

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Pat Wood, III, Chairman;
Nora Mead Brownell, Joseph T. Kelliher,
and Suedeem G. Kelly.

Northern Natural Gas Company

Docket No. RP04-155-000

ORDER FOLLOWING TECHNICAL CONFERENCE

(Issued July 29, 2004)

1. On January 30, 2004, Northern Natural Gas Company (Northern) filed a general rate increase application pursuant to section 4 of the Natural Gas Act (NGA) and Part 154 of the Commission's regulations. Northern's proposal included a primary case and a prospective case. This order addresses Northern's proposal in its primary case to revise section 44 of its General Terms and Conditions (GT&C) to lower the acceptable levels of oxygen and carbon dioxide contained in gas received on its system.

2. On February 27, 2004, the Commission accepted and suspended Northern's tariff sheets, including the revised gas quality proposal, to become effective August 1, 2004.¹ The Commission directed staff to conduct a technical conference on Northern's gas quality proposal. Commission staff convened the technical conference on April 20, 2004, and the parties have filed several rounds of comments following the technical conference. This order rejects Northern's proposed changes to its gas quality provisions in its tariff. The order benefits the public by assuring that pipeline proposals that fail to meet the burden of proof required by section 4 of the NGA are not permitted to become effective.

Details of Filing

3. In this order, we address Northern's proposal to modify certain gas quality standards in its tariff. Specifically, in its section 4 filing Northern proposed on a system wide basis: (1) to decrease its carbon dioxide tolerance level from less than or equal to two percent by volume to less than or equal to one percent; and (2) to decrease its oxygen tolerance level from less than or equal to 0.2 percent by volume to 0.02 percent.

4. In its initial and reply comments, Northern has modified its proposal. This order addresses Northern's latest revised proposal, since that is the proposal it currently desires to implement. For its oxygen proposal, Northern continues to propose a decreased

¹ Northern Natural Gas Co., 106 FERC ¶ 61,195 (2004).

tolerance level of 0.02 percent, but has added a provision that it will provide at least 24 hours notice prior to the beginning of the gas day before enforcing the proposed specification. Northern asserts that this will provide shippers with an opportunity to make alternative arrangements in sourcing their gas for the next day and thereby reduce any interruptions of service.

5. For its carbon dioxide proposal, Northern now proposes to continue its existing two percent threshold for carbon dioxide, except for gas that will flow into its underground storage fields at Redfield Iowa, Lyons, Kansas, or Cunningham, Kansas from certain receipts that would be listed in its tariff. The tariff would permit Northern to require that the gas flowing into storage contain no more than one percent carbon dioxide by volume. Before applying the one percent specification for carbon dioxide, Northern would provide at least five business days notice on its website. Northern asserts that this would give affected shippers an opportunity to alter their transportation arrangements to avoid any disruption of service. In addition, the tariff would provide that Northern would not enforce the one percent specification at individual receipt points if such gas could be blended to less than or equal to one percent before the gas entered the storage fields.

6. Northern also stated that in order to apply the one percent carbon dioxide limit to any other area, it would have to amend its tariff. Northern asserts that this approach would eliminate any uncertainty as to any additional areas that may be subject to the one percent carbon dioxide limitation. All parties would have the right to protest Northern's new tariff filing proposing to subject new areas to the one percent carbon dioxide limit.

Initial and Reply Comments

7. At the technical conference, parties agreed to file initial comments on or before May 10, 2004 and reply comments on or before May 24, 2004. Because Northern made a revision to its proposal in its reply comments, parties were given until July 2, 2004, to file a response to Northern's reply comments. We discuss parties' concerns below.

Discussion

8. A pipeline has the burden under NGA section 4 to show that its proposed tariff changes are just and reasonable. For the reasons discussed below, the Commission finds that Northern has failed to present sufficient evidence in its pleadings in this proceeding to show that its proposal is just and reasonable. Therefore, the Commission rejects Northern's proposal to restrict carbon dioxide and oxygen tolerance levels for gas entering its system, without prejudice to its making a new proposal to address any corrosion problems on its system.

