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Evaluation of ICx Fido® Verdict™ Portable Explosives and Narcotics Identifier

Project Information

Title: Evaluation of ICx Fido® Verdict™ Portable Explosives and Narcotics Identifier

Evaluation Type: Portable Raman Spectrometer

Stakeholder: ICx Technologies, Inc.

Start Date: 05/10/2010 End Date: 08/14/2010

Kit Model Number(s): FV-01-A

Serial Number(s): 07000113

Cost: MSRP is $17,485, GSA $15,982

Manufacturer Information

Manufacturer: ICx Technologies, Inc.

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Evaluation Summary

The Forensic Services Chemistry Section of the National Forensic Science Technology Center (NFSTC) performed an evaluation of the ICx Fido® Verdict™ Portable Explosives and Narcotics Identifier. This palm-sized Raman spectrometer is currently used by law enforcement, border patrol officers, military personnel and other first responders to chemically characterize unknown solids, liquids and powders encountered in field environments. The evaluation included assessments of conformity, reproducibility, mixture sensitivity, specificity, portability,

ruggedness, and ease of use, including sample preparation and training requirements. The evaluation team also briefly examined the associated Enabler™ software and its library-building capabilities. The objective of this product assessment was to provide data to agencies interested in incorporating portable Raman technology into their laboratory or field-testing protocols.

The instrument was evaluated using samples representative of categories likely to be encountered in a field or first-responder environment, including controlled substances, common diluents of controlled substances, explosives, common chemicals, and ignitable liquids. In addition, the unit was transported to the Manatee County Sheriff's Office, Forensic Chemistry Laboratory to analyze 20* adjudicated case samples. Each sample was analyzed in triplicate, and each of these three trials was performed by a different evaluator.

**One of the 20 case samples did not include a reported identity by the Sheriff's Office. The results will be discussed for reproducibility and portability.*

Product Specifications

The Verdict weighs approximately 430 grams (0.95 lb), which includes the lanyard-attached polystyrene standard, and is approximately 19 cm (7½") long (including the sampling head), 4.1 cm (1⅝" deep), and 8.6 cm (3⅜") wide. The standard sampling head tip has two positional settings to enable the user to adjust the focal length for sampling, using a provided hex key. The default setting ("in") is optimized for sampling through vials and thick plastic bags, and the "out" setting is optimized for sampling a substance directly or through thin plastic bags. For safety purposes, the standard sampling head must be fully depressed before spectral sampling can occur.

The Verdict has a keypad with three buttons and an LCD display screen that prompts the user with updated status and results information. The Verdict comes with an externally-attached polystyrene standard for checking its performance; a USB cable for charging, recalibration and data communication; a USB port wall plug; a microSD card; the Enabler software; and a rugged carrying case, equipped with safety glasses.* There are no associated consumables for this unit. Battery life is listed at 4 continuous hours, or 12 hours of typical use** when fully charged. Spectral sampling is performed externally from the instrument, either via direct contact with the sampling head and the neat unknown solid or liquid, or through clear bags, vials, or bottles containing these types of materials. Files are sequentially numbered and stored on a microSD card, which can be uploaded onto a computer for data review and storage.

**An updated version (2.21) of the User Manual lists a second sampling head as included in the kit. This was not included in the kit provided to NFSTC and thus was not part of the evaluation.*

***"Typical use" was not defined in product literature and not evaluated by NFSTC.*

The Verdict's function is based on Raman spectroscopy, which measures the inelastic scattering of monochromatic laser light by the molecules of a sample. The scattered light is collected and separated into individual wavelengths. A charge-coupled detector then measures the intensity of light at each wavelength and converts it to a spectrum, characteristic of a chemical compound. The spectrum from the sample is searched against library entries residing in the instrument memory. Match quality is assigned a "correlation score" based on similarity of the sample spectrum to the closest library spectra. In a match situation, between one and three of the most correlated library entries are listed, in order of highest to lowest correlation. Library entries are accompanied by a number of "bar" icon(s) to indicate the correlation. The match ranking is as follows: 5 bars: 0.95 to 1.00

(highest correlation); 4 bars: 0.90 to 0.95; 3 bars: 0.80 to 0.89; 2 bars: 0.70 to 0.79; 1 bar: 0.60 to 0.69; 0 bars: 0.00 to 0.59 (lowest correlation). If the match quality falls within the "0 bar" range, or the instrument fails to register a signal, the instrument will display "no match". Some matches are assigned to categories in order to further assist the user, such as "N" for narcotic, or "E" for explosive. Correlation and category designations are designed to provide assistance in material identification and mixture analysis.

The Verdict has a rugged design that includes rubber casings protecting each end of the palm-sized device. The USB and microSD card ports located on the outer plastic case are protected from harsh field conditions by tightly fitting rubber plugs. The device is designed to operate in temperatures ranging from -20 to 40°C (-4 to 104°F), in relative humidity of 10 to 90%, and at altitudes of 0 to 3,048 meters (0 to 10,000 feet). It is equipped with a class 3B laser source that operates at 785 nm and 70 mW (100 mW max) and has a nominal ocular hazard distance (the distance at which the radiation has decreased to below the maximum permissible exposure) of approximately 71 cm (28"). Changes to libraries loaded on the instrument, manual calibrations, and spectra comparisons are performed on a computer using the Enabler software. Files are stored sequentially on a 1-gigabyte microSD card in one of two digital formats (.spc or .prn.)* and can be uploaded onto a computer for storage, data analysis, or reporting, depending on the format.

