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Reviewed by:

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Approved on: 09-May-2018

Approved by (PI or delegate) Spiegelberg, Stephen

This report was prepared for: Jeffrey McClung

Rapiscan Systems

Quote Number: 5650

Purchase Order: Credit Card

Wednesday, May 09, 2018

To: V. Mishra, K. Perry, Rapiscan Systems

Re: Itemiser® DX4 detector testing per ASTM E2520-07[1]

This document represents a full report of the data, applicable procedures, analysis and interpretation for this project.

Project Manager: M. van Buren
Project Scientist: M. van Buren
Testing completed on: 6/19/2015

Equipment: Rapiscan Systems Itemiser® 4DX trace explosives detector.

1 Summary

A Rapiscan Systems Itemiser® 4DX trace explosives detector (S/N 240166) was tested according to ASTM E2520-07, "Standard Practice for Verifying Minimum Acceptable Performance of Trace Explosive Detectors", and was found to be in compliance with this standard.

2 Samples

NIST Trace Explosives Calibration Solutions kit # 2906 was obtained by the client, and contained the following solutions in glass-sealed ampoules:

1. Trinitrotoluene (TNT), solution in isopropyl alcohol
2. Cyclotrimethylenetrinitramine (RDX), solution in isopropyl alcohol
3. Pentaerythritol tetranitrate (PETN), solution in isopropyl alcohol
4. Isopropyl alcohol (process blank)

The kit also contained dropper bottles for each test solution listed above.

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[1] ASTM has recently re-issued this standard as E2520-15 Standard Practice for Measuring and Scoring Performance of Trace Explosive Chemical Detectors. E2520-15 is substantially different from E2520-07 in both its goal and methods. E2520-07 is a pass-fail test for explosives detectors defining a minimum acceptable performance and uses a standard suite of explosive compounds (TNT, RDX, and PETN) for this purpose. E2520-15 is a procedure to determine the limit of detection (LOD) performance of trace explosives detectors using eight of sixteen explosive chemicals in the presence of standard background challenge materials (BCM). E2520-15 also determines the effective sampling rate of trace explosives detectors. E2520-15 includes much of the methodology described in ASTM E2677-14 Standard Test Method for Determining Limits of Detection in Explosive Trace Detectors. Under E2520-15, process blank swabs are prepared using a suspension of a selected BCM. Test swabs are prepared by addition of an explosives chemical dilute solution of 0.01 to 100 ng/µL to a swab with the BCM already applied. Test swabs are prepared starting with the lowest concentration of explosive chemical and increasing the challenge concentration to the highest level. The LOD90A (limit of detection where 90% of the test swabs give an alarm) is then calculated for the instrument. The number of swabs processed in an eight hour shift and the explosive chemical test area on the swab are used to determine the effective sampling rate.

It is our opinion the E2520-07 methods are appropriate for verification of instruments for which the LOD was defined in the initial instrument development phase.

The three explosive compound samples were dissolved in isopropyl alcohol. The ampoule seals were intact and the ampoules opened at the time of testing. The contents of each ampoule were transferred from the glass ampoule to a NIST supplied dropper vial by Eppendorf micropipette and the vial then capped with a dropper cap.

3 Experimental

Testing was performed in compliance with ASTM E2520-07 "Standard Practice for Verifying Minimum Acceptable Performance of Trace Explosive Detectors" at Rapiscan Systems. (23 Frontage Rd., Andover, MA). The instrument was initially powered down at the start of testing. The Itemiser® 4DX detector is controlled by software version C10.06.14-CEP. The instrument successfully powered up showing a green "Ready to test" message after performing an internal self-calibration. Manual calibration of the instrument is not required.

The NIST #2906 standard ampoules were opened and transferred to individually labeled dropper bottles and capped with a dropper cap. The test sample traps used were Teflon™ coated fiberglass strips produced by Rapiscan Systems (Sample Trap M0002057). The sample traps were placed on an absorbent paper-lined metal tray, two sample traps for each explosives test solution and six sample traps for process blank solution for a total of 12. Instrument blank sample traps were taken from the package of sample traps as needed. Two drops were expressed from the dropper bottle onto a disposable absorbent wipe prior to application of a single drop of test liquid on a sample trap and another drop on the second sample trap. This process was repeated for all explosive samples and for process blank isopropyl alcohol. All prepared sample traps were allowed to evaporate off isopropyl alcohol for approximately 15 min at room temperature prior to test.

The analysis procedure consists of insertion of the test sample trap into the sample slot on the front of the instrument. The instrument acquires the volatiles from the test sample trap and detects compounds with an Ion Trap Mobility Spectrometer (ITMS™) The analysis takes 10 to 15 sec after test sample trap insertion. The instrument displays both an ion chromatogram and a table of identified volatiles with concentrations. The upper section of the display shows a green (no explosives detected) message or a red (TNT, RDX or PETN detected) alert message at the conclusion of the analysis.

An instrument blank sample trap (new, unused test sample trap) was first run, followed by the process blank sample trap (isopropyl alcohol). The three explosive samples were then run through the instrument, with instrument blank sample trap runs between each explosive sample. This process was repeated twice.

The instrument tested was as follows:

Manufacturer: Rapiscan Systems
Model Number: Itemiser® 4DX
Serial Number: 240166

4 Laboratory Certification

Cambridge Polymer Group, Inc. is certified to ISO 9001:2008.
Certification number: C32314
Certification date: 11/15/2013 (expiration 11/5/2016)

5 Results

The instrument passed all tests, and is therefore in compliance with ASTM E2520-07. The evaluation paperwork (provided in ASTM E2520-07) is shown in the Appendix.

6 *Appendix: Evaluation Paperwork and Other Records*[2]

Cambridge Polymer Group

E2520-07

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Date	6/19/2015
Principle Investigator (name)	M. F. VAN ZUREN
Principle Investigator (signature)	M.F. van Buren
Instrument Manufacturer	Morpho Detection LCC
Instrument Model Number	IT4DX (Itemiser 4DX)
Serial Number	240166
Test Kit Identification Number	NIST 2906

Instruction	Evaluation 1		Evaluation 2	
	Pass	Fail	Pass	Fail
1. Power on as described in 6.1	✓			
2. Preparation of work area is completed (5.1)	✓			
3. Preparation of test swipes have been completed and are ready for evaluation as described in 5.2.	✓			
4. Analyze instrument blank swipe as described in 6.3. To pass this test, there should be no explosives alarm signal.	✓		✓	
5. Analyze process blank swipe as described in 6.4. To pass this test, there should be no explosives alarm signal.	✓		✓	
6. Analyze test swipes as described in 6.5. To pass this test, the correct alarm signal should be observed for each corresponding test swipe.				
• TNT	✓		✓	
• RDX	✓		✓	
• PETN	✓		✓	
7. Analyze instrument blank swipe as described in 6.6. To pass this test, there should be no explosives alarm signal.				
• Following TNT test swipe	✓		✓	
• Following RDX test swipe	✓		✓	
• Following PETN test swipe	✓		✓	

Comments: Testing performed at Morpho Detection, 23 Frontage Rd., Andover, MA 01810 by Dr. V. Mishra 6/19/2015.

[2] Original report was issued prior to Morpho Detection being acquired by OSI Systems and merged with Rapiscan Systems.

Cambridge Polymer Group

E2520-07

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Additional Calibration/Standards Information

Pipette: Eppendorf Research pipette 145102
Calibrated 1/27/15

200 µL pipette tips cat 022491938
Lot C153453P-1440

Sample swipes - Safran Morpho Sample Traps
M 0002057 – unopened

ITHDX Software Ver. C10.06.14-CEP