



DEPARTMENT OF NATURAL RESOURCES
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July 10, 2007

Mr. Norm Cox
1620 Holly Avenue
Greeley, CO 80631



RE: Complaint #200109834 ✓
NWSW Section 12 - T5N - R65W
Weld County, Colorado

Dear Mr. Cox:

As you are aware, the Colorado Oil & Gas Conservation Commission (COGCC) collected gas and water samples from your water well on April 30, 2007. The gas sample was submitted to Isotech Laboratories, Inc. in Champaign, Illinois for gas compositional analyses. The water samples were taken to Evergreen Analytical Laboratory in Wheat Ridge, Colorado for organic and inorganic analyses.

This letter summarizes analytical results of the samples collected from your water well. Copies of the laboratory analytical reports are included with this letter.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO STANDARDS

The analytical results for the recent water sample from your well and applicable ground water and/or drinking water standards are summarized in this letter. The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established these standards. Please keep in mind that the human standards were established for public drinking water supplies, and often people use and consume ground water from private wells that exceed the standards.

- **Total Dissolved Solids (TDS):** The TDS standard for human drinking water is 500 milligrams per liter (mg/l). Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 2,000 mg/l for irrigation, and below 5,000 mg/l for most livestock watering.

TDS was detected in the recent water sample from your well at a concentration of 1,010 mg/l. This is greater than the human drinking water standard, within the recommended maximum concentration for irrigation, and within the recommended maximum concentration for most livestock watering.

- **Sodium (Na):** Although the CDPHE does not have a standard for sodium, people on salt restricted diets should be aware of the sodium concentration in the water they drink. A concentration of less than 20 mg/l is recommended by some for people on salt restricted diets or for people suffering from hypertension or heart disease. Sodium sometimes occurs naturally at concentrations exceeding recommended levels.

Sodium was detected in the recent water sample from your well at a concentration of 110 mg/l, which is greater than the recommended level.

- Chloride (Cl): The CDPHE chloride standard for human drinking water is 250 mg/l. Chloride concentrations in excess of 250 mg/l usually produce a noticeable taste in drinking water.

Chloride was detected in the recent water sample from your well at a concentration of 63.5 mg/l, which is within the human drinking water standard.

- Sulfate (SO₄): The CDPHE sulfate standard for human drinking water is 250 mg/l. Although CDPHE does not have an agricultural standard for sulfate, other agencies recommend a concentration below 1,500 mg/l for livestock watering. Water containing high concentrations of sulfate, typically caused by the leaching of natural deposits of magnesium sulfate (Epsom salts) or sodium sulfate (Glauber's salt) may be undesirable because of their laxative effects.

Sulfate was detected in the recent water sample from your well at a concentration of 416 mg/l, which is greater than the human drinking water standard and less than the recommended agricultural level.

- Total Nitrate (NO₃) + Nitrite (NO₂) as Nitrogen (N): The CDPHE total nitrate (NO₃) + nitrite (NO₂) as nitrogen (N) standard for human drinking water is 10 mg/l. Nitrate and Nitrite are common contaminants in ground water from agricultural sources, such as fertilizer and animal wastes. They are known to cause infant cyanosis or "blue baby disease" in humans and, at concentrations greater than 100 mg/l as nitrogen, may be dangerous to livestock.

Total nitrate (NO₃) + nitrite (NO₂) as nitrogen (N) was detected in the recent water sample from your well at a concentration of 5.32 mg/l, which is within the human drinking water standard.

- Iron (Fe): The CDPHE iron standard for human drinking water is 0.3 mg/l. Small amounts of iron are common in ground water. Iron produces a brownish-red color in laundered clothing, can leave reddish stains on fixtures, and impart a metallic taste to beverages and food made with it. After a period of time iron deposits can build up in pressure tanks, water heaters, and pipelines, reducing the effective flow rate and efficiency of the water supply.

Iron was not detected in the recent water sample from your well.

- Manganese (Mn): The CDPHE manganese standard for secondary drinking water is 0.05 mg/l and for agricultural water it is 0.2 mg/l. Manganese rusts like iron but it is not magnetic.

Manganese was detected in the recent water sample from your well at a concentration of 0.0061 mg/l, which is less than the secondary drinking water standard and the agricultural water standard.

- **Fluoride (F⁻):** The CDPHE fluoride standard for human drinking water is 4.0 mg/l and for agricultural water it is 2.0 mg/l.

Fluoride was detected in the water sample collected from your well at a concentration of 1.2 mg/l, which is within the human drinking water standard and the agricultural standard.

