



April 23, 1997

File: 2940-8400-59240-16  
970431

Mr. David W. Lui, P. Eng.  
Petroleum Engineering Consultant  
Novagas Clearinghouse Ltd.  
Suite 800, 707 Eighth Avenue SW  
Calgary, AB T2P 3V3

Dear Mr. Lui:

**Re: Applications For Acid Gas Injection Norcen Caribou c-4-G/94-G-7  
(WA 7961) Halfway Formation**

---

This refers to your Application wherein you requested approval of acid gas injection into the subject well.

Attached, please find Approval 97-16-001 for the Application, granted under section 100 of the Petroleum and Natural Gas Act.

It should be noted that the Ministry must be notified, in writing, of the date of commencement and the date of termination of acid gas injection into the well.

We are in receipt of a letter from Norcen Energy Resources Limited indicating their agreement with your plans but also their intention to place the c-4-G well on continuous gas production from the Halfway formation following the termination of acid gas injection phase.

Yours sincerely,

Bou van Oort  
Director  
Engineering and Operations Branch

Attachment

cc: Jonas Marshall  
Norcen Energy Resources Limited

APPROVAL 97-16-001

PETROLEUM AND NATURAL GAS ACT  
THE PROVINCE OF BRITISH COLUMBIA  
MINISTRY OF EMPLOYMENT AND INVESTMENT  
ENERGY AND MINERALS DIVISION

---

IN THE MATTER of a proposal by Novagas Clearinghouse Ltd. (the Operator) to temporarily inject acid gas into the Halfway Formation in the well Norcen Caribou c-4-G/94-G-7 (the well).

The Minister of Employment and Investment, pursuant to section 100 of the Petroleum and Natural Gas Act, hereby orders as follows:

1. The proposal of the Operator for the injection of acid gas (hydrogen sulphide and carbon dioxide) into the Halfway Formation in the well, as such proposal is described in:
  - a) applications from the Operator to the Ministry dated March 3, and April 16, 1997,
  - b) an application for a Project Approval Certificate from the Operator to the Environment Assessment Office dated July 17, 1996, and
  - c) supplementary information filed in support thereof,is hereby approved, subject to terms and conditions herein contained.
2. Acid gas shall be injected only into the approved well.
3. The wellhead injection pressure must not exceed 10,500 kPag.
4. The sandface injection pressure must not exceed 17,500 kPag.
5. The injection rate must not exceed  $69 \times 10^3 \text{m}^3/\text{d}$  expressed at 101.325 kPa and 15 degrees Celsius.
6. The cumulative volume injected must not exceed  $8.3 \times 10^6 \text{m}^3$  expressed at 101.325 kPa and 15 degrees Celsius.
7. The Operator must monitor the casing, conduct annular packer isolation tests and implement appropriate corrosion protection measures.
8. The Operator must monitor pressure in the offsetting wells and maintain the hydraulic isolation of the injection zone.

*modified by D. Krizanowski - as per letter of Apr 28/97. (attached at the back)*

9.) The Wellhead Emergency Shut-Off Device and Subsurface Safety Valve must be installed to operate "fail-safe" and these must be linked to H<sub>2</sub>S detector heads at the wellhead.

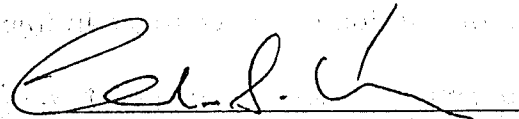
10. A barricade must be installed around the wellhead which is capable of withstanding vehicle collision.

11. All injection operations must be immediately suspended if any injection equipment, monitoring equipment or safety devices considered necessary for safe operation should fail.