A. Northern's Case-in-Chief

9. Northern states that its proposal is a response to industry research and an advisory by the Office of Pipeline Safety (OPS) cautioning pipeline operators to give special attention to factors that influence the formation of internal corrosion. Northern also points to U.S. Department of Transportation regulations, which provide that pipelines may not transport corrosive gas unless the corrosive effect of the gas on the pipeline has been investigated and steps taken to minimize internal corrosion. In addition, Northern states that research done by various industry groups, such as the National Association of Corrosion Engineers, (NACE) and the Pipeline Research Council International (PRCI), support Northern's gas quality modifications. Northern included in its section 4 filing the testimony of two witnesses, Thomas Mertz and Mary Kay Miller, to support its proposed tightening of its gas quality standards. It supplemented that evidence with a presentation at the technical conference, which it included in its comments filed after the technical conference.

10. As a general matter, Northern explains that there are four primary corrosive gas agents that contribute to internal pipe corrosion: carbon dioxide; hydrogen sulfide; oxygen; and water. Northern states that combinations of these elements can produce local areas of high internal corrosion, *e.g.*, when carbon dioxide and water are present in a pipeline, corrosive acid is produced, resulting in corrosion. Northern also describes factors that accelerate internal corrosion. First, as temperature increases, many of the corrosive agents will increase in corrosivity mainly due to heat's effect of accelerating the electrochemical reactions involved. Second, as pressures increase, corrosion rates increase. Pressure is the predominant factor in generating a corrosive atmosphere because it increases the partial pressure of the gasses. Third, oxygen accelerates other corrosive agents. Fourth, abrasive materials such as sand can accelerate internal corrosion by eroding the pipe wall. Fifth, deposits or scaling on the pipe wall can accelerate corrosion by shielding inhibitors and not allowing them to get to the surface they are intended to protect. Thus, the presence of carbon dioxide, oxygen and water in the pipe with the accelerators creates a more aggressive overall corrosion effect than any single agent.

11. Northern also explains that its main concern for tightening its gas quality standards is to ensure the integrity of its storage systems, where water, temperature and high pressures magnify the impact of corrosive contaminants. Northern states that carbon dioxide enters Northern's system from gas produced in the Rocky Mountains and in some areas of west Texas. Given the configuration of Northern's system, Rocky Mountain gas enters Northern's system in close proximity to its underground storage fields. Northern states that it is currently able to blend such high carbon dioxide gas with lower carbon dioxide gas to avoid shutting in supplies and remains committed to continue this practice. However, Northern argues that as it receives more Rocky Mountain gas, *e.g.*, from the new Cheyenne Plains Gas Pipeline Company (Cheyenne Plains) interconnect, scheduled

to be in service by January 2005, blending to the current two percent level will become increasingly problematic. As stated by Northern witness Mertz, under Northern's proposal, carbon dioxide would be lowered to a threshold that results in partial pressures low enough to minimize corrosion in water-saturated systems.

12. As evidence that actual corrosion had occurred, Northern presents photographs of portions of pipe on Northern's system where – according to Northern – corrosion occurred due to the presence of carbon dioxide and oxygen. The photographs indicated pitting and general wall loss. Northern also states that a photograph of an existing storage well casing shows evidence of carbon dioxide corrosion in an underground natural gas storage well. Northern explains that dimples on the well are most likely caused by subscale carbon dioxide corrosion.

B. Comments

13. All the commenters, except one, oppose Northern's proposal, including both producers whose gas is delivered onto Northern's system as well as LDCs and others who receive gas downstream.

