Hydrogen Sulfide Summary Update

October 06, 2011

http://cogcc.state.co.us/

STATE OF COLORADO OIL & GAS

OIL & GAS CONSERVATION COMMISSION

What is Hydrogen Sulfide (H_2S)?

Characteristics

- A colorless, transparent gas that is heavier than air.
- Often characterized as having a "rotten-egg" smell at low concentrations. The odor is apparent to most people at 0.13 parts per million (ppm). It is easily smelled at 4.6 ppm.

Health and Safety Thresholds

- The typical warning level is 10 ppm.

  OSHA requires SCBA equipment (supplied air) for on-site workers at concentrations above 20 ppm.
- The action level is 100 ppm.

  BLM and COGCC require submittal of special operation plans when concentrations exceed 100 ppm.

What is Hydrogen Sulfide (H_2S)?

<u>Industrial and Municipal Sources of H_2S:</u>

- Certain oil and gas formations and facilities, although it is uncommon in most areas of the Piceance Basin.
- Mining operations
- Geothermal exploration and hot springs
- Breweries
- Slaughterhouses
- Pulp paper processing
- Asphalt roofing
- Municipal sewers

Physiological response:

10 ppm	Beginning eye irritation
50-100 ppm	Slight conjunctivitis and respiratory tract irritation after 1 hour exposure
100 ppm	Coughing, eye irritation, loss of sense of smell after 2-15 minutes. Altered respiration, pain in the eyes and drowsiness after 15-30 minutes followed by throat irritation after 1 hour. A several hour exposure results in gradual increase in severity of these symptoms and death may occur within the next 48 hours.
200-300 ppm	Marked conjunctivitis and respiratory tract irritation after 1 hour of exposure
500-700 ppm	Loss of consciousness and possibly death in 30 minutes to 1 hour.
700-1000 ppm	Rapid unconsciousness, cessation of respiration and death.

From: American National Standards Institute standard: Z37.2-1972 Acceptable Concentrations of Hydrogen Sulfide

COGCC Rule 607
HYDROGEN SULFIDE GAS

a. When **well servicing operations** take place in zones known to contain at or above one hundred (**100**) ppm hydrogen sulfide gas, as measured in the gas stream, the operator shall file a hydrogen sulfide drilling operations plan (United States Department of the Interior, Bureau of Land Management, Onshore Order No. 6, November 23, 1990).

b. When **proposing to drill** a well in areas where hydrogen sulfide gas in excess of one hundred (**100**) ppm can reasonably be expected to be encountered, the operator shall submit as part of the Form 2, Application-for-Permit-to-Drill, a hydrogen sulfide drilling operations plan (United States Department of the Interior, Bureau of Land Management, Onshore Order No. 6, November 23, 1990).

c. Any **gas analysis indicating** the presence of hydrogen sulfide gas shall be reported to the Commission and the local governmental designee.

H_2S Summary for the area south of Parachute, Colorado

- In March 2009 Noble Energy reported to BLM and COGCC the presence of H_2S south of Parachute.

- Noble has 353 active wells in the Parachute, Grand Valley and Rulison Fields

- Recent draeger tube data indicates that 313 have H_2S
  - 271 Less than 10 ppm
  - 37 Have 10 ppm to less than 100 ppm
  - 4 Have 100 ppm or more

Based on draeger tube H_2S data from March 12 to April 5, 2011
Data provided to COGCC on 8-03-2011

draeger Tube

Tested Wells

Tests of Wells by Draeger Tube and Gas Chromatograph

Year	Number of Wells Tested	Number Tests	Results								
			100 ppm or More			Between 10 and 99 ppm			Less Than 10 ppm		
			Number of wells	sample counts	Percent of Total Samples	Number of wells	sample counts	Percent of Total Samples	Number of wells	sample counts	Percent of Total Samples
2009	213	1238	5	32	3.2%	43	558	60.6%	165	648	52.5%
2010	274	1490	6	12	0.3%	56	114	7.7%	212	1364	92.0%
2011	241*	576*	5*	5*	0.9%	15*	26*	4.5%	221*	545*	94.6%

Based on draeger tube and gas chromatograph H_2S data from 02/27/2009 to 08/22/2011;
Data provided to COGCC on 9-16-2011 and 10-03-2011
* 238 Fee mineral and the 3 federal mineral wells

