawings, and preventative maintenance schedule.

6.0 GUARANTEE

Manufacturer shall guarantee this equipment against defects in materials and workmanship for a period of one (1) year after installation.

QUESTION 140

What is the maximum distance and travel time from each maintenance site to (a) a leak or rupture along the pipeline and (b) compressor station?

RESPONSE:

(a) At present the furthest point along the Company's pipeline from a maintenance site is 145 miles which is approximately three hours in surface travel time. However, operators based in towns throughout the province are within 50 miles or one hour's travel time to all parts of the Company's system.

Normally the Company establishes maintenance sites within 50 miles or one hour's travel time of all parts of the pipeline. The exception noted refers to a portion of the Peace River mainline and is temporary because of the small volume of gas carried in that line. As throughput increases additional maintenance sites will be added until the normal spacing is reached.

(b) At present the maximum distance from a maintenance base to a compressor station is about 50 miles or one hour's travelling time. This standard will be maintained by adding maintenance sites as referred to in part (a) when new compressor sites are brought into service.

QUESTION 148

Section 4.0, Volume 1, Exhibit Z-1 lists a number of programs which the applicant proposes to initiate to enhance the environment or mitigate adverse environmental impacts. Many of these programs are based on studies now underway, committed, or planned, and for these or other reasons have not been put into final form. The applicant is requested to itemize all such studies planned for Alaska and Canada and to indicate the status and expected date of completion of each. As the format for each program is completed, submit copies of the program and the date on which it is based to the FPC staff for review. The program details and results submitted should include the following areas mentioned in Section 4:

(a) Environmental training for construction and operation personnel.

(b) A central traffic control system.

(c) Geotechnical design development.

(d) Erosion and drainage control.

(e) Seismic design development.

(f) Ecological data collection and associated mitigation techniques.

(g) Photographic mapping of vegetation and soils.

(h) Revegetation, fertilization, and soil stabilization studies.

(i) Plant community and/or species surveys.

(j) Vegetation recovery on the Haines pipeline corridor.

(k) Fish stream studies and associated stream crossing and diversion techniques.

(l) Reduction and clean-up of accidental toxic material spillage.

(m) Thermal studies to predict ice dam formation or intergravel flow reductions.

(n) Nuisance animal control.

(o) Contingency plan for gas explosions and fires.

(p) Waterfowl and falcon nesting studies and associated construction scheduling.

(q) Environmental sound sensitivity studies and associated compressor station locations and/or designs.

(r) Archaeological surveys and their use in determining pipeline routing changes or delays while archaeological preservation is accomplished.

QUESTION 148

RESPONSE: Continued

(a) The manual of construction procedures which includes environmental considerations is given to each contractor at a preconstruction meeting. The manual includes sections on right-of-way clearing, soil stabilization, right-of-way reclamation and revegetation, the disposal of liquid wastes and a paragraph on archaeological awareness. Further, during the construction of certain portions of the pipeline route, it is proposed to have a professional environmentalist employed by the Company on site working along with the clearing and ditching operations.

An active program of environmental awareness and ecological consequences with all our field personnel is now into its second phase. We are planning on refining this program for presentation to our contractor's construction personnel.

(b) We have proposed no such control system to date as we do not anticipate conditions to exist which will differ greatly from any pipelining experiences we have encountered in constructing the present system.

(c) Our present program of geotechnical investigation is concerned only with slopes greater than 15 degrees where past or potential earth slides due to surface or ground water effects are apparent. At the present time, the Company is having prepared a geotechnical report on the slopes stability of our proposed pipeline crossings over the three major rivers - Simonette, Smoky and Peace. Further geotechnical work will be done wherever existing conditions warrant. Previously, slope stability has been determined on all the other major river crossings south of the Simonette River to the Saskatchewan-Alberta border at Empress. There are existing pipeline crossings at all these last mentioned rivers where the right-of-way will be utilized again in any subsequent looping programs.

