Methamphetamine and Cocaine Field Test Results used in the National Institute of Justice Funded Research and Development on Instrumental Analysis for Forensic Science: Presumptive Field Testing Using Portable Raman Spectroscopy

The Las Vegas Metropolitan Police Department (LVMPD) was awarded a National Institute of Justice (NIJ) research grant in 2010. The NIJ grant funded a study to compare chemical field test kits used by the LVMPD to an instrument based presumptive test using a Raman hand held device. The chemical field test kits utilized in the research are comparable to the reagents used as a screening tool in the forensic laboratory. These kits are strictly used in the field by officers to preliminarily screen suspected cocaine, marijuana and methamphetamine.

COMPARISON TESTING – PHASE I

The first phase of the research, which is pertinent to your request, involved performing a comparison study between a portable Raman hand held device called the ReporteR and chemical field tests manufactured by ODV. This phase of testing was conducted in the LVMPD Forensic Laboratory by Forensic Scientists on samples impounded by officers. These samples were conclusively identified in the Forensic Laboratory using gas chromatography/mass spectrometry (GC/MS).

Laboratory Methamphetamine Testing: The methamphetamine testing revealed a 92% accuracy rate for the ReporteR and a 100% accuracy for the chemical field test kits (based on 126 samples). See Table 1.

Table 1.

Methamphetamine-Phase I Testing			
Lab Personnel	**Positive GC/MS**	**Positive Lab Raman ReporteR**	**Positive Lab Chemical Field Test**
D	8	6	8
B	25	20	25
A	37	36	37
C	33	32	33
E	23	22	23
Total	**126**	**116 (92%)**	**126 (100%)**

Methamphetamine Chemical Field Test Comparison: Of the above 126 samples listed in Table 1, 58 samples were previously subjected to a methamphetamine chemical field test which required an officer completed checklist. See Table 2. These tests were found to be 100% accurate as confirmed by laboratory personnel, shown in Table 1.

Table 2.

Lab Personnel	**Positive Officer Chemical Field Test**	**Total Chemical Field Tests Performed by Officers**
D	6	6
B	17	17
A	10	10
C	4	4
E	21	21
Total	**58**	**58 (100%)**

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Laboratory Cocaine Testing: The cocaine testing revealed a 73% accuracy rate for the ReporteR and a 73% accuracy rate for the chemical field test kits. This was based on 104 samples that were confirmed to contain cocaine by GC/MS analysis. 141 suspected cocaine case samples were tested in the Forensic Laboratory, however, 37 samples were confirmed not to contain cocaine. See Table 3.

Table 3.

Cocaine-Phase I Testing-Positive (+) for Cocaine			
Lab Personnel	**GC/MS Results**	**Positive Lab Raman ReporteR**	**Positive Lab Chemical Field Test**
A	22	21	16
B	26	17	25
C	7	6	2
E	15	13	13
D	34	19	20
Total	**104**	**76 (73%)**	**76 (73%)**
Cocaine-Phase I Testing-Negative (-) for Cocaine			
Lab Personnel	**GC/MS Results**	**Positive Lab Raman ReporteR**	**Positive Lab Chemical Field Test**
D	8	0	0
B	2	0	0
E	19	0	0
A	8	0	0
C	0	0	0
Total	**37**	**0**	**0**
+ & - Total	**141**	**76**	**76**

Cocaine Chemical Field Test Comparison: Of the above 141 samples listed in Table 1, 77 samples were previously subjected to a cocaine chemical field test which required an officer completed checklist. Results from the 77 field tests of suspected cocaine samples performed by officers revealed inconsistencies. The Forensic Laboratory determined by GC/MS that there were three samples that were not cocaine, which are considered false positive chemical field test kit results (3.8%). There were also three samples that contained cocaine, but did not have positive chemical field test results, and therefore considered false negatives (3.8%). The Forensic Laboratory personnel detected zero false positive results when testing the same samples using chemical field test kits. See Table 4.

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Table 4.

77 Purported Cocaine Samples Chemical Field Tested by Officers					
Lab Personnel	**Positive Officer tests determined to be accurate by lab**	**Officer tests determined to be False Positive by lab**	**Negative/Inconclusive Officer tests determined to be accurate by lab**	**Officer tests determined to be False Negative/Inconclusive by lab**	
A	8	1	1	0	
B	22	0	2	0	
C	3	0	0	2	
D	26	2	2	1	
E	5	0	2	0	
Total	**64**	**3 (3.8%)**	**7**	**3 (3.8%)**	**Total: 77**

OFFICER FIELD TESTING STUDY – PHASE II

In the second phase of testing, officers performed presumptive ReporteR testing alongside chemical testing in the field. All samples tested were subsequently conclusively identified in the Forensic Laboratory using GC/MS. During this phase, laboratory follow-up consisting of a comparison of chemical field test kits results was not pertinent due to the high accuracy of the officer performed chemical field test.

Methamphetamine Testing: 77 methamphetamine samples were tested in the field by officers. There was a 77.9% accuracy rate using the ReporteR and a 98.7% accuracy rate for the chemical field test kits, with no false positive results. Of these samples, laboratory personnel had a ReporteR accuracy rate of 100%. See Table 5.