12. The Operator must submit a progress report to the Energy and Minerals Division for the 4 month period during which the project is in operation, determined from the first day of injection. The progress report is due within 60 days after the end period and must contain:

- a) details of any workover or treatment program done on the well with reasons for the workover and results of the workovers,
- b) a discussion of any changes in injection equipment and operations,
- c) a general review of the operation of the project including identification of problems, remedial action taken and results of the remedial action on project performance,
- d) a discussion of the overall performance of the project,
- e) an evaluation of all monitoring done during the reporting period including corrosion protection, fluid analyses, logs and any other data collected,
- f) a table showing monthly volumes of injected fluid, corresponding maximum wellhead injection pressures, maximum daily injection rates, average wellhead temperatures and hours on injection,
- g) the volume-weighted average composition and formation volume factor for the injected fluid,
- h) a plot showing monthly injection volume and average pressure versus time on an ongoing basis,
- i) a table showing tonnes of sulphur and CO<sub>2</sub> disposed on a monthly and cumulative basis.

13. The project shall be deemed to have commenced upon the initiation of acid gas injection into the well. The Manager, Field Operations, at Charlie Lake must be notified in writing 72 hours prior to the commencement of injection operations.
14. An emergency response plan procedure must be filed with the Manager, Field Operations prior to the commencement of injection operations.
15. The operations of the acid gas injection scheme will be subject to review by the Ministry. The Director of Engineering and Operations Branch or the Manager, Field Operations, may issue general guidelines regarding the operations of the acid gas injection scheme.
16. The approval or any condition of it may be modified or rescinded by the Director of Engineering and Operations Branch for non-compliance of the conditions or unsafe operations.



Charles Kang, on behalf of the  
Minister of Employment  
and Investment

DATED AT the City of Victoria, in the Province of British Columbia, this  
23 day of April, 1997.

MINISTRY OF EMPLOYMENT AND INVESTMENT

- I. Prepared for Charles Kang, Deputy Minister for DECISION
- II. Subject: Application by Novagas Clearinghouse Ltd. for approval of "Acid Gas Injection" under section 100 of the Petroleum and Natural Gas Act (PNG Act).

III. Recommendation:

Your approval of this application is recommended.

IV. Background:

A Project Approval Certificate under the Environmental Assessment Act was granted to Novagas Clearinghouse Ltd. (NCL) on November 13, 1996 to build and operate the Caribou gas processing plant. A condition of the Certificate required NCL to obtain from the Ministry of Employment and Investment, approval to inject acid gas (hydrogen sulphide and carbon dioxide) into the well c-4-G/94-G-7. NCL subsequently applied for the approval of acid gas injection under section 100 of the PNG Act.

V. Discussion:

Acid gas injection into deep subsurface reservoirs is a relatively new development in the oil and gas industry. The accepted industry practice was to release acid gases to the atmosphere with or without prior removal of sulphur. Handling and storage of sulphur and venting of waste carbon dioxide (a greenhouse gas) should be minimized for environmental reasons. Also, environmental legislation limits the amount of acid gas which can be incinerated. Under these circumstances, the injection of acid gas into a deep subsurface reservoir is operationally, economically and environmentally superior over traditional sulphur and carbon dioxide disposal operations.

The c-4-G/94-G-7 well is completed in the Halfway Formation which is gas bearing. No objections were received following publication of notices of the application in the BC Gazette. All safety concerns have been appropriately addressed. There are no equity or resource conservation issues.

VI. Options:

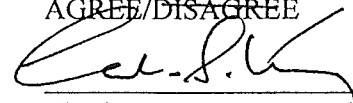
Option 1: Approval of the acid gas injection, consistent with the Province's approval of the Caribou plant under the Environmental Assessment Act.

Option 2: Rejection of acid gas injection into this well and require NCL to re-apply for a redesigned gas plant that emits sulphur and CO<sub>2</sub> into the atmosphere or injects it at another location.

VII. Recommended Option:

Option 1.

AGREE/DISAGREE

  
Charles Kang, Deputy Minister

Prepared by: P.S. Attariwala, P. Eng.  
Engineering and Operations Branch  
952-0311  
April 21, 1997  
EMD170339

PEO