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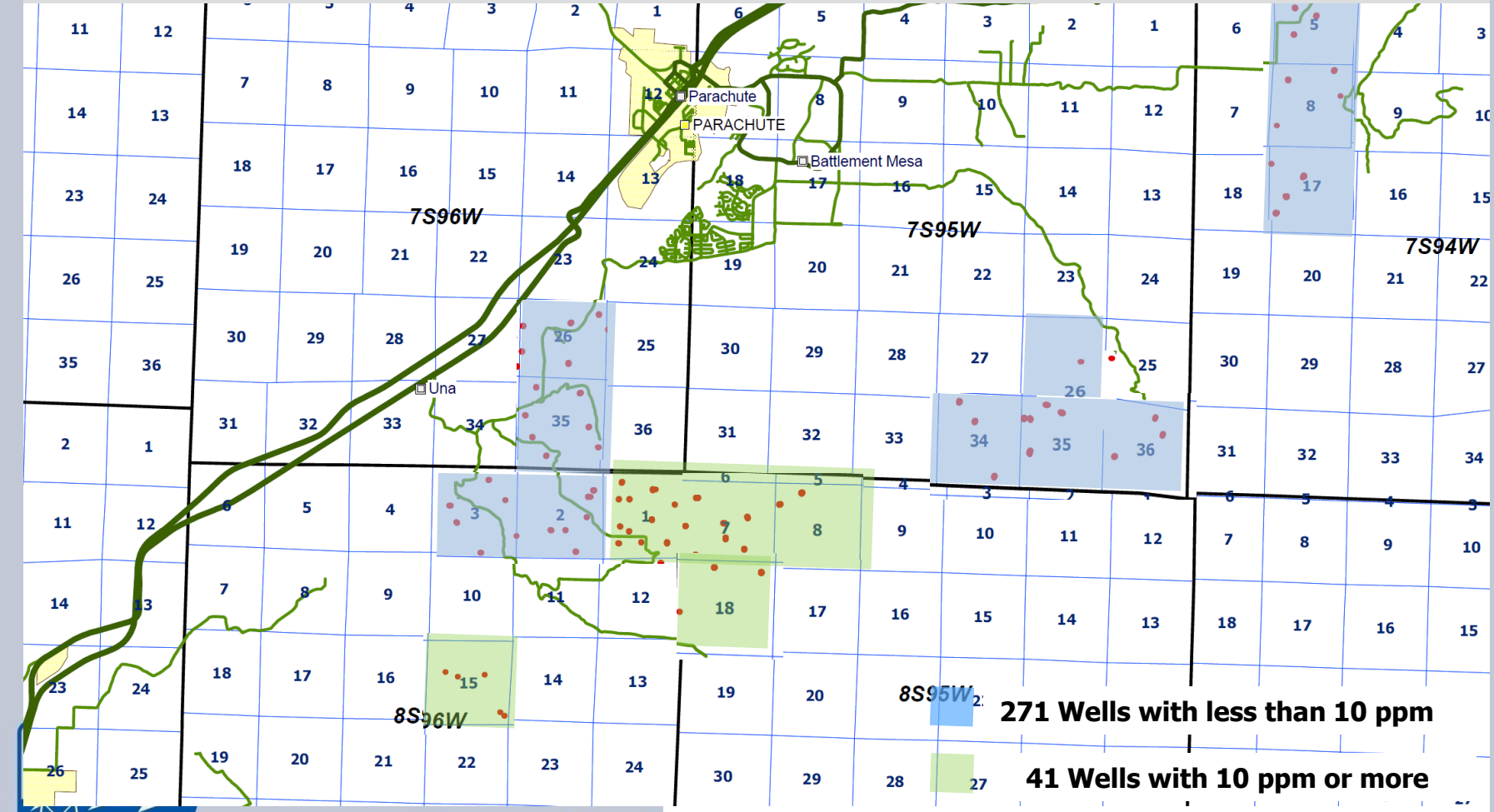
Location of Recent draeger Tube Data indicates that 313 have H_2S