- Calcium (Ca), Potassium (K), Magnesium (Mg), Bicarbonate (HCO₃) and Carbonate (CO₃) were also tested for in your well water. There are no standards from CDPHE for these parameters.

If your water exceeded any of the CDPHE standards for human drinking water, and if you or your livestock and pets drink your water, then you may wish to discuss the possible health effects of continued consumption with your physician and/or veterinarian. In addition, it may be prudent for you to consider treating your water prior to consumption. Information is being provided to you that contain procedures recommended by the EPA.

METHANE GAS CONCENTRATION

Dissolved methane was not detected in your well. For your reference, the theoretical threshold whereby methane could accumulate to potentially explosive levels in unventilated areas is 2 mg/L.

Methane alone is physiologically inert and non-toxic to humans. The presence of methane in drinking water does not present a known health hazard to humans or other animals by ingestion. Methane gas dissolved in water "exsolves" when exposed to the atmosphere and dissipates rapidly because it is lighter than air. If the methane occurs at a high enough concentration and if it is allowed to accumulate in a confined space, such as a well pit, crawl space, closet, etc., then an explosion hazard could exist.

COMPARISON OF ORGANIC ANALYTICAL RESULTS TO STANDARDS

Benzene: The CDPHE basic ground water standard for benzene is 5 ug/l. Benzene was not detected in your water well.

Toluene: The CDPHE basic ground water standard for toluene is 1,000 ug/l. Toluene was not detected in your water well.

Ethylbenzene: The CDPHE basic ground water standard for ethylbenzene is 700 ug/l. Ethylbenzene was not detected in your water well.

Xylene: The CDPHE basic ground water standard for xylene is 1,400 ug/l. Xylene was not detected in your water well.

GAS COMPOSITION

The gas produced from the oil/gas wells around your home is "thermogenic" methane. Thermogenic gas is formed by the thermal breakdown of organic material in rocks resulting from high temperatures created by deep burial. Thermogenic gas typically

contains methane (C1), ethane (C2), propane (C3), iso-butane (iC4), normal butane (nC4), iso-pentane (iC5), normal pentane (nC5), and hexane (C6). The sample from your water well did not contain any methane but did contain a trace amount of propane without any of the other components typically found in thermogenic gas. As a result, the propane is from an unknown source unrelated to nearby oil/gas wells.

Laboratory results of the gas sample from your water well indicates that nitrogen, oxygen, carbon dioxide are predominantly present. The air we breathe consists mostly of nitrogen (78%), oxygen (20%), noble gases (1%), and carbon dioxide (0.03%). The results from your water well have been plotted with the general makeup of common air to show the similarities (see Exhibit 1).

REVIEW OF WATER WELL RECORDS

Information on your water well and nearby water wells was obtained from the Division of Water Resources. Within a ½ mile radius of your water well there are permits on at least seven (7) water wells and two (2) monitoring holes. Total reported depths of these wells range to 82 feet below ground surface (fbgs).

According to available information, your water well was drilled and completed in 1967 with perforations from 24 fbgs to total depth of 33 fbgs. .

DATA EVALUATION OF ANALYTICAL RESULTS

Within a ½ mile radius of your water well there are at eight (8) producing oil/gas wells and one (1) permitted well locations. Of the producing wells, there are two completion types: the Codell Sandstone and the Niobrara/Codell. COGCC files contain analytical data of the produced water from the Codell and the Niobrara. Additionally, COGCC files contain water quality data from other domestic water wells.

The data was entered into HydroChem, a RockWare earth science computer software program. Data can then be plotted on Stiff diagrams or Piper diagrams, two types of visual presentations.

Cox Water Well vs. Produced Waters

The Stiff diagrams of the laboratory data clearly show the differences between the cation/anion signature of the recent sample from your water well and the cation/anion signature of the Codell and Codell-Niobrara produced waters (Exhibit 2).

The Piper diagram displays data on a tri-linear chart. Total Dissolved Solids (TDS) values for each datum are indicated by circles; the greater the TDS, the larger the diameter of the circle. The Piper diagram clearly shows that the produced water data plot in close proximity on the chart. The datum from the recent sample from your water well plots away from the produced waters. The Piper diagram also shows that the recent sample from your water well has a much lower TDS concentration than the produced waters (Exhibit 3).

Cox Water Well vs. Other Domestic Water Wells

The Stiff diagrams of the laboratory data shows some similarities of the cation/anion signatures between the recent sample from your water well and the Martin, Johnson and Ray water wells (Exhibit 4). Your well water contains less sodium and more calcium than the three other water wells.

