

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



July 16, 2020¹

MATERIALS LABORATORY FACTUAL REPORT

Report No. 18-096

A. ACCIDENT INFORMATION

Place : Dallas, Texas
Date : February 23, 2018
Vehicle : Pipeline operated by Atmos Energy
NTSB No. : PLD18FR002
Investigator : Sara Lyons²

B. COMPONENTS EXAMINED

Sensit Gold CGI Combustible Gas Indicators serial numbers (S/N) 02737 and 18615; and Sensit Gold G2 Combustible Gas Indicators S/Ns G2 29901 and G2 48509, manufactured by Sensit Technologies, Valparaiso, Indiana.

C. DETAILS OF THE EXAMINATION

Figure 1 shows a photograph of the four as-received combustible gas indicators. Used during the accident investigation, the gas indicators are used in bar hole testing to determine the relative level of methane in the soil. The gas indicators were sent to Sensit Technologies, manufacturer of the instruments, to retrieve data that would indicate whether the gas indicators were calibrated for the period between February 20 and 24, 2018, which includes the day of the accident. At Sensit, the gas indicators were subjected to a 'bump test', a test of the unit's reaction to applicable standard calibration gases.

A copy of the Sensit test results with a print out of the gas calibration log for each instrument is shown in Appendix 1. The Sensit report indicated that the four combustible gas indicators were calibrated for the period between February 20 and 24, 2018.

Frank Zakar
Senior Metallurgist

¹ This laboratory report was originally completed on November 19, 2018 but later was revised based on minor comments received during the Technical Review, which was held on July 14, 2020.

² The on-site investigators were Ravi Chhatre and Roger Evans. The current investigator-in-charge is Sara Lyons.