14. Numerous commenters argue that Northern's proposal is too speculative. Western Gas asserts that Northern's stated concerns about increased corrosion are unsubstantiated and overblown, and that Northern's cost estimates for addressing potential corrosion are greatly exaggerated. Western Gas also asserts that Northern provided evidence suggesting the possibility of corrosion in only a single well. Virginia Power notes that this well is not even an exemplar of the condition of Northern's storage wells generally, because it is without the protective tubing liner that would mitigate any corrosion. Virginia Power asserts that when asked to produce any corrosion studies it has undertaken regarding storage well corrosion generally, Northern responded that no such studies had been performed. Western Gas further asserts that Northern provided no evidence whatsoever of any down-hole corrosion problems in any of Northern's two hundred thirty-two other storage wells. The American Iron and Steel Institute, Alcoa Inc., Archer Daniels Midland Company and the United States Gypsum Company and USG Interiors, Inc. (collectively, the Industrials) argue that Northern has not presented any evidence that the corrosion occurring on Northern's system is anything more than normal wear and tear.

15. Several commenters including Indicated Shippers and Western Gas argue that the proposed reduced tolerance levels for oxygen and carbon dioxide are inconsistent with corresponding tariff provisions of the majority of interstate pipelines, including those interconnected with Northern. Western Gas asserts that more than 70 interstate pipelines have a carbon dioxide specification less stringent than the specification proposed by Northern. ONEOK also asserts that approving Northern's proposal would act to balkanize the interstate pipeline grid, and would be contrary to the Commission's policy

of fostering a national energy market. Duke argues that the Commission needs to consider whether the proposed stricter tolerance will cause a bottleneck that impinges upon the ability of shippers to move gas into and across Northern's system. Duke argues that imposing stricter gas quality standards on upstream supply sources will present a particular problem for Rocky Mountain gas, some of which is coal methane production with slightly higher carbon dioxide content than competing supplies.

16. Commenters also express concern that the proposal will harm Northern's customers. The Industrials state that they are concerned that the proposal would be cost-prohibitive for many producers and would force marginal wells out of service. Indicated Shippers argues that the proposed notice periods do not provide sufficient opportunity for customers to comply with the specification or to line up other supplies to replace non-complying gas. Western Gas and Evergreen assert that Northern's proposed one percent tariff specification for affected areas will impose significant increased costs on Northern's customers. Because Northern retains the discretion to shut down receipts at the 17 receipt points associated with Northern's storage fields on short notice, the Coalition asserts that Northern's revised proposal does not eliminate the possibility that Northern's customers would be subject to uncertainty. The Coalition also asserts that Northern's proposed tightening of the gas quality specifications would undermine an LDC's ability to purchase reliable long term supplies. Duke asserts that Northern's proposed tariff changes are not only unnecessary, they are actually harmful to competition and to gas producers, marketers and consumers.

17. Several commenters argue that Northern gives insufficient consideration to alternative solutions to any corrosion problems. Duke argues that use of storage liner solutions by Northern would be more practical than restricting carbon dioxide and oxygen standards. Mewbourne argues that shifting the burden of storage well protection to producers makes little sense because Northern has many affordable options to limit the introduction of corrosive elements to its wells.

18. Several commenters expressed concern that aspects of Northern's proposal are discriminatory. For example, the Indicated Shippers argue that Northern's proposal to provide at least five business days notice prior to enforcing the one percent specification at certain receipt points are discriminatory. Mewbourne asserts that the modified proposal would give Northern the authority to pick and choose which receipt points, with five days notice, would be subjected to Northern's blending analysis. Mewbourne argues that this would provide opportunities for arbitrary determinations by Northern, and may lead to discrimination and dispute. The Coalition states that its main concern was that Northern may, with as little as five days' notice, refuse to receive gas that Coalition members may need to meet their customers' needs.

19. Mewbourne also argues that Northern's characterization of gas in excess of one percent as "high CO₂ gas" is inaccurate and misleading because gas containing two percent of carbon dioxide or less is considered the industry standard for pipeline quality gas. Mewbourne also asserts that corrosion rates in Northern's underground storage wells are not caused by carbon dioxide or oxygen at all; rather, corrosion is caused by the hydrogen sulfide that originates in Northern's storage reservoirs.