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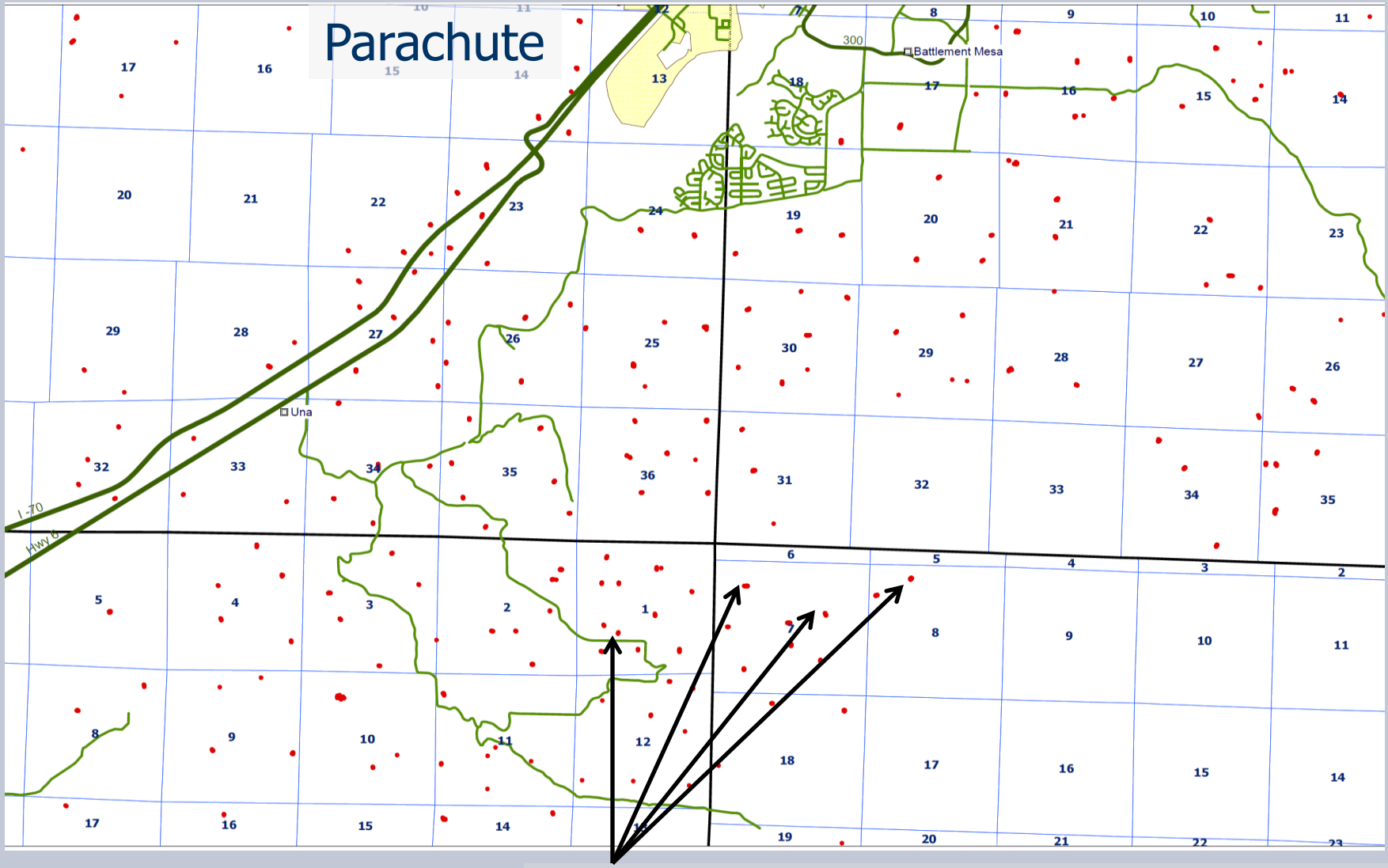

4 locations with draeger Tube H_2S Data at 100 ppm or more on March 12 to April 5, 2011