Table 5.

Phase II Methamphetamine Samples	**Positive Officer Chemical Field Tests**	**Positive Officer Raman ReporteR**	**Positive Lab Raman ReporteR**
77	76 (98.7%)	60 (77.9%)	77 (100%)

Cocaine Testing: 49 cocaine samples were tested in the field by officers. There was a 73.4% accuracy rate using the ReporteR and a 100% accuracy rate for the chemical field test kits, with no false positive results. Of these samples, laboratory personnel also had a ReporteR accuracy rate of 73.4%. See Table 6.

Table 6.

Phase II Cocaine Samples	**Positive Officer Chemical Field Tests**	**Positive Officer Raman ReporteR**	**Positive Lab Raman ReporteR**
49	49 (100%)	36 (73.4%)	36 (73.4%)

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OFFICER FIELD TESTING STUDY WITH ENHANCED Reporter R - PHASE III

A Raman ReporteR device was upgraded and enhanced to new specifications based on the first two phases of the research. Using the *enhanced* ReporteR, officers performed presumptive Raman alongside chemical testing in the field. Laboratory personnel used *a non-enhanced* ReporteR in the laboratory portion of this testing. At the time, only one ReporteR was enhanced by the manufacturer, as a prototype, based on the first two phases of this research. Comparing the results from the initial (*non-enhanced*) ReporteR to the results of the upgraded (*enhanced)* ReporteR measured the effectiveness of the manufacturer's enhancements. All samples were confirmed via GC/MS and compared to data obtained from a Raman microscope. The focus of this phase was to test the enhancements applied to the ReporteR.

Methamphetamine Testing: Officers yielded a 97.3% accuracy rate using the *enhanced* ReporteR for 75 methamphetamine samples. The methamphetamine chemical field tests performed by officers yielded a 100% accuracy rate, with no false positives. Laboratory personnel yielded an accuracy rate of 96% using a *non-enhanced* ReporteR on these same items. See Table 7.

Table 7.

Phase III Methamphetamine Samples	Positive Officer Chemical Field Tests	Positive Officer Enhanced ReporteR	Positive Lab Non-enhanced ReporteR
75	75 (100%)	73 (97.3%)	72 (96%)

Cocaine Testing: Officers yielded a 100% accuracy rate using the *enhanced* ReporteR for 27 cocaine samples. Cocaine chemical field tests performed by officers yielded a 100% accuracy rate with no false positives. Laboratory personnel yielded an accuracy rate of 66.6% using a *non-enhanced* ReporteR on these same items. See Table 8.

Table 8.

Phase III Cocaine Samples	Positive Officer Chemical Field Tests	Positive Officer Raman ReporteR	Positive Lab Raman ReporteR
27	27 (100%)	27 (100%)	18 (66.6%)

HISTORICAL EVALUATION OF ERRORS ASSOCIATED WITH OFFICER CONDUCTED CHEMICAL FIELD TESTS SENT TO THE LABORATORY FOR CONCLUSIVE IDENTIFICATION

A review of field testing errors revealed that from 2010 to 2013, 67.8% of false positive errors encountered by the laboratory were attributed to suspected cocaine samples. 63.1% of cocaine false positive tests actually contained lidocaine. See Table 9.

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Table 9.

Known Chemical Field Test Errors 2010-2013					
Total Error Memos Clark County	**Total False Positives**	**Cocaine False Positives**	**% Total False Positives**	**% Cocaine False Positives /Total False Positives**	**% Lidocaine False Positives /Cocaine False Positives**
292	28	19	9.5%	67.8 %	63.1%

Table 9 shows the breakdown of false positive error memos generated by the forensic laboratory. When a chemical field test checklist contains a clerical error, or when the lab performs a confirmatory analysis that gives a result that differs from the presumptive field test result, an error memo is generated and sent out to the officer who completed the test. Table 9 also reflects a correction to the number of **cocaine false positives** tests reported in the original final technical report which stated that there were 20 **cocaine false positives** results. After a review of the data, only 19 results could be included as **cocaine false positives** results. This correction was due to the fact that the officer completed the wrong field test checklist, and therefore does **not** qualify as "cocaine false positive" for the purpose of this study.

Approximately 28,600 cocaine and 32,000 methamphetamine chemical field test kits were ordered by the department from December 2009 through December 2013. The documented results from these chemical field tests can be used as probable cause when introduced at a preliminary hearing only. When the case is bound over and a District Court trial is scheduled, the forensic laboratory will perform confirmatory testing on the substance. These tests were never intended to be conclusive identification of an illicit substance. The number of cocaine chemical field tests used by officers (28,600) compared to the number of tests submitted to the laboratory for conclusive identification (292) is minuscule when compared to the number potentially used in the field by officers. Therefore, the percentage of false positives may appear to be overly high based on the small number of samples analyzed by the laboratory.

The LVMPD is moving forward with the implementation of Raman handheld devices for use in the field. The Raman devices will replace the cocaine and methamphetamine chemical field test kits. The training of all officers who will potentially book evidence will take place over the next several months. The research supporting Raman handheld technology as a presumptive field test will be presented in a court of law so that it may be accepted at future preliminary hearings.