20. Virginia Power requests expedited action, explaining that a critical counterparty has recently indicated that it is currently unwilling to sell any gas to flow onto Northern's system due to uncertainty over gas quality standards.

21. MidAmerican Energy Company (MidAmerican) filed comments supporting Northern's proposal. MidAmerican argues that as the interstate pipeline operator, Northern is ultimately responsible for pipeline integrity and safety. In addition, MidAmerican asserts that if the Commission permits producers to introduce gas with high levels of carbon dioxide onto Northern's system with the expectation that Northern will have to address the consequences, Northern's customers will eventually bear the expense of addressing the effects of the corrosive agents. MidAmerican also states that reducing the level of carbon dioxide permits more molecules of gas to flow, allowing for increased capacity.

22. In its reply comments, Northern attempts to defend its proposal as being sufficiently justified by the evidence presented. Northern states that the assertion that Northern has shown evidence of corrosion in only one well is incorrect because evidence of corrosion in one well is evidence of corrosion in the other wells because they all receive the same blended gas, including contaminants. Northern also disputes the idea that it should have to show more damage to specific pipes because it is undisputed that introducing high carbon dioxide gas into a storage field will produce carbonic acid; because the laws of physics and chemistry do not change among the various wells, corrosion will inevitably result.

23. Northern argues that producers should be responsible for the quality of the gas put into Northern's system. Northern asserts that other solutions are irrelevant, because it is the producers who should pay to solve the problem caused by their "high CO₂ gas". Northern also argues that it is appropriate for Northern to have a stricter carbon dioxide tolerance than other pipelines because the specific circumstances of Northern's system require it to take preventive measures to protect its storage fields. Specifically, Northern points to the geographic location of its storage fields as being in close proximity to high carbon dioxide gas. Northern asserts that its proposal is based on Northern's system, and that if other pipelines are not receiving high carbon dioxide gas, then their carbon dioxide thresholds are not relevant for determining the reasonableness of Northern's proposal.

C. Commission Determination

24. Pipelines are obligated by law to protect the integrity of their systems, and the Commission is aware of the serious harm that corrosion can cause. Left unchecked, corrosion can result in serious operational problems, and it is understandable that Northern would seek to address corrosion on its system proactively before such problems occur. However, the Commission also has a statutory obligation to ensure consumers “access to an adequate supply of gas at reasonable prices.”² Consistent with that obligation, the Commission must ensure that proposals that are intended to address system integrity do not unnecessarily discourage new sources of supply or impose unreasonable costs on shippers and consumers. Rocky Mountain gas, despite its higher carbon dioxide content, is a vital source for mid-American markets. It is unclear if Northern’s proposed gas quality specifications would discourage Rocky Mountain producers from continuing to develop and produce this resource area, resulting in reduced supplies and eventually harming consumers with higher prices. In addition, Northern’s proposal could require shippers to bear the cost of addressing the corrosion problem on Northern’s system, for example, by building relatively expensive new gas treatment plants.

25. Given these potential adverse effects of Northern’s proposal, Northern must provide sufficient evidence supporting its case-in-chief to demonstrate that its proposal reasonably balances Northern’s legitimate need to control corrosion on its system with the goal of ensuring consumers adequate gas supplies at reasonable prices. We believe that Northern has, thus far, failed to do so. Specifically, Northern has inadequately: (1) delineated the extent and causes of corrosion in its storage fields; (2) shown that its proposed tolerance levels for carbon dioxide and oxygen would resolve any corrosion problems; and (3) shown that there are not lower cost ways to address any existing corrosion which would have less adverse impact on the development of new supplies.