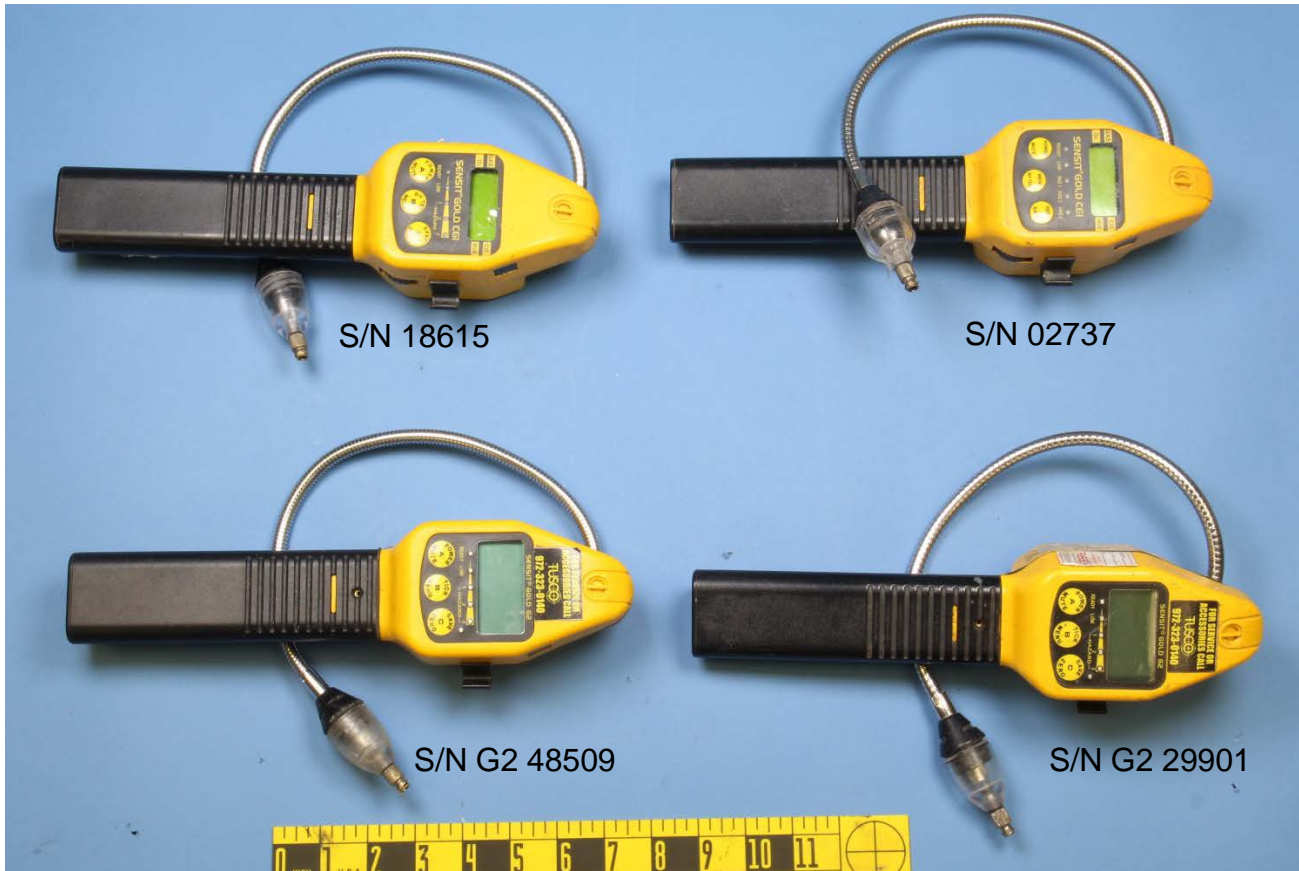


Figure 1. As-received combustible gas indicators shown with their corresponding serial numbers.

APPENDIX I

TEST RESULTS FROM SENSIT TECHNOLOGIES

July 9, 2018

Sensit Technologies

Assessment of Instrumentation Condition and Operation

Prepared for Frank Zakar, National Transportation Safety Board
Materials Laboratory Division, 490 L' Enfant Plaza East, Washington, DC. 20594.

[REDACTED]

This assessment was conducted on the following instruments presented to us while under the authority and at the request of Mr. Zakar. They were maintained in "As Found" condition for testing purposes and remain so.

1. Sensit Gold G2, model EX/TC/CO/O2/H2S, #48509
2. Sensit Gold G2, model EX/TC/CO/O2, #29901
3. Sensit Gold CGI, model EX/TC/CO/O2, #18615
4. Sensit Gold CGI, model EX/TC/CO, #2737

The assessment includes a Tech Review, a board level external and internal examination for corrosion, dirt or debris present or prior evidence thereof, on or in the circuitry or any component/part of the instrument. A list of any original part or feature that is no longer functioning or operating within our factory specifications. Lastly, a test of the unit's reaction to all standard calibration gases applicable during a timed exposure, (T90 @ 60sec). Commonly referred to as a "Bump Test".

1. Sensit Gold G2 #48509

Software version 1.96, batteries installed were "Procell" brand (approved), measuring 1.43v. The unit has an acceptable current draw of 190ma. Date set is OK. However, clock set is over 11 hours too fast. Software is calling for calibration for all sensors during warm-up. The unit has been set for (30) day calibration cycle and this has been exceeded.

Tech Review:

LEL Sensor PCB – Dirt visible inside sensor cap trapped between inlet and sensor cap filter. Sensor appears clean however. Sensor base shows damage from what appears to be high heat conditions around the top interior edge. Sensor base has (2) O-rings installed. The instrument main cavity and boards were clean. No signs of corrosion of debris.

Bump Test #1 – (#48509) (6/29/18)

(2.5% Vol. Methane or 50%LEL Methane & 100ppm CO, aka "Combo gas") = 80% LEL Methane, (out-of-spec), 104ppm CO, (In-spec).

(100% Volume Methane) = 100% Vol. (In-spec).

(25ppm H₂S/Air) = 22ppm H₂S, (In-spec).

O₂ Depletion = (In-spec).

Bump Test #2 - (#48509) (6/30/18)

(Combo gas) = 92.4% LEL Methane, (Out-of-spec), 107ppm CO, (In-spec).

(100% Volume Methane) = 100% Vol. (In-spec).

(25ppm H₂S/Air) = 23ppm H₂S, (In-spec).

O₂ Depletion = (In-spec).

Bump Test #3 – (#48509) (7/02/18)

(Combo Gas) = 5.0% Vol. aka 100% LEL Methane, (Out-of-spec), 110ppm CO, (In-spec).

(100% Vol. Methane) = 100% Vol. (In-spec).

(25ppm H₂S/Air) = 23ppm H₂S, (In-spec).

O₂ Depletion = (In-spec).

NOTE: Although #48509 has at this time exhibited LEL sensor drift into the Out-of-Spec range, it did record acceptable Methane calibration in early **February, March and April 2018** and presumably operated in this scale and timeframe of specification as evident in the Cal log printout. Please see the Calibration Log data from the instrument's Print Menu, included in this report.

2. Sensit Gold G2 #29901

Software version 1.67, batteries installed were "Procell" brand (approved), measuring 1.32v. The unit has an acceptable current draw of 210ma. Date set is OK. However, clock set is over 11 hours too fast. Software is calling for calibration for most sensors during warm-up. The O₂ sensor is alerting in FAIL mode at start-up. This would have to be corrected by the Customer conducting an O₂ Test, as outlined in the User Manual. This failure mode is a feature by design. It is not a failure of the O₂ sensor, per se. The unit has been set for (30) day calibration cycle and this has been exceeded.

Tech Review:

LEL Sensor PCB – Dirt collected forward of the LEL Sensor Cap Filter. Cap was clean inside. Inlet luer was restricted as was flowrate by debris.