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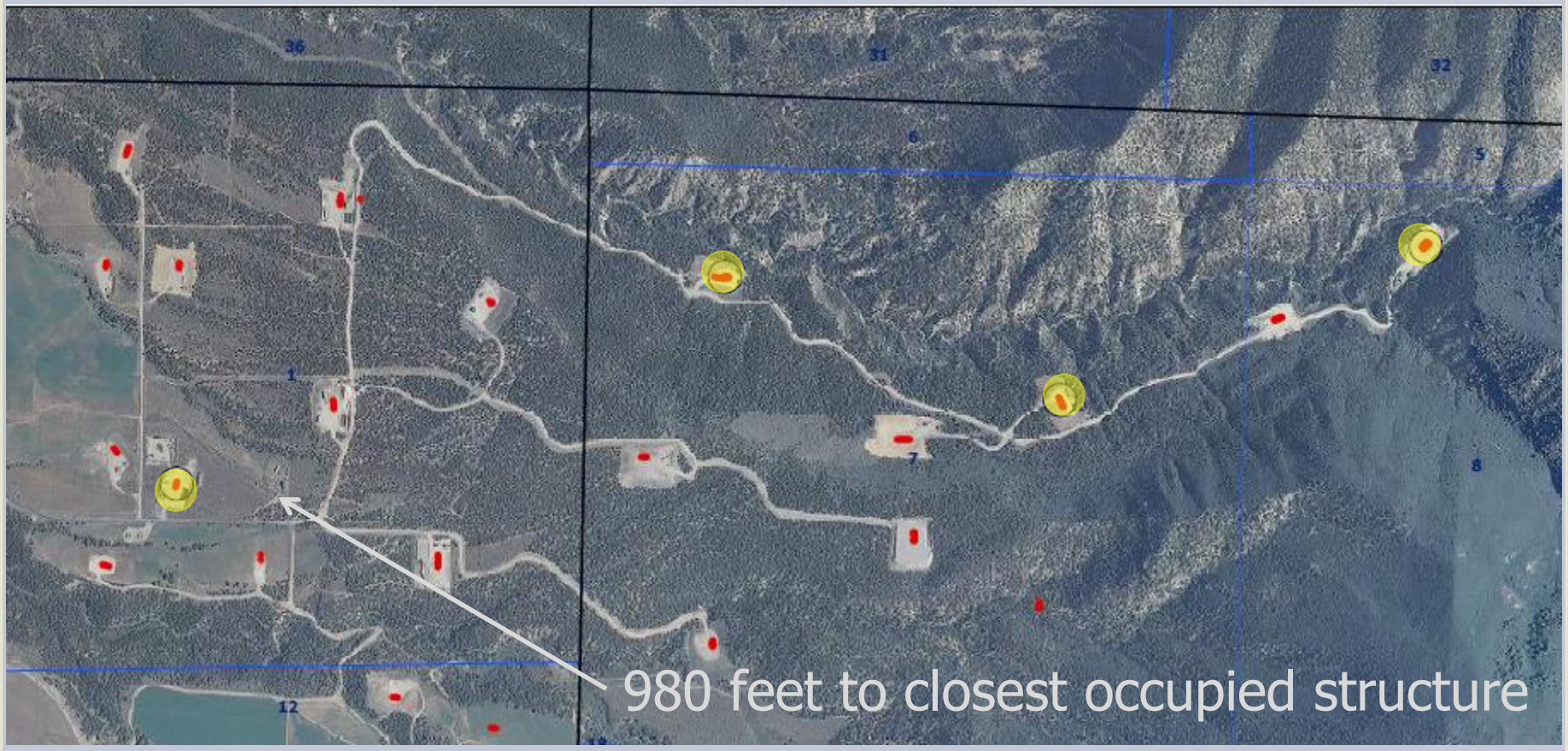
Recent data for 4 wells with 100 ppm or more

Well Name	Well Pad	API Number	draeger Tube		Gas Chromatograph	
			Test Date	Measurement H2S (PPM)	Test Date	Measurement H2S (PPM)
Federal 6-14D	7D	05-045-15331	03/16/2011	100	02/21/2011	6.9
Federal 7-32D	7G	05-045-12163	03/12/2011	170	03/4/2011	99
Federal 8-21C	8C	05-045-13787	03/12/2011	200	03/1/2011	non-detect
Ramos 1-23A	SGV 1K	05-045-12700	04/05/2011	450	09/15/2011	0.3