26. First, Northern has failed to delineate the extent and causes of corrosion in its storage fields. Specifically, Northern has failed to provide sufficient evidence of the extent of corrosion in its storage fields to justify its proposal to make its oxygen and carbon dioxide standards significantly more stringent than those of most other pipelines. Northern has provided tangible evidence of only one storage well suffering from possible corrosion. Northern has not presented evidence of any down-hole corrosion in any other wells and has not conducted a detailed study of carbon dioxide corrosion in its storage wells. Accordingly, the Commission cannot determine, based on Northern’s evidence whether any other wells are experiencing similar problems. Moreover, the single storage well in which corrosion was found lacks the most rudimentary form of corrosion protection – production tubing – that would protect the casing from down-hole corrosion while providing a cost-effective means of repairing corrosion that might occur.

² Tejas Power Corp. v. FERC, 908 F.2d 998, 1003 (D.C. Cir. 1990).

27. Northern asserts that it has provided sufficient evidence in support of its proposal. Northern dismisses arguments that showing corrosion in a single storage well is insufficient because gas quality, temperature, water and pressure are similar for each well in its storage field. Therefore, Northern states that evidence of corrosion in one storage well is evidence of corrosion in other storage wells. Northern asserts that it is not required to remove a piece of pipe from each mile of its pipeline system to demonstrate that carbonic acid causes corrosion in each section, because the laws of physics do not change from one storage well to another.

28. The Commission agrees with Northern that it need not present physical evidence of corrosion from each storage well. Also, Northern's argument that similarly situated wells should be experiencing the same degree of corrosion is not without merit. However, Northern has not provided sufficient evidence that its other storage wells are similarly situated to the one well for which it did provide actual evidence. While evidence of corrosion in one storage well *may* be evidence of corrosion in other wells, this assertion disregards the fact that different sections of pipe on Northern's system are different ages, some with protective coatings. Corrosion is likely to be occurring in all of Northern's pipes, but without additional information we have no way of knowing the cause of the corrosion, how much corrosion is occurring and where it is occurring. Northern need not remove a piece of pipe from each mile of pipeline, but, particularly in light of the potential costs of its proposal discussed above, it does need to provide more concrete information than it has to date.

29. In addition, Northern has failed to demonstrate that high carbon dioxide and oxygen levels are causing the existing corrosion in its storage wells. As discussed *supra*, Northern has identified four primary corrosive agents that contribute to internal corrosion: carbon dioxide, hydrogen sulfide, oxygen, and water. It also states that increases in temperature or pressure increase the rate of corrosion. Of these six possible causes of corrosion Northern identified, Northern believes that carbon dioxide and oxygen are the main causes of corrosion on its system. For example, Northern's Director of Corrosion Control identified dimples on a storage well casing as pitting *most likely* caused by subscale carbon dioxide corrosion. While Northern has provided the Commission with generic information about corrosion, Northern has not provide any laboratory analysis or other study that would identify and confirm the actual cause of the corrosion it is experiencing on its pipelines and storage casings. Without conducting a laboratory analysis of a reasonable sampling of actual corroded parts, there is no way for the Commission to determine the actual agent or agents that are causing corrosion on the facilities of the Northern system.

30. Second, Northern has failed to justify that its proposed tolerance levels for carbon dioxide and oxygen would resolve the particular corrosion problems it is experiencing. As discussed above, Northern has not demonstrated that carbon dioxide and oxygen are

the primary causes of corrosion on Northern's system. Until such a showing is made, there is not a sufficient basis to conclude that tightening tariff specifications for carbon dioxide and oxygen in the manner proposed by Northern will provide a sufficient benefit to Northern's system to justify the potential costs of accepting Northern's proposal. We also find that Northern has not shown that existing corrosion rates are unreasonably high and not a result of old age. In Northern's data response³ it states that it has had to remove 1,358 feet of pipe of the Spraberry line (24-inch diameter) and 5 feet of the Kermit line (16-inch diameter) due to corrosion. Northern states that its Spraberry Line was built in 1954 and that the Kermit line was built in 1959. Northern does not indicate whether either of these pipes was internally coated. Further, according to Northern, only 13.5 percent of Northern's entire system has internally coated pipe.⁴ Due to the age of these pipes (Spraberry is 50 years old and Kermit is 45 years old) and the probable lack of internal coating, the Commission does not find it unusual that these pipes would need to be replaced or rehabilitated.

