

HEATER-TREATER SOURCE CATEGORY

NOx Emission 4-Factor Analysis for Reasonable Progress (RP)

I. Source Description

A heater-treater is a device used to remove contaminants from the natural gas at or near the well head before the gas is sent down the production line to the gas plant. Generally, the contaminants include liquid hydrocarbons and water. The composition of the liquid hydrocarbons (oil and condensate) can vary by gas field but the majority of gas wells in Colorado are located in the Denver-Julesburg (DJ) Basin which produces a condensate liquid.

The heater-treater is a combination of a heater, free-water knockout, and oil/condensate and gas separator. It prevents the formation of ice and natural gas hydrates that may form under the high pressures associated with the gas well production process. These solids can plug the wellhead. Since chokes in the wellhead restrict the flow of the oil and gas from the well, temperatures may drop due to the pressure changes of the choke. This may cause the water or hydrates to freeze and plug the well, thereby slowing or stopping the condensate and gas production. Two diagrams at the end of this document show examples of heater-treaters.

Information regarding heater-treater emissions and control strategies is scarce. The paucity of information is likely due to the very low emissions associated with each heater-treater that very often falls below regulatory thresholds. However, the multitude of gas wells in Colorado (~26,000 by 2018) result in cumulative heater-treater NOx emissions that are projected to be the largest single area source category in Colorado by 2018.

II. Heater-Treater Source Category Emissions - Statewide

Pollutant	Heater-Treater Emissions (tpy)	2018 Annual Emissions (tpy)
CO	0.18 ¹	4,809
NO ₂	0.88 ¹	22,901
PM ₁₀	negligible ²	negligible
SO ₂	Negligible ³	negligible

Notes:

1. Source: "Final Report – Oil and Gas Emission Inventories for the Western States", by ENVIRON International Corporation for Western Governors' Association, December 27, 2005
2. Source: AP-42, 5th Edition, Volume 1, Chapter 1, Section 1.4.3
3. Source: "A Comprehensive Oil and Gas Emissions Inventory for the Denver-Julesburg Basin in Colorado," by ENVIRON International Corporation, May 2008

III. Control Technology Evaluation

Step 1: Identify All Available Technologies

Five technologies have been identified to lower NOx emissions from heater-treaters:

Technology #1 - Lowering the heater-treater temperature

Technology #2 - Installing insulation on the separator

Technology #3 - Retrofitting with low-NO_x burners

Technology #4 - Adding post combustion technology – selective non-catalytic reduction (SNCR) or selective catalytic reduction (SCR)

Technology #5 - Using central gathering facilities

Technology #1: This technology (lowering the heater-treater temperature) was identified by EPA Natural GasSTAR in PRO Fact Sheet No. 906. The fact sheet was written with reduction of methane in mind, although this technology would also reduce combustion emissions because it would reduce fuel use. The following is from the fact sheet: "...heater-treater temperatures at remote sites may be higher than necessary, resulting in increased methane emissions. Commonly, the reason for this is that operators need to reduce the chance of having a high water content in the produced oil and manpower limitations do not allow for constant monitoring at remote sites. Field personnel, consequently, are inclined to operate the equipment at levels that cause the least problems, but also result in higher than necessary emissions."

Technology #2: This technology (installing insulation on the separator) was identified by the Four Corners Air Quality Task Force in 2007. This technology would reduce combustion emissions because it would reduce fuel use.

Technology #3: This technology (retrofitting with low-NO_x burners) was identified by the EPA and is documented in the AP-42 "Compilation of Air Pollutant Emission Factors." The following is from the 5th Edition, Volume 1, Chapter 1, Section 1.4.4: "Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation."

Technology #4: This technology (adding NSCR or SCR) involves adding post-combustion control equipment to treat engine exhaust.