The Piper diagram displays data on a tri-linear chart. Total Dissolved Solids (TDS) values for each datum are indicated by circles; the greater the TDS, the larger the diameter of the circle. The Piper diagram of the laboratory data shows that the recent sample from your water well does not plot near the other water wells (Exhibit 5). The other water wells generally contain more sodium than your well.

SUMMARY

Based on the laboratory results, the water quality in your water well is somewhat typical of other water wells. Furthermore, water quality results from your well had much different cation/anion signatures from produced water associated with oil & gas wells completed in the Codell and Codell-Niobrara formations.

The gas sample predominantly contained nitrogen, oxygen, and carbon dioxide. The volumes of these gases are somewhat similar to common air (Exhibit 1). However, the sample from your water well contained less oxygen and more carbon dioxide than common air. A trace amount (.012%) of propane was detected in the water well sample. The source of the air in your water well is unknown, but may be attributed to cavitation caused by the pump.

Based on available information, the water in your well does not appear to have been impacted by nearby oil/gas operations. Therefore, this complaint is resolved and no further investigation will be conducted at this time.

Should you have any questions, please call me at (303) 894-2100 ext. 118.

Sincerely,

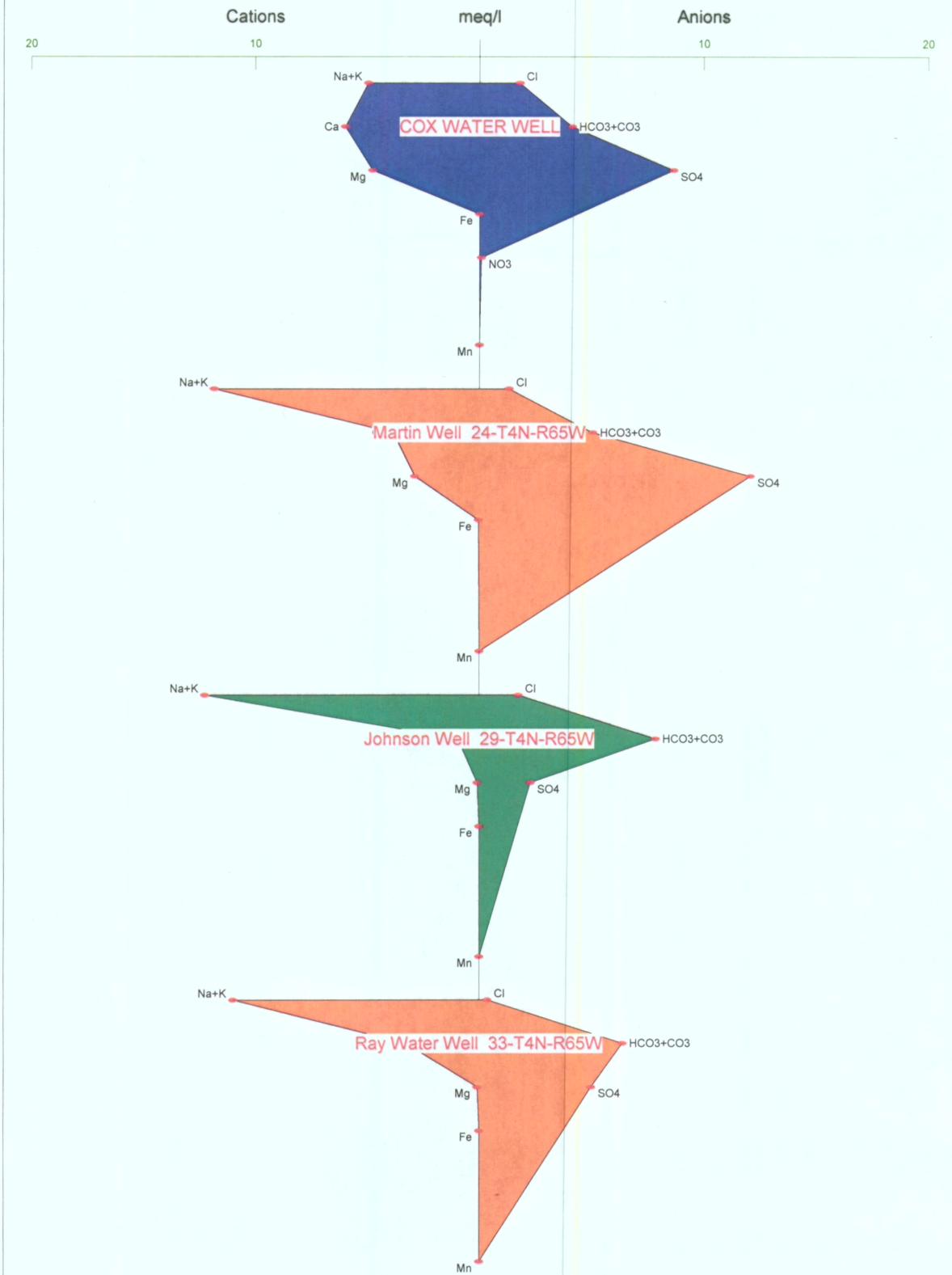


Randall H. Ferguson
Environmental Protection Specialist

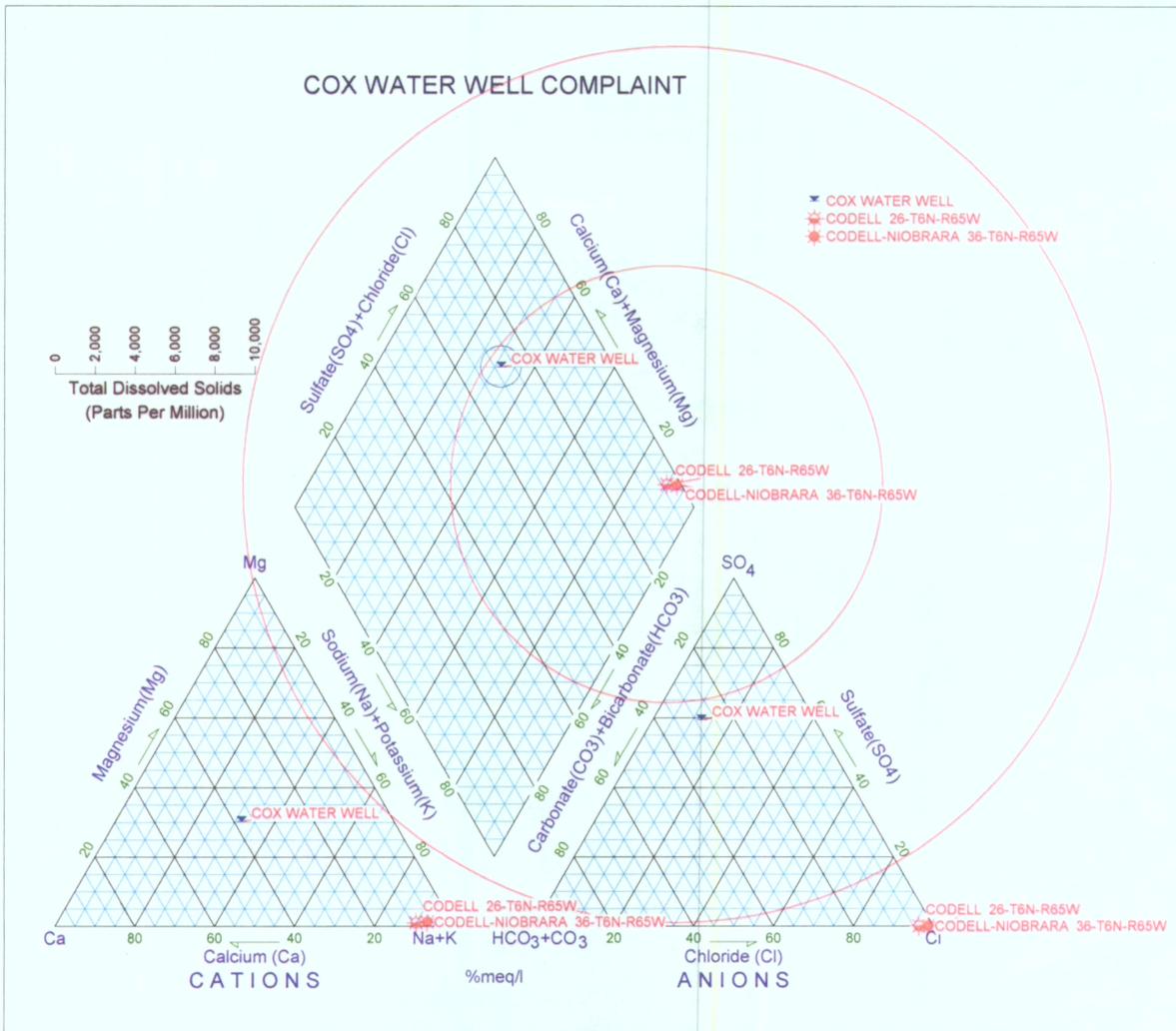
Attachments

Cc: Brian Macke – COGCC Director
Debbie Baldwin – COGCC Environmental Manager

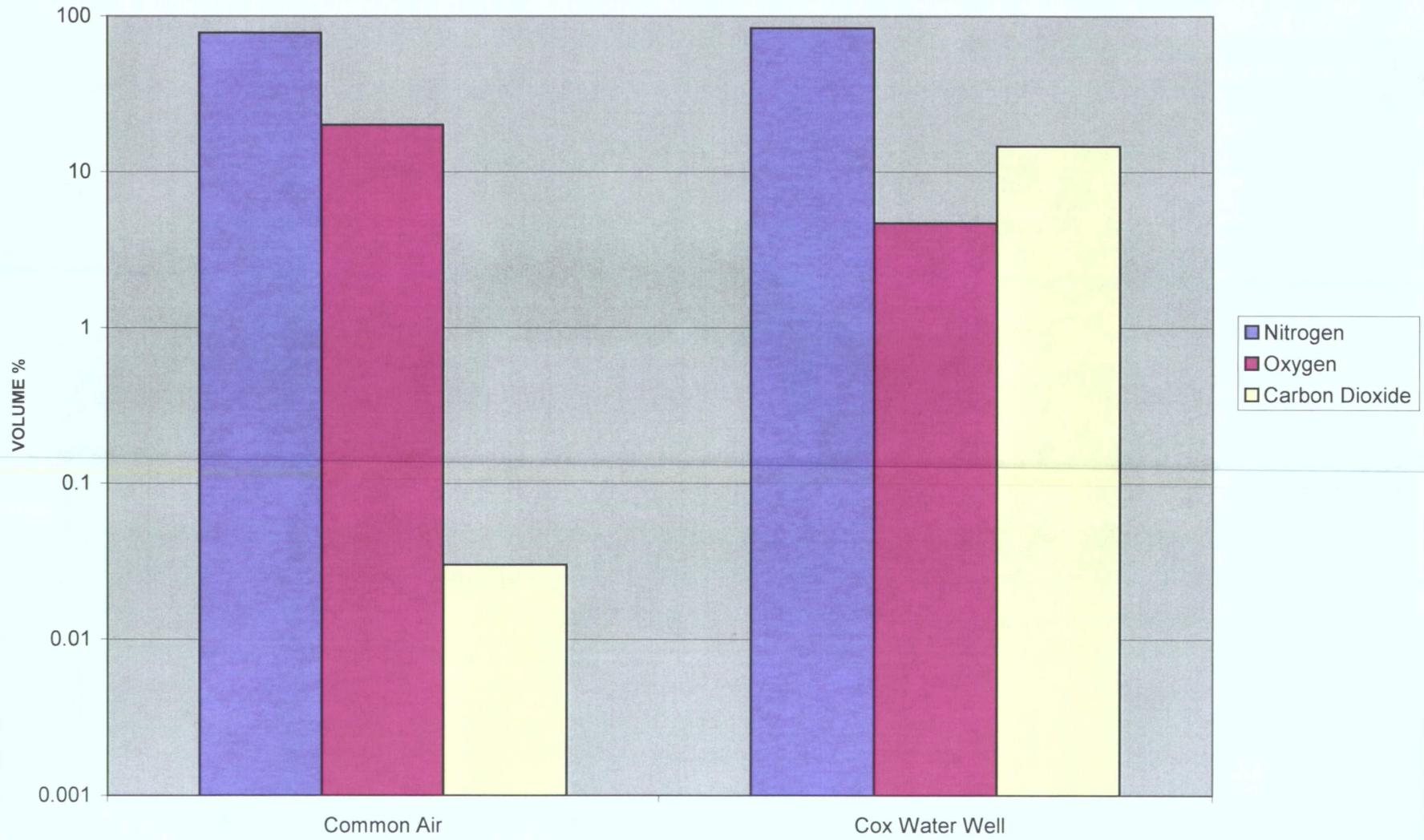
COX WATER WELL COMPLAINT



COX WATER WELL COMPLAINT



COX WATER WELL / GAS COMPOSITION



COX WATER WELL COMPLAINT



- ▼ COX WATER WELL
- Martin Well 24-T4N-R65W
- Johnson Well 29-T4N-R65W
- Ray Water Well 33-T4N-R65W