Four locations with H_2S levels equal to or greater than 100 ppm



Locations > 100 ppm

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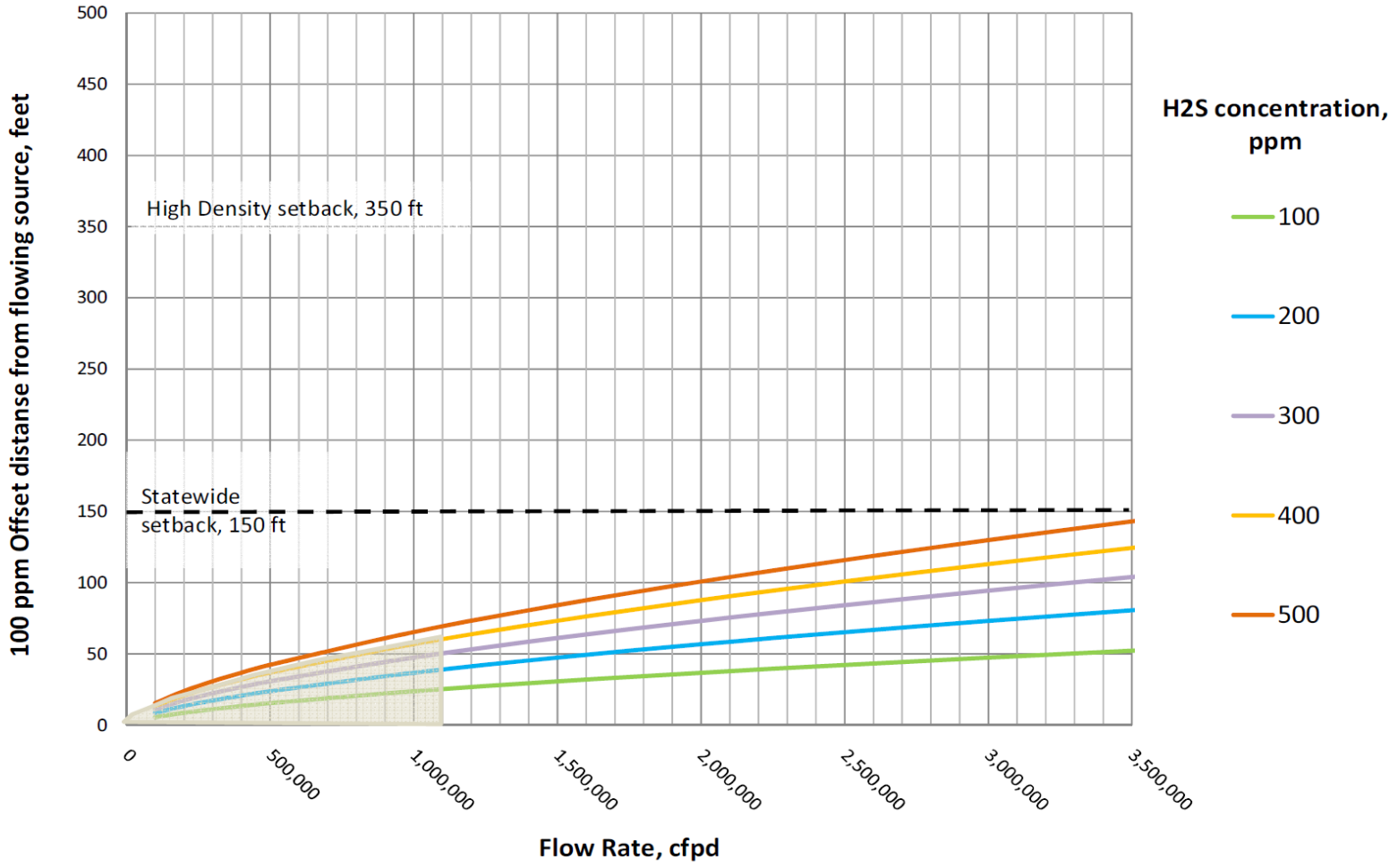
Public Safety

a) All wells are connected to a closed system of pipelines and production facilities and do not vent to the atmosphere.

b) H_2S has not been observed during drilling, but it is present in some production operations, and it may be present during some well operations.

c) Any atmospheric releases during these well operations are closely monitored and are short in duration. Short-term dispersed concentrations would be less than those shown on the following slide, which are calculated for a constant source.

RADIUS OF EXPOSURE Calculation for – Pasquill-Gifford Equation



Worker Safety

- Noble has an OSHA Plan (worker's safety plan) in place.
- Periodic H_2S training is required for employees and contractors who may be exposed to H_2S.
- On-site visitors must be escorted.
- On-site monitors are required.
- Signage, wind indicators, SCBA equipment, and record keeping are required.
- Best practices and operations are specified
- Other areas are also monitored to ensure that pipeline specifications for low H_2S are met, which enables detection of any new sources.

Further COGCC Investigation:

1. Continue to gather H_2S data from operators (required by Rule 607.c. – operators must report any gas analysis indicating the presence of H_2S)

2. Site inspections to verify signage, monitoring, and record keeping

3. Confirm that H_2S Plans are established and implemented in areas with H_2S above 100 ppm

4. Continued review of Parachute, Grand Valley and Rulison Fields

5. Other wells and areas on GIS system