Technology #5: This technology (central gathering facilities) is being used by some companies, including in the Piceance Basin and in the Jonah/Pinedale region of Wyoming. Other terms include central collection facilities, liquid gathering systems, or 3-phase gathering systems. In some cases, produced natural gas is separated into two or three phases (gas and liquids [produced water and condensate] or gas, produced water, and condensate) at the wellhead and those liquid streams are sent to central gathering facilities. In other cases, including a facility in the Piceance Basin, produced gas (including the liquids) is sent directly to the central gathering facilities. In those cases, emissions from heater-treaters would be reduced because fewer heater-treater devices would be required.

Step 2: Eliminate Technically Infeasible Options

Technology #1: This technology is technically feasible.

Technology #2: This technology is technically feasible.

Technology #3: The Four Corners Air Quality Task Force considered low NO_x burners as a mitigation option for the Four Corners area and had the following finding: “Application not appropriate for the San Juan Basin, because most burners commonly used in the Four Corners Area are smaller than the technology is capable of providing emission reduction.” It appears likely that this technology would also be technically infeasible for the Denver-Julesburg (DJ) Basin considering that low-NO_x burners are not commercially available for very small combustion sources such as heater-treaters.

Technology #4: A heater-treater is a combustion device that is similar to internal combustion engines where the application of NSCR and SCR on engines smaller than 100 hp is not practical or technically feasible. Moreover, the cost per unit of power is higher, and there are uncertainties as to whether the proper exhaust temperature for optimum performance can be reliably maintained. Consequently, NSCR and SCR may not be commercially available for many small engines. (source: Four Corners Air Quality Task Force document available at www.nmenv.state.nm.us/aqb/4C/Docs/ArgonneRICEmat.DOC). Similarly, for small fuel burning equipment, such as heater-treaters, the availability of post combustion controls is anticipated to be unavailable and therefore technically infeasible.

Technology #5: This technology is technically feasible.

Step 3: Evaluate Control Effectiveness of Each Remaining Control Technology

Technology #1: The EPA Natural GasSTAR in PRO Fact Sheet No. 906 regarding lowering heater-treater temperatures was written from the methane reduction perspective. Emission reductions for NO₂ and CO were not provided.

Technology #2: The Four Corners Air Quality Task Force did not provide the control effectiveness of installing insulation and additional information on the effectiveness of such control appears to be unavailable.

Technology #5: Removing individual heater-treaters and replacing them with a central gathering facility would eliminate emissions from the heater-treaters. The central gathering facility would be a new source of emissions; however, overall emissions will be reduced. Not only would combustion emissions from the multiple heater-treaters be eliminated, VOC emissions from condensate tanks (which would also be removed from wellheads if this technology was implemented) would be eliminated. If a vapor recovery unit (VRU) were used at the central gathering facility, VOCs could be compressed back into the gas stream.

Step 4: Evaluate Impacts and Document Results

Factor 1: Costs of Compliance

Technology #1 - Lowering the heater-treater temperature: Although the EPA Natural GasSTAR fact sheet was written with methane reductions in mind, the costs of implementing the control technology also applies to combustion emission reductions. Capital costs range from \$1,000 to \$10,000. Annual operating and maintenance costs are \$100 to \$1000. The payback, through incremental labor and fuel gas savings, is less than one year.

Technology #2 - Installing insulation on the separator: Installing insulation on heater-treaters will reduce fuel usage and is economically feasible where there is a payback that meets an operators respective investment targets (e.g., ROI or NPV). For older units where the remaining life of the equipment is limited, the economics may not justify the application of insulation.

Technology #5 – Centralized gas well gathering facilities to reducing the number of Heater-Treaters: The cost of removing a group of heater-treaters and replacing them with a central gathering facility will vary due to many parameters, including topography, composition of the produced natural gas, number of heater-treaters being removed, and mineral rights. Topography may cause difficulties in dealing with large slugs of liquids; frequent pigging may be required to move liquids to the central gathering facility. It would be more cost efficient to implement this technology on a new field, rather than retrofitting an existing field that already has infrastructure based on wellhead separation. Typically when a well is drilled there are multiple ownerships in the well due to land and mineral rights. This requires that volumes be allocated back to each specific well for proper royalty treatment. To track this requires equipment at each well, which increases capital and operating costs and reduces the savings from eliminating equipment at each wellhead. This allocation issue goes away when a company owns all associated mineral and land rights. Cost savings include recovery of product that was previously lost to the atmosphere, reduced truck traffic to wellheads, and reduction of condensate and water tanks.