**These digital formats were listed in the Operators Manual. Evaluators in these test series obtained files in a ".dnu" format. This file type was transferable and could be loaded onto the Enabler software for spectral review.*

References

Fido® Verdict™ Operators Manual, Version 2.

Fido® Verdict™ Operators Manual, Version 2.21, 2009.

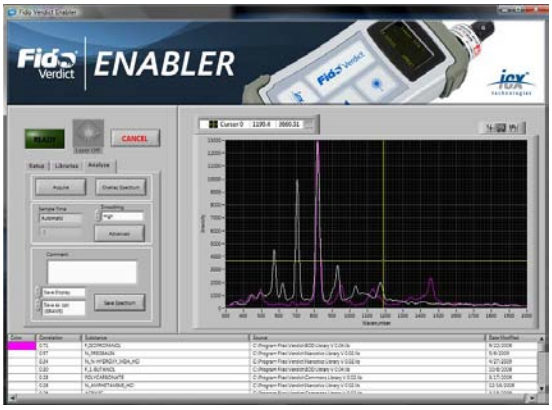
Koussiafes, Perry M. The Interpretation of Data Generated from Fire Debris Examination: Report Writing and Testimony, *Analysis and Interpretation of Fire Scene Evidence*; Ed. Jose Almirall and Kenneth Furton; Boca Raton, FL; 2004.

Skoog, D., Holler, F., and Nieman, T. Raman Spectroscopy. *Principles of Instrumental Analysis*; Fifth Edition; USA; 1998.

Photos

Verdict Kit

Verdict Enabler Software Open



Isopropanol spectrum appears in pink and unknown in white

Product Uses

The Verdict can be used to identify a variety of chemical compounds, including a number of drugs (illicit) and pharmaceuticals, explosives, ignitable liquids (or components thereof), oxidizers, and toxic compounds. This function is useful in forensic science applications such as on-target military use or field use by first responders or law enforcement officers.

Level of Operator Knowledge (Set per Manufacturer)

☒ Non-Scientist ☐ Technician ☐ Scientist

Minimal training is required to safely and properly use the instrument and to interpret the results.

Procedure

A total of 111 samples (333 trials) were prepared by placing sample compounds into vials. Testing was conducted using the following method for performance checking and sample analysis:

Performance Check

1) Put on the safety glasses supplied in the carrying case.
2) Power the Verdict on by holding the power button down for two to three seconds. (The screen will display "Startup," then "Ready.")
3) Perform the system check as outlined in the manual.
    a. Place the polystyrene test rod against the tip of the sampler head and depress the head. (The screen will display "Standby.")
    b. Press the laser button to arm the laser. (The screen will display "Armed.")

c. Keeping the rod pressed against the head and the head pressed in, press the laser button again. (The screen will display "Reading Sample" and "Laser On" in the upper right corner, then "Laser Off.")
d. Remove the rod from the head when the screen displays "Analyzing Data."
e. Verify that the screen displays "REF_POLYSTYRENE" with four to five correlation bars.
    i. If the correlation is fewer than four bars, re-perform the system check; clean the sampler head and re-perform; or calibrate and re-perform.
    ii. If the correlation is four or more bars, proceed to sample analysis.

Sample Analysis

The following method was used for sample analysis:

1) Put on the safety glasses supplied in the carrying case.
2) Ensure the sampling head is screwed down to the "in" sampling position.
3) Power the Verdict on by holding the power button down for two to three seconds. (The screen will display "Startup," then "Ready.")
4) Place the tip of the sampling head against the sample vial, ensuring that the head is completely depressed and focused on the contents.
5) Press the laser button. (The screen will display "Reading Sample" and "Laser On" in the upper right corner, then "Laser Off.")
6) Remove the sample vial from the head when the screen displays "Analyzing Data."
7) Record the result, the categorical designation ("N", "F", "O", "E", etc.) and the number of correlation bars shown on the screen.
    a. Match:
        i. Record "Y" in the "Match Y/N" column of the data sheet.
        ii. Using the down button, scroll through the matches and record them, including the number of match quality bars displayed, and a category designation, if listed, on the data sheet.
        iii. Record "Y" in the "Correct Y/N" column if any of the following criteria are met:
            1. The identity with the largest number of correlation bars matches the identity of the sample
            2. The identity with the largest number of correlation bars is a synonym for the sample name (e.g., nicotinamide and niacinamide; Tylenol and acetaminophen)
            3. If more than one match of the possible three has the same largest number of correlation bars and fits the preceding criteria
            4. If in a mixture, one of the two components was identified with the preceding criteria. (Note: If in an ignitable liquid mixture, the component must be one that will identify the entire mixture; e.g., "diesel")
        iv. Record "N" in the "Correct "Y/N" column if none of the criteria in Step 7) a. iii. are met.

   b. No Match:
      i. Record “N” in the first “Match Y/N” column.
      ii. Record “N” in the “Correct Y/N” column.
8) Using the down button, scroll through any additional results and record them, including any designations and correlation bars.
9) Hold the down button to return to the main screen.

Ruggedness Trials

1) Place the Verdict in the following locations for approximately two hours, performing one trial per day.
   a. **Trial One:** Dashboard of a car
   b. **Trial Two:** Trunk of a car
   c. **Trial Three:** Front seat of a car
2) Place a portable electronic thermometer at the location with the Verdict.
3) Record the temperature upon placement and removal.
4) Perform testing as soon as possible using the previously described method.

Library Build Analysis Using the Enabler Software

1) Power the Verdict on by holding the power button down for two to three seconds. (The screen will display “Startup,” then “Ready.”)
2) Complete the performance check using the provided reference standard.
3) Scan the following two compounds using the sampling method described and record the results:
   a. Papaverine HCl
   b. Levamisole HCl
4) Install the Enabler software on an available computer.
5) Open the Enabler software.
6) Attach the Verdict to the laptop computer using the provided USB cord.
7) Select I/O COM port 5 to establish communication.
8) UNABLE TO CONTINUE WITH USER LIBRARY BUILD*

**The version of Enabler software provided with the unit for this evaluation did not support the creation of user created libraries or edits to existing libraries. The evaluator spoke with an ICx Technologies representative and was told that the next release of the software will support this feature. According to the User Manual provided (copyright 2009), the software is capable of calibrating the instrument and loading or unloading libraries onto the Verdict.*

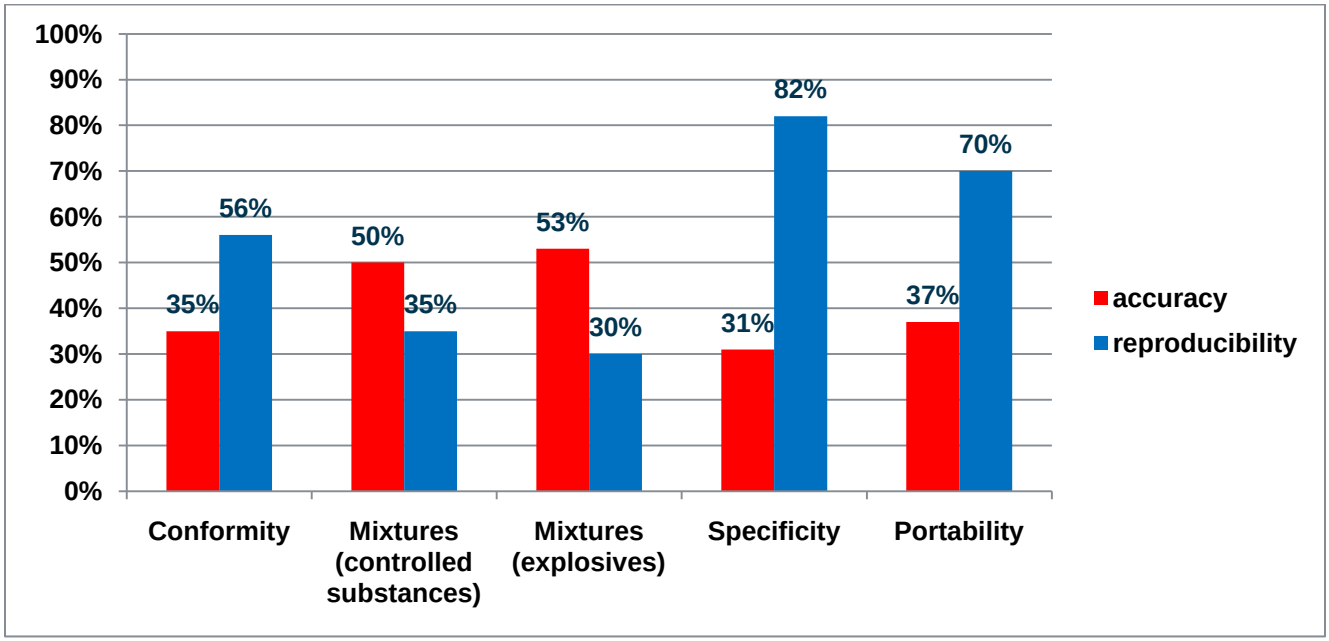
Results and Discussion (For Data, See Appendix)

A total of 111 samples (333 trials) were evaluated using the Verdict. Each sample was analyzed using three trials, and each trial was conducted by a different evaluator at a different time. A performance check was conducted by each evaluator prior to each testing session*.

**Performance checks were not included in the sample or trial count.*

Criteria to define accuracy are listed in the described method. (Note: Because the ignitable liquids in this evaluation are mixtures of many compounds, an accurate answer was defined as one that would enable the user to make an identification. For example, ethanol may be a component of gasoline, but identifying ethanol will not enable a user to identify an unknown liquid as gasoline.) (See also "Areas for Improvement" and "Limitations" in the "Findings" section.)

Results were defined as reproducible (precise) if the most-correlated or equally most-correlated result (second or third choice as highly correlated as the first) matched for all three replicates. This included results that were "no match", incorrect matches, and synonyms (e.g., sugar and sucrose) in order to correct for a compound not being in the existing libraries.



Conformity Set

Accuracy

For the 25 samples used to evaluate conformity, the Verdict accurately identified the target compound in 26 of the 75 trials (~35%). Eight of these 26 were controlled substances (methamphetamine, heroin, cocaine HCl) and caffeine. Thirteen were explosives, explosive precursors, or similar compounds (RDX, ammonium nitrate (prills and powder), sugar, urea nitrate). The remaining five were ignitable liquids (gasoline and diesel).

Reproducibility

Fourteen of the 25 conformity samples (56%) identified the same most correlated compound (or synonym), or had no-match results for each of the three replicates. Gasoline, caffeine, ammonium nitrate (prills and powder), urea nitrate, and ammonium nitrate powder were the only samples with three correct answers. Three samples (cocaine base, inositol and cumin) resulted in "no-matches" for all three replicates. Boric acid, ammonium perchlorate, mineral spirits, Klean-Strip® VM&P Naptha Thinner, Ronsonol lighter fuel®, and Kingsford® charcoal lighter fluid resulted in consistent incorrect match results. Five other sample sets had two of three correct results, and four sample sets had two of three consistent incorrect results.

Discussion

The Verdict had better reproducibility between trials than accuracy. Of the 25 samples, 24 showed two or more reproducible results. Lower accuracy may be due to factors such as the inherently weak spectra of certain compounds (e.g., heroin), or the exclusion of compounds in the existing libraries. Though the Verdict was unable to identify every controlled substance sample present, it did not incorrectly identify any non-controlled samples as controlled substances (no "false positives").

Mixture Sensitivity Set

Four controlled substances mixture series and two explosive mixture series were analyzed in triplicate. Five mixture ratios were prepared by weight of the target compound to the weight of the diluent as follows: 80:20, 60:40, 50:50, 40:60, and 30:70.

Accuracy

Out of four controlled substances mixture series (20 samples with 60 trials), the Verdict correctly identified one of the two components in 30 of the 60 trials (50%). Of these, it correctly identified both components in the top three matches once (Cocaine HCl: Caffeine (50:50)). It did not identify quinine or dimethyl sulfone in any of the 30 trials containing these compounds. However, it correctly distinguished between cocaine hydrochloride and cocaine base in all of the cocaine identifications in those mixtures.

The Verdict identified either ammonium nitrate or sugar in 14 of the 15 mixture trials, and in the 60:40 mix, identified both ammonium nitrate and sugar in the top three results. In the mixture series with cumin, ammonium nitrate was the most correlated result twice out of 15 trials, while cumin was not identified in any of the trials. Cumin is a common yellow-brown spice; color and fluorescence are two properties known to interfere with Raman spectroscopy.

Reproducibility

Out of four controlled substances mixture series (20 samples with 60 trials), the Verdict identified the same most correlated result for each of three replicates approximately a third of the time (seven samples, or 21 trials) (~35%). Three of these seven were caffeine identified in a mixture with cocaine and the other four were three "no match" results in the heroin/quinine and methamphetamine/DMS samples.

In the explosive substances series, three out of ten samples (nine of 30 trials), had the same most correlated result for all three trials (30%). Of these, only one sample (AN: Sugar 30:70) returned three correct results (sugar), while the others were "no match" results. Additionally, three out of the remaining seven samples returned three correct, but different matches (i.e., ammonium nitrate twice and sugar once), and one resulted in two correct matches.

Discussion

In all four controlled substances mixtures, the target compound (drug) was detected in the sample with the highest ratio of controlled substance (80:20) and then randomly, if at all, in mixtures of lower ratios. The explosive mixtures were less predictable, as ammonium nitrate was detected throughout the series. An identification trend corresponding to the ratio of components was not observed.

The identification of a component within a non-liquid mixture is highly reliant upon which component particle of the mixture the Raman laser happens to be fixed. Identifying either component could therefore be considered correct.

Specificity Set

A total of 84 trials were performed on 28 samples to evaluate the ability of the Verdict to differentiate between compounds similar to common target compounds or commonly associated with target compounds.

Accuracy

In 26 of 84 trials (~30.9%) of controlled substances, the Verdict accurately identified the target compound. Acetaminophen, aspirin, ibuprofen, and pseudoephedrine (common diluents and OTC drugs); and urea and sulfuric acid were identified in all trials. The Verdict failed to identify the phenethylamine group of compounds (MDMA, MDA, and MDEA), diphenhydramine, chlorpheniramine, codeine sulfate, lidocaine, and procaine.

Reproducibility

In 23 of 28 samples (~82.1%), the results were reproducible across all three trials. Of these, twelve of the samples reported "no match" for all three replicates and three were the same incorrect most correlated result across the three replicates (MDMA, codeine sulfate, and diphenhydramine). The samples containing procaine, aspirin, ibuprofen, pseudoephedrine, baking soda, acetaminophen, urea, and sulfuric acid were correctly identified in all three individual sample trials.

In three additional samples, the most highly correlated results were the same for two of the replicates.

Discussion

Results for phenethylamine compounds (MDEA, MDA, and MDMA) showed little accuracy, but in four of nine trials, the instrument indicated an incorrect phenethylamine compound. In addition, some other compounds such as ammonium perchlorate and ferric nitrate resulted in similar but not accurate matches (perchloric acid and lead

nitrate). These results could be due to a lack of reference spectra within the existing libraries or the inability of the software to resolve the differences.

Ruggedness Set

Eight samples were tested using heat to measure the ruggedness of the unit. These trials were intended to model some of the storage and transportation practices by law enforcement officers, first responders, and field users. Samples were chosen to represent different categories of compounds. According to the Operators Manual (Version 2, p. 72), the instrument should function at temperatures of -20 to 40°C (-4 to 104°F), and that users should avoid water getting inside of the tip of the sampling head (p. 41). Higher temperatures are recorded as shortening battery life (not tested) (p. 72).

One of the compounds used for this trial (ammonium perchlorate) was not accurately identified under normal laboratory conditions. For the purposes of the following three samples sets, the "conformity" results were compared to the "ruggedness" result (perchloric acid) for this compound.

Trial One:

The instrument was placed in the trunk of a car for approximately two hours.

The interior temperature of the trunk upon placement was ~36°C (~97°F). Upon removal, the interior temperature was ~36°C (~97°F).

Accuracy

The Verdict correctly identified the target compound eight of eight times. Although the sample of ammonium perchlorate was misidentified as perchloric acid, this was the same most highly correlated result as that under normal laboratory conditions (see "Conformity" in Appendix Table 1).

Reproducibility

N/A: The conditions were not similar enough after the first set of trials to perform in triplicate.

Trial Two:

The instrument was placed on the dashboard of a car for approximately two hours. The temperature upon placement was ~141°F (~60°C). Upon removal, the thermometer's screen was not readable*.

**It is possible that the temperature exceeded the threshold of the thermometer (158°F or ~70°C) and was thus immeasurable.*

Accuracy

The Verdict correctly identified the target compound two of eight times (RDX and perchloric acid). Five other samples had no match result and one other (ammonium nitrate) was inaccurate.

Reproducibility

N/A: The conditions were not similar enough after the first set of trials to perform in triplicate.

Trial Three:

The instrument was placed on the front seat of a car for approximately two hours.

The interior temperature upon placement was ~81°F (~27°C). Upon removal, the interior temperature was ~106°F (~41°C).

Accuracy

The performance check passed and the instrument identified seven of the eight target compounds.

Reproducibility

N/A: The conditions were not similar enough after the first set of trials to perform in triplicate.

Discussion

Despite the fact that the temperature exceeded the recommended operating temperature in each trial, the performance of the Verdict in two of these high-temperature trials (Trials One and Three) was comparable to that in normal laboratory conditions. Thirteen of these 16 trials resulted in an accurate top result. Two more resulted in the same most correlated result as the conformity trial.

The conditions in Trial Two exceeded the temperature threshold of the thermometer and therefore most probably for the Verdict. These conditions seemed to affect the ability of the Verdict to return accurate and precise results. Only one compound (RDX) was accurately identified. One more resulted in the same most correlated result as the conformity trial.

Portability Set

The Verdict was transported to the Manatee County Sheriff's Office to test a variety of adjudicated controlled substance case samples. Each sample was tested in triplicate (once each by three evaluators). A performance check was performed by each evaluator before proceeding. Samples included six tablets, seven cocaine HCl and cocaine base exhibits, five heroin exhibits, and two exhibits in which no controlled substance was detected (lidocaine and acetaminophen*). Tablets were crushed and placed into vials before testing.

**This was not reported by the Manatee County Sheriff's Office but was reproducibly identified in all trials.*

Accuracy

In the two tablets (Darvocet and Lortab), the Verdict correctly identified acetaminophen, the major component in these preparations, in six of six trials. It did not identify the minor component in any of the top three matches in any of the trials. All trials for the alprazolam (Xanax 2 mg), methadone (Methadone 10 mg), and oxycodone (Roxicodone 15 and 30 mg) tablets resulted in "no match". All trials from the five heroin samples resulted in "no match".

The Verdict identified cocaine* in 12 of 21 total trials and lidocaine in three of three trials.

**Both "cocaine (FB)" and "cocaine HCl" were counted as correct matches for cocaine HCl and cocaine base exhibits, as the case sample may have contained a mixture of both.*

Reproducibility

Fourteen of the 20 samples had reproducible results across the three trials (~70%). This included nine samples that had three "no match" results each, three identifying acetaminophen, one identifying cocaine, and one identifying lidocaine. Additionally, three of the cocaine samples each had two consistent correct results.

Discussion

The sample set provided to the evaluators included six tablets and one non-controlled, unidentified sample. Each tablet had to be crushed in order to sample it using the same method as the other samples in this evaluation. The presence of an entire crushed tablet in a field-type setting is unlikely. The ability to identify a small amount of a target controlled substance in a tablet is also unlikely. The Verdict identified cocaine (FB) and lidocaine, though it did not identify them in all of the previous trials (as discussed in "Conformity Set" and "Specificity Set"). It also did not identify heroin in any of the five exhibits, despite its detection in one of three conformity trials for heroin. Heroin does not have a strong Raman spectrum, so these results are not unexpected. However, this limitation could be an issue in jurisdictions where heroin is a problem.

Software Evaluation

Library Build

Papaverine HCl and levamisole HCl were sampled on the Verdict in attempt to add them to a user library. This option was not available on the version of the software provided for the evaluation. Contact with an ICx Technologies representative indicated that updated software in the future will have a user's library as an option.

Data Review

Data can be transferred into the Enabler software to view and compare to library spectra, but since the spectra are sequentially numbered, it is not possible to see which spectrum is being viewed. However, multiple spectra can be viewed at once, and each selected spectra is displayed in a different color.

Discussion

The evaluator was unable to build a library or operate the instrument from the software. According to the provided Operators Manual (Version 2, p. 42), this software is used predominantly for recalibration of the Verdict and for loading new libraries onto the Verdict. The Enabler software was useful for comparing different library spectra and can be used for spectral comparisons.

Findings

Strengths

- The Verdict is compact and weighs less than one pound.
- The technique is non-destructive, and little to no sample preparation is required. Results are available quickly and in an understandable format for a non-scientist.
- The Verdict displays up to three results with a correlation of 0.60 or better, eliminating confusion from results with low correlation. Results without a match correlated at 0.60 or higher are listed as "no match".
- The category designation for some of the library entries gives valuable added information when present.

- The unit is easy to operate.
- The battery can be recharged using a wall unit or by attaching the Verdict to a computer with the USB cord.
- There are no associated consumables for the unit.
- The cost of the unit is relatively low compared to other portable Raman spectrometers.
- The unit can operate at temperatures of -20°C to 40°C (-4 to 104°F) according to the manufacturer. The Verdict provided for the validation operated similarly to normal lab conditions, even when exposed to temperatures near and above this upper range.
- The Verdict provided for the validation was equipped with a polystyrene reference standard that was attached to the instrument via a lanyard.
- The Verdict is designed to operate in rugged conditions such as wind and light precipitation as long as care is taken to avoid moisture inside the tip.
- There are a number of incorporated safety features:
- The microSD card acts as a laser key. The laser will not fire unless it is properly inserted.
- The sampling tip must be properly installed for the laser to turn on.
- To activate the laser, the laser button must be pressed twice and the sampling tip must be depressed.
- The battery charge lasted longer than indicated on the screen.

Areas for Improvement

- The library is limited. It could benefit from additions such as phenethylamines and more common chemicals (household and laboratory) that could be used as diluents or precursors in drug and explosive exhibits. The ability to add compounds to a user library would also be useful.
- There is no mechanism to name spectra prior to sampling, and no identifying information on the handheld device when viewing results. It would be helpful to have a file name or other unique identifier to reference.
- Though the algorithms give a correlation score to aid the user, the sample and library reference spectra cannot be visually compared on the instrument. Because of the lack of identifying information upon sampling, it is also difficult to view spectra on the software. It would be useful to enable a simpler comparison, especially when results have matches with low correlations.
- There is no mechanism to view the match results on the instrument after exiting that result screen.
- The spectra files on this version of the Verdict were saved in a ".dnu" format on the microSD card and thus limited to the software provided.
- The results are inconsistently accompanied by a category.
- The result names are often truncated on the results screen, which may complicate further research by a user.
- The *Operators Manual* (Version 2) provided to the evaluators did not coincide with the instrument provided. For example:
    - On p. 29, six categories of results are listed, including "D" for drug entries. The Verdict instrument provided for this evaluation had only four categories of results ("N" for narcotic, "O" for oxidizer, "F" for flammable, and "E" for explosive).

  - On p. 28, there is a statement indicating that if the instrument returns a match, "it will always return the top three matches for comparison with the primary match." Evaluators found that the Verdict would return up to three matches, but often fewer.
  - On pp. 24-25, the manual shows screen shots of the messages displayed during sampling that do not coincide with the messages displayed on the screen of the evaluation unit.
  - Note: This was corrected in an updated *Operators Manual* (Version 2.21).
- Data formats for GRAMS software (.spc) and for Microsoft Excel (.prn) allow users to access files with other programs. The spectra were saved on the instrument in a .dnu format.
- Holding the sample steady and depressing the sampling tip while operating the buttons was slightly awkward. Container size may negate or exacerbate this issue. Altering this configuration or making it more user-friendly would be beneficial.
- It would be useful to have the software incorporated onto the unit, instead of separately on the computer.
- The unit requires an electrical outlet or computer with USB port to recharge the battery. The ability to exchange dead batteries for charged ones in absence of an outlet or computer would increase its portability.

Limitations

- Raman spectroscopy does not work well on highly fluorescent or pigmented items.
- Raman scattering is an inherently weak signal that can be affected by background light, which may lead to poor spectral quality.
- The identification of materials is limited to the reference samples contained in the library.
- This Verdict does not have built-in mixture deconvoluting software. Therefore, mixtures will not be reported as such.
- Comparison of sample and reference spectra cannot be conducted on the instrument.
- Additions to the user libraries cannot be conducted on the instrument.
- Identification of common drugs and diluents, such as cocaine base, MDMA, morphine, codeine and heroin was not accurate or reproducible.
- Identification of ignitable liquids was not accurate or reproducible.
- The compound identified in a mixture did not necessarily correspond with the compound in the highest ratio in the mixture.
- Proper training must be conducted in order to ensure the user correctly interprets results.
- Performance of the instrument depends on the user to get proper contact between the sample and the tip of the sampling head, and to choose the correct focal length.
- Raman scattering is limited to molecules that have a change in polarization potential in regard to distance between nuclei.

Health and Safety Issues

- The Verdict has a nominal ocular hazard distance of approximately 71 cm (28 inches). The unit should be held at this distance from the eyes, and the included safety goggles should be worn for protection, even when radiation is not "visible."
- The laser has the ability to explode samples such as black gunpowder. It should not be used to sample dark-colored materials, nor used near bulk materials. Samples should be limited to small masses or volumes for testing.

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APPENDIX

Table 1 –Results

Results are reported as displayed on the instrument.

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
PERFORMANCE CHECK	1	Y	Polystyrene	Y	5	Ref						
	2	Y	Polystyrene	Y	4	Ref						
	3	Y	Polystyrene	Y	5	Ref						
CONFORMITY												
Cocaine HCl	1	Y	Cocaine HCl	Y	3	N	Benzoylecgonin	2				
	2	Y	Cocaine HCl	Y	1	N						
	3	N										
Cocaine base	1	N										
	2	N										
	3	N										
Methamphetamine	1	Y	Methamphetamine	Y	3	N	Benzaphetamin	2	N	Ephedrine	2	N
	2	N										
	3	Y	Methamphetamine	Y	4	N	Benzaphetamin		N	Ephedrine		N
Heroin	1	Y	Heroin	Y	3	N	Hydromorphone	2	N	Morph.Sulfate5H2	1	N
	2	N										
	3	N										
Mannitol	1	Y	H Peroxide	N	2	O	Alcohol	2		Ethanol	1	F
	2	Y	Am Nitrate	N	1	O	Methanol	2	F			
	3	Y	H Peroxide	N	3	O	Alcohol	3		Ethanol	1	F
Niacinamide	1	Y	Am Nitrate	N	2	O	Methanol	1	F	Silver Nitrat	1	O

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	2	Y	Am Nitrate	N	1	O	Methanol	1	F	Silver Nitrat	1	O
	3	Y	K Nitrate	N	2	O	Methanol	1	F	Silver Nitrat	1	O
Boric Acid	1	Y	Ethanol	N	2	F	H Peroxide	2	O	Alcohol	2	
	2	Y	Ethanol	N	2	F	H Peroxide	2	O	Alcohol	2	
	3	Y	Ethanol	N	3	F	H Peroxide	2	O	Alcohol	2	
Inositol	1	N										
	2	N										
	3	N										
Caffeine	1	Y	Caffeine	Y	4		TATP	1	E			
	2	Y	Caffeine	Y	2							
	3	Y	Caffeine	Y	4		TATP	1	E			
Quinine	1	N										
	2	Y	TNT	N	1	E						
	3	N										
RDX	1	Y	C4	Y	1	E	RDX4	1	E			
	2	N										
	3	Y	C4	Y	3	E	RDX4	3	E	RDX5	3	E
Ammonium Nitrate (prills)	1	Y	Am Nitrate	Y	4	O	Silver Nitrat	3	O	Ba Nitrate	2	O
	2	Y	Am Nitrate	Y	3	O	Silver Nitrat	2	O	Ba Nitrate	1	O
	3	Y	Am Nitrate	Y	5	O	Silver Nitrat	4	O	Ba Nitrate	3	O
Ammonium Perchlorate	1	Y	Perchloric Aci	N	5	O	Am ClO4	3	O	Na Chlorate	1	O
	2	Y	Perchloric Aci	N	4	O	Am ClO4	3	O	Na Chlorate	1	O
	3	Y	Perchloric Aci	N	4	O	Am ClO4	3	O	Na Chlorate	1	O
Sugar	1	Y	Sugar	Y	3							

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	2	N										
	3	Y	Sugar	Y	3							
Cumin	1	N										
	2	N										
	3	N										
Urea Nitrate	1	Y	Urea Nitrate	Y	4	E	Guan Nitrate	3	E	Cobalt Nitrat	2	O
	2	Y	Urea Nitrate	Y	5	E	Cobalt Nitrat	3	O	Guan Nitrate	2	F
	3	Y	Urea Nitrate	Y	5	E	Guan Nitrate	3	E	Cobalt Nitrat	3	O
Ammonium Nitrate (powder)	1	Y	Am Nitrate	Y	2	O	Silver Nitrat	1	O	Ba Nitrate	1	O
	2	Y	Am Nitrate	Y	4	O	Silver Nitrat	4	O	Ba Nitrate	3	O
	3	Y	Am Nitrate	Y	5	O	Silver Nitrat	4	O	Ba Nitrate	4	O
Mineral Spirits	1	Y	Mineral Oil	N	3	F	Diesel	3	F	Ethyl hexanol	2	F
	2	Y	Mineral Oil	N	3	F	Diesel	2	F	Ethyl hexanol	1	F
	3	Y	Mineral Oil	N	3	F	Diesel	2	F	Ethyl hexanol	2	F
BP® 87 Octane Gasoline	1	Y	Gasoline	Y	4	F	Phenylacetone	2	N	Phentermine HC	2	N
	2	Y	Gasoline	Y	2	F	Methylamine HC	1	N	Phenylacetone	1	N
	3	Y	Gasoline	Y	4	F	Phenylacetone	2	N	Phentermine HC	2	N
BP® Diesel Fuel	1	Y	Diesel	Y	4	F	Mineral Oil	3	F			
	2	N										
	3	Y	Diesel	Y	4	F	Mineral Oil	3	F	Gasoline	1	F
Kerosene	1	Y	Diesel	N	4	F	Mineral Oil	4	F	Ethyl hexanol	1	F
	2	N										
	3	Y	Diesel	N	4	F	Mineral Oil	3	F	Ethyl hexanol	1	F

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
Klean-Strip® VM&P Naptha Thinner	1	Y	Mineral Oil	N	2	F	Diesel	2	F			
	2	Y	Mineral Oil	N	2	F	Diesel		F			
	3	Y	Mineral Oil	N	1	F	Diesel	1	F			
Lamplight® lamp oil	1	Y	Mineral Oil	N	4	F	Diesel	3	F	Ethyl hexanol	2	F
	2	N										
	3	Y	Mineral Oil	N	4	F	Diesel	3	F	Ethyl hexanol	2	F
Ronsonol lighter fuel®	1	Y	Mineral Oil	N	2	F	Diesel	2	F	Ethyl hexanol	2	F
	2	Y	Mineral Oil	N	2	F	Diesel	2	F	Ethyl hexanol	1	F
	3	Y	Mineral Oil	N	2	F	Diesel	2	F	Ethyl hexanol	2	F
Kingsford charcoal lighter fluid	1	Y	Mineral Oil	N	4	F	Diesel	3	F	Ethyl hexanol	2	F
	2	Y	Mineral Oil	N	3	F	Diesel	2	F	Ethyl hexanol	1	F
	3	Y	Mineral Oil	N	3	F	Diesel	3	F	Ethyl hexanol	2	F
MIXTURE SENSITIVITY												
Cocaine HCl: Caffeine (80:20)	1	Y	Cocaine HCl	Y	3	N	Benzoylecgonin	1	N			
	2	N										
	3	Y	Cocaine HCl	Y	2	N						
Cocaine HCl: Caffeine (60:40)	1	Y	Caffeine	Y	2							
	2	N										
	3	Y	Caffeine	y	2							
Cocaine HCl: Caffeine (50:50)	1	Y	Caffeine	Y	3							
	2	Y	Caffeine	Y	3							
	3	Y	Caffeine	Y	2		Cocaine HCl	1	N			

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
Cocaine HCl: Caffeine (40:60)	1	Y	Caffeine	Y	3							
	2	Y	Caffeine	Y	2							
	3	Y	Caffeine	y	3							
Cocaine HCl: Caffeine (30:70)	1	Y	Caffeine	Y	4		TATP	1	E			
	2	Y	Caffeine	Y	3							
	3	Y	Caffeine	Y	4		TATP	1	E			
Cocaine base: caffeine (80:20)	1	Y	Cocaine (FB)	Y	2	N	Benzoylecgonin	1	N			
	2	N										
	3	Y	Cocaine (FB)	Y	2	N	Phenylacetone	1	N	Benzoylecgonin	1	N
Cocaine base: caffeine (60:40)	1	Y	Cocaine (FB)	Y	2	N	Phenylacetone	1	N	Benzoylecgonin	1	N
	2	N										
	3	Y	Caffeine	Y	1							
Cocaine base: caffeine (50:50)	1	Y	Caffeine	Y	1							
	2	N										
	3	Y	Caffeine	y	2							
Cocaine base: caffeine (40:60)	1	Y	Caffeine	Y	3							
	2	N										
	3	Y	Caffeine	Y	3							
Cocaine base: caffeine (30:70)	1	Y	Cocaine (FB)	Y	3	N	Benzoylecgonin	2	N	Phenylacetone	1	N
	2	N										
	3	Y	Caffeine	Y	3							

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
Methamphetamine: DMS (80:20)	1	Y	Methamphetamin	Y	2	N	Benzaphetamin	2	N	Ephedrine	1	N
	2	N										
	3	Y	Methamphetamine	Y	3	N	Benzaphetamin	2	N	Ephedrine	2	N
Methamphetamine: DMS (60:40)	1	N										
	2	N										
	3	Y	Methamphetamine	Y	3	N	Benzaphetamin	2	N	Ephedrine	2	N
Methamphetamine: DMS (50:50)	1	N										
	2	N										
	3	Y	Methamphetamine	Y	1	N	Ephedrine	1	N	Benzphetamine	1	N
Methamphetamine: DMS (40:60)	1	N										
	2	N										
	3	N										
Methamphetamine: DMS (30:70)	1	N										
	2	N										
	3	N										
Heroin: Quinine (80:20)	1	Y	Heroin	Y