31. Third, it does not appear that Northern has adequately considered alternatives to its proposal that might better balance the need to control corrosion with the goal of providing access to adequate gas supplies at reasonable prices. We note that there are several ways to control internal corrosion and extend the life of a pipeline. Methods include protective coatings and linings, materials selection, inhibitors, and inserting cleaning pigs to remove accumulated solids and debris from the walls of the pipeline. Coatings and linings are the main tools for defending against corrosion. They are often applied in conjunction with cathodic protection systems, which protect against external pipeline corrosion, to provide the most cost-effective protection for pipelines. Materials selection refers to the selection and use of corrosion-resistant materials such as stainless steels, plastics, and special alloys to enhance the lifespan of a structure such as a pipeline. Materials selection personnel must consider the desired lifespan of the structure as well as the environment in which the structure will exist to optimize the material selection. Corrosion inhibitors are substances which, when added to a particular environment, decrease the rate of attack of that environment on a material such as metal.

32. Northern asserts that alternative solutions for addressing corrosion are irrelevant because the producers' "high CO₂ gas" is causing the corrosion problem. Northern thus concludes that the producers should pay to solve the problem or allow Northern to manage the gas quality issues through the proposed tariff language. We disagree that other alternatives should not be considered. The issue of corrosion is too important to address without first considering other options. Even if Northern is correct that the primary cause of corrosion is carbon dioxide found in the producers' gas, there may be far more cost effective ways of addressing corrosion than requiring producers to install

³ Reference No. TCMOC-16.

⁴ Reference No. TCMOC-09.

gas treatment plants to reduce the oxygen and carbon dioxide levels in their gas. It would be economically wasteful to require that enormous sums be spent on gas treatment facilities when more modest solutions such as installing tubing liners would suffice.

33. Northern also points to the prospect of its system receiving more high carbon dioxide gas from Cheyenne Plains when it commences deliveries in 2005. While Northern may be correct that more high CO₂ gas may enter its system from the proposed interconnect with Cheyenne Plains, until it provides more evidence (1) detailing the extent of the corrosion on its system and (2) demonstrating that such corrosion is, in fact, caused by carbon dioxide, we see no reason to accept its proposal based on the prospect of harm caused by gas received from Cheyenne Plains. This is particularly so, since, as discussed *supra*, we are concerned that tightening gas quality specifications on Northern's system could impede the flow of Rocky Mountain gas to the market.

34. In addition, we are concerned that acceptance of Northern's proposal could have a balkanizing effect on the mid-continental gas market. Northern's proposed revised standards are inconsistent with those of the majority of interstate pipelines, including those interconnected with Northern. Northern's proposal raises the possibility that interconnecting upstream pipelines would be forced to adopt an equally stringent carbon dioxide standard – a standard that is more restrictive than the industry standard -- in order to assure their ability to redeliver gas into the system. Such a result might impair the Commission's policy of fostering a national energy market and further hinder development of Rocky Mountain gas supplies and thus be contrary to the public interest.

35. Last, we emphasize that we find only that Northern has not provided sufficient evidence in its pleadings in this case to support its proposal. We make no findings on the merits of whether Northern's proposed standards could be justified by additional evidence, and we reject the proposal without prejudice to Northern refile and justifying its proposal. The Commission recognizes the importance of controlling corrosion on pipeline systems so as to ensure their safe and reliable operation.

The Commission orders:

Fifth Revised Sheet No. 281 filed by Northern on January 30, 2004 is rejected.

By the Commission.

(S E A L)

Linda Mitry,
Acting Secretary.