(d) The procedures to control erosion and undesirable drainage along the right-of-way have been well established in the past by the Company construction and reclamation procedures. Reports have been prepared on the control of vegetation to minimize erosion and an on-going report on vegetation is progressing well.

(e) We refer you to our response to Question 53.

(f) What we believe to be adequate ecological material and associated mitigation procedures have been reported in at least three volumes, one by Beak Consultants(1), one by F. F. Slaney(2) and another Canadian Arctic Gas Study Limited.(3)

QUESTION 148

RESPONSE Continued

(g) The right-of-way proposed by the Company has been aerial photographed and a photomosaic of the right-of-way has been prepared. These show the major vegetation species from which some assessment of soils can be made. Much of the route covers spruce forests, muskeg and agricultural land. Some soil typing has been done in the northern section of our proposed routing and this has been reported by EBA Consultants Ltd.(4)

(h) Beyond the Company's in-house programs on reclamation of the right-of-way and preservation of the integrity of the pipeline, there is a three-year research program, which Trunk Line is partially funding, in progress in northern British Columbia on slope revegetation fertilization and soil stabilization.

(i) Determinations of this nature generally are specified for seed mixes on revegetation programs. Also this work is being done in conjunction with part (h) above.

(j) Not applicable to the Company.

(k) Reports have been prepared by Beak Consultants for us. As well other reports have been prepared along with provincial fish and wildlife material which is available to us. As a general rule, the Company has not diverted streams during pipeline crossing construction. No diversions are planned for this project.

(l) The Company does not propose to use toxic material in any volume that would be considered hazardous to the environment should there be an accidental spillage.

(m) No such studies have been conducted as we do not foresee ice dam formation or intergravel flow reductions occurring downstream of any winter pipelining river activity.

(n) All wastes from construction camps will be buried to discourage the proximity of nuisance animals around the camp sites. Construction personnel will be instructed on the proper methods of personal waste disposal.

(o) Contingency plans for such occasions as these have been prepared and are given in the Company's supporting document covering the southern looping portion of our proposed pipeline route.

(p) No studies have been done on these considerations per se. However, the Company is aware of two waterfowl nesting and breeding areas which are in proximity to the proposed right-of-way. Construction in these areas will be scheduled for a time of year that will avoid any productive disturbance to these waterfowl.

QUESTION 148

RESPONSE Continued

(q) In-house reports have been produced on sound intensities surrounding compressor stations. The Company has also commissioned a consultant to prepare a report which is complete on noise level isoplastes outside the Company's compressor stations.

(r) Reports of such surveys are being prepared for the Company's proposed new pipeline route in Alberta.

1. Environmental Impact Statement (AGTL South) 1975 Beak Consultants Limited, Calgary, Alberta

2. F. F. Slaney Company Limited Preliminary Environmental Report, Volumes I, II, III Vancouver, B.C.

3. Environmental Statement (Canada South of the 60th Parallel) Section 14.dS Canadian Arctic Gas Pipeline Limited

4. Geotechnical Evaluation (Proposed AGTL Pipeline project) Hydrology 1976. EBA Engineering Consultants 5664 Burleigh Crescent, Calgary, Alberta.

QUESTION 153

The construction schedule in Tab 10, Volume I, Exhibit Z-4 indicates that the environmental study for the British Columbia segment of the proposed main pipeline will be completed in August 1976. Does this include the field studies, referred to on Page 5-2, Volume 2, Exhibit Z-1, necessary to determine the extent and severity of impact in critical wintering, breeding, staging and migration areas? When will the environmental study results be available for review by the FPC staff? When will similar studies on other proposed pipeline segments be available? Outline the environmental studies presently under way in the field in Canada.

RESPONSE:

Environmental studies have been completed by the Company for the proposed route from the Sousa compressor site to Empress, Alberta. A study has been commissioned by the Company to determine the environmental impact of the construction and operation of the pipeline from Sousa west to the Alberta-British Columbia border.