Factor 2: Time Necessary for Compliance

Technology #1 - Lowering the heater-treater temperature: Additional time for achieving compliance with this technology is not anticipated.

Technology #2 - Installing insulation on the separator: Additional time for achieving compliance with this technology is not anticipated.

Technology #5 – Centralized gas well gathering facilities to reduce the number of Heater-Treaters: The additional time necessary to comply with centralizing gas well gathering would be very site specific and would likely vary depending on gas well density and topographical barriers.

Factor 3: Energy Impacts and Non Air-Quality Environmental Impacts

Technology #1 - Lowering the heater-treater temperature: Lowering the heater-treater temperature will reduce fuel use. There are not any non air-quality impacts.

Technology #2 - Installing insulation on the separator: Installing insulation on heater-treaters will reduce fuel use. There are not any non air-quality impacts.

Technology #5 – Centralized gas well gathering facilities to reduce the number of Heater-Treaters: It is more energy efficient to operate a central gathering facility rather than multiple individual heater-treaters. There are not any non air-quality impacts.

Factor 4: Remaining Useful Life

Technology #1 - Lowering the heater-treater temperature: Heater-treaters typically have a service life of approximately 30 to 40 years. (source: manufacturer, ProSept Technologies) This control technology would not affect the service life.

Technology #2 - Installing insulation on the separator: Heater-treaters typically have a service life of approximately 30 to 40 years. (source: manufacturer, ProSept Technologies) This control technology would not affect the service life.

Technology #5 – Centralized gas well gathering facilities to reduce the number of Heater-Treaters: Heater-treaters typically have a service life of approximately 30 to 40 years. (source: manufacturer, ProSept Technologies) If heater-treaters were removed and replaced with a central gathering facility, the heater-treaters would not be used for their entire service.

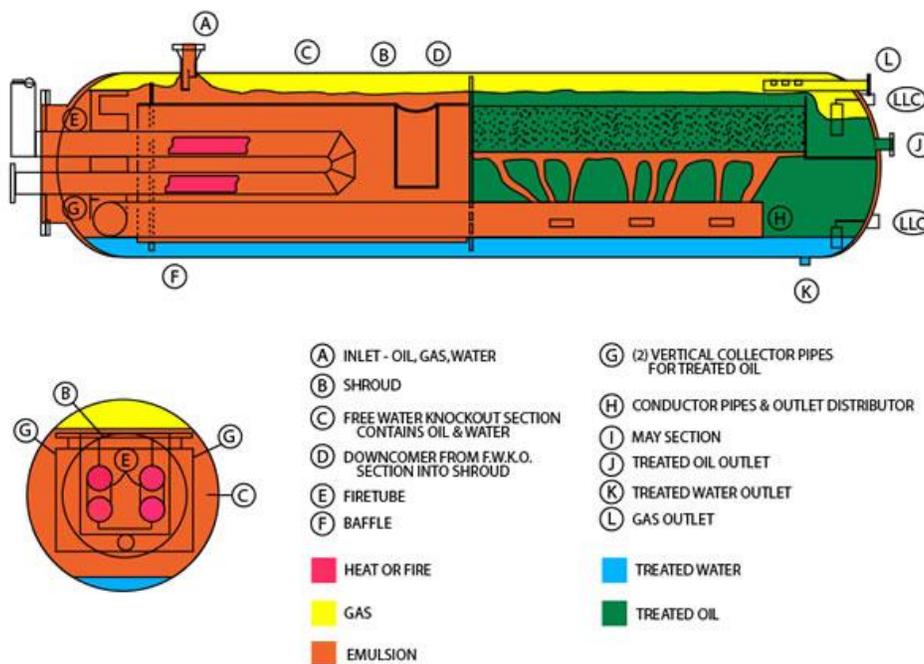
Step 5: Select Reasonable Progress Control