Inside instrument's main cavity and boards were clean.

Bump Test #1 – (#29901) (6/29/18)

(Combo Gas) = 54.4% LEL Methane, (In-spec), 108ppm CO, (In-spec).

(100% Vol. Methane) = 100% Vol. (In-spec).

O2 – In Fail Mode at start-up (Sensor fault, needs replacement, goes into fail mode as by design).

Bump Test #2 – (#29901) (6/30/18)

(Combo Gas) = 49.4% LEL Methane, (In-spec), 108ppm CO, (In-spec).

(100% Vol. Methane) = 100% Vol. (In-spec).

O2 – Fail Mode at Start-up.

Bump Test #3 – (#29901) (7/02/18)

(Combo Gas) = 51.6% LEL Methane, (In-spec), 107ppm CO, (In-spec).

(100% Vol. Methane) = 100% Vol. (In-spec).

O2 – Fail Mode at Start-Up.

NOTE: #29901 continued to maintain in-spec responses to 50% LEL Methane. The Cal Log printout revealed the same pattern with acceptable readings in **early January, late January and early March of 2018**. Please refer to the instrument Cal Log printout included with this report.

3. Sensit Gold CGI #18615

Software version 5.20, batteries installed were "Procell" brand (approved), measuring 1.38v. The unit has an acceptable current draw of 180ma. Date set is OK. However, clock set is over 11 hours too fast. Software is calling for calibration for all sensors during warm-up. The unit has been set for (30) day calibration cycle and this has been exceeded.

Tech Review:

LEL Circuit Board and surrounding area are clean. Inside the main housings there was a small amount of dirt mostly contained near the area between the gooseneck and speaker. It appears like a fine powder. This dirt was also noticed in the intake tubing and pump. This unit had a replacement pump on-board which was not installed by the factory.

Bump Test #1 – (#18615) (6/29/18)

(Combo Gas) = 40.5% LEL Methane , (out-of-spec), 110ppm CO, (In-spec), O2 Depletion – OK
(100% Vol. Methane) = 100% Vol. (In-spec).

Bump Test #2 – (#18615) (6/30/18)

(Combo Gas) = 39.6% LEL Methane, (out-of-spec), 110ppm CO, (In-spec), O2 Depletion – OK
(100% Vol. Methane) = 100% Vol. (In-spec).

Bump Test #3 – (#18615) (7/02/18)

(Combo Gas) = 38.1% LEL Methane, (out-of-spec), 110ppm CO., (In-spec), O2 Depletion – OK
(100% Vol. Methane) = 100% Vol. (In-spec).

Note: #18615 failed to produce In-spec readings at the 50% LEL Methane level at this time. However, it was noted that the instrument's Cal log printout listed acceptable readings and valid calibrations for two occasions in **early February 2018 and early March 2018**. Please see Calibration Log Report included.

4. Sensit Gold CGI #2737

Software version 3.92, batteries installed were "Procell" brand, (approved), measuring 1.37v. The unit has an acceptable current draw of 230ma. Date set is OK. However, clock set is over 11 hours too fast. Software is calling for calibration for all sensors during warm-up. The unit has been set for (30) day calibration cycle and this has been exceeded. Unknown prior user/operator has changed the display mode of this unit to read % volume of methane gas instead of % LEL of gas.

Tech Review:

Heavy amount of dirt impacted into the neck of the sensor base. The sensor cap is in far better condition. Small pieces of dirt or debris located inside intake tubing. Flowrate not compromised.

Bump Test #1 – (#2737) (6/29/18)

(Combo Gas) = 4.0% Vol. gas (aka 80% LEL), (out-of-spec), 92ppm CO, (In-spec).

(100% Vol. Methane) = 100% Vol. (In-spec).

Bump Test #2 – (#2737) (6/30/18)

(Combo Gas) = 3.78% Vol. gas (aka 75.6% LEL), (out-of-spec), 91ppm CO, (In-spec)

(100% Vol. Methane) = 100% Vol. (In-spec).

Bump Test #3 - (#2737) (7/02/18)

(Combo Gas) = 3.6% Vol. gas (aka 76% LEL), (out-of-spec), 89ppm CO, (In-spec)

(100% Vol. Methane) = 100% Vol. (In-spec).

NOTE: #2737 presented high, out-of-spec % LEL Methane readings when reviewed as late as July 2nd, 2018. But, showed by way of stored Calibration Log data that it achieved proper calibration levels for **January, February and March of 2018**. Please refer to Calibration Log printout included with this report.