Currently, heater treaters are not regulated (issued permits) by the Division as they fall under an exemption for fuel burning equipment that uses gaseous fuel and has a design rate of less than or equal to 5 million BTUs/hour (AQCC Regulation 3, Part A, II.D.1.k). Generally, reports from source operators (provided to the Division on emission inventory reporting forms) indicate that a typical heater-treater design rate is about half of the exemption threshold.

Due to the lack of sufficient data, the Division is not able to make a control technology determination for heater-treaters in this planning period. The Division intends to reassess this category in the next planning period.

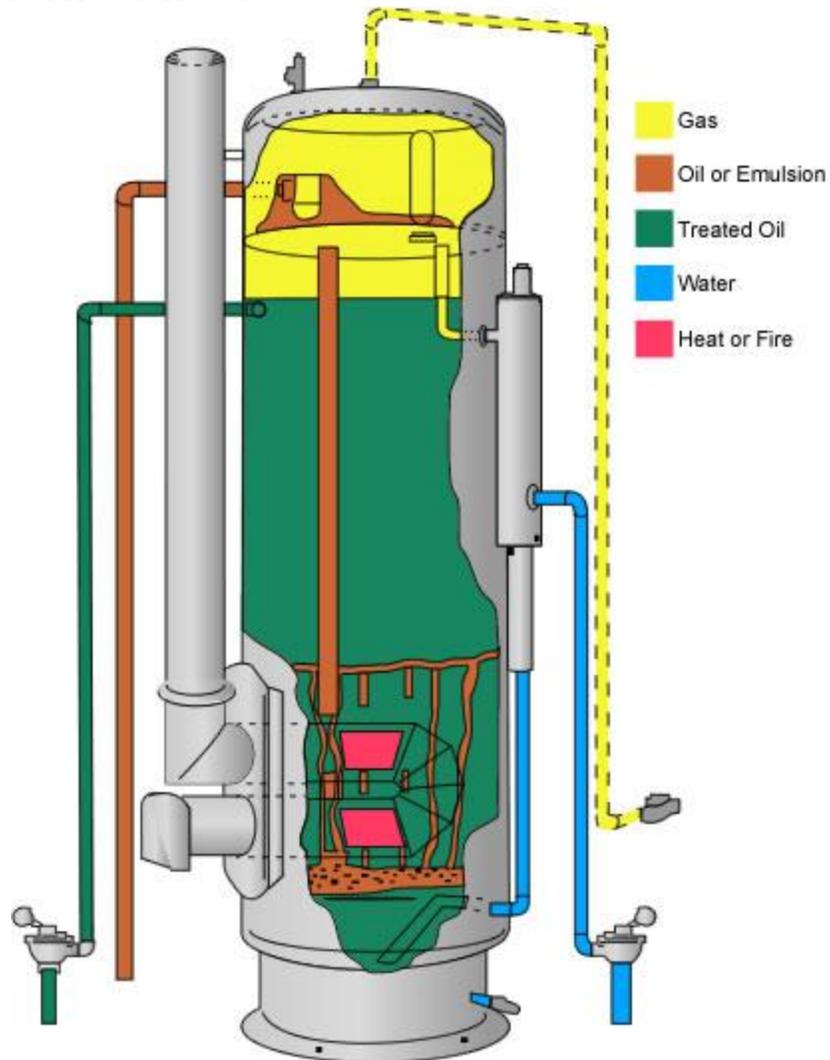
The below diagrams provide basic information on the typical heater-treater designs.

Diagram 1: Horizontal Heater-Treater



This diagram was provided by KW International. Further explanation about heater-treaters is available at <http://www.kwintl.com/oil-treating.html>.

Diagram 2: Vertical Heater-Treater



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