Certified gases used for the Bump Tests listed were:

1. 2.5% Methane/air (50%LEL) and 100ppm CO (referred to as "Combo Gas") Lot # 8-093-60, exp. 4/2021
2. 2.5% Methane/air (50%LEL) and 100ppm CO (referred to as "Combo Gas") Lot # 8-136-751, exp. 5/2021
3. 100% Volume Methane, Lot # 8-066-61, exp. 3/2021
4. 100% Volume Methane, Lot # 202340, exp. 4/2020
5. 25ppm H2S/Air, Lot # 8-053-3, exp. 4/2023
6. 25ppm H2S/Air, Lot # 8-057-5, exp. 5/2020

E.O. R. 5 pages with 1 Attachment (Cal Log Printout)

Submitted By: Greg Wood, Service Dept Manager / Terry Murphy, VP of Operations – Sensit Technologies.

SENSIT CGI
ver 6.50
Serial # 18615

CAL LOG OXY
29 JUN 2018 21:10 8427
28 JUN 2018 19:59 8400
25 JUN 2018 20:12 8400
06 APR 2018 01:40 8481
06 APR 2018 01:31 8485

CAL LOG CO
02 MAR 2018 23:03 1459
02 FEB 2018 10:40 1426
13 JAN 2018 01:14 1421
13 JAN 2018 01:08 1408
11 DEC 2017 23:20 1599

CAL LOG LEL
02 MAR 2018 23:02 37606
02 FEB 2018 10:39 37419
11 DEC 2017 23:20 45120
13 OCT 2017 23:52 45505
24 JUL 2017 19:59 41941

CAL LOG METHANE
02 MAR 2018 23:04 20758
02 FEB 2018 10:41 23134
13 JAN 2018 01:15 21588
13 JAN 2018 01:08 21495
11 DEC 2017 23:21 20934

CAL LOG PROPANE
29 MAR 2011 09:18 390
DATA N/A65535
DATA N/A65535
DATA N/A65535
DATA N/A65535

SENSIT CGI
ver 6.20
Serial # 2737

CAL LOG CO
07 MAR 2018 00:02
06 FEB 2018 11:16
03 JAN 2018 11:45
21 NOV 2017 14:40
19 OCT 2017 22:52

CAL LOG LEL
07 MAR 2018 00:01
06 FEB 2018 11:15
03 JAN 2018 11:44
21 NOV 2017 14:39
19 OCT 2017 22:51

CAL LOG METHANE
07 MAR 2018 00:02
06 FEB 2018 11:16
03 JAN 2018 11:45
21 NOV 2017 14:41
19 OCT 2017 22:53

CAL LOG PROPANE
07 JAN 2010 10:15
30 APR 2007 10:14
16 MAR 2007 11:22
DATA N/A
DATA N/A

SENSIT GOLD G2
212305P0
Serial # 29901

CAL LOG OXY
29 JUN 2018 20:56
28 JUN 2018 19:51
28 JUN 2018 19:49
25 JUN 2018 19:51
06 APR 2018 01:32

CAL LOG CO
02 MAR 2018 02:02
30 JAN 2018 00:04
29 JAN 2018 23:36
04 JAN 2018 06:59
09 OCT 2017 23:37

CAL LOG LEL-NAT
02 MAR 2018 02:01
30 JAN 2018 00:03
04 JAN 2018 06:58
09 OCT 2017 23:37
22 JUL 2017 05:51

CAL LOG 100%NAT
02 MAR 2018 02:02
30 JAN 2018 00:04
29 JAN 2018 23:38
04 JAN 2018 07:00
09 OCT 2017 23:40

CAL LOG LEL-PRO
08 AUG 2013 13:01
DATA N/A
DATA N/A
DATA N/A
DATA N/A

SENSIT GOLD G2
212345P0
Serial # 48509

CAL LOG OXY
29 JUN 2018 20:50
28 JUN 2018 19:38
25 JUN 2018 19:52
25 JUN 2018 18:42
06 APR 2018 01:38

CAL LOG CO
04 APR 2018 20:19
05 MAR 2018 21:16
05 FEB 2018 23:16
05 FEB 2018 23:04
05 FEB 2018 22:58

CAL LOG H2S
04 APR 2018 20:20
05 MAR 2018 21:17
05 FEB 2018 23:18
05 FEB 2018 23:06
05 FEB 2018 22:59

CAL LOG LEL-NAT
04 APR 2018 20:18
05 MAR 2018 21:15
05 FEB 2018 23:16
15 SEP 2017 14:17
18 AUG 2017 11:04

CAL LOG 100%NAT
04 APR 2018 20:21
05 MAR 2018 21:18
05 FEB 2018 23:18
05 FEB 2018 23:06
05 FEB 2018 23:00

CAL LOG LEL-PRO
15 SEP 2017 14:21
DATA N/A
DATA N/A
DATA N/A
DATA N/A

*CALIBRATION LOG DATA
ALERTS OBTAINED 6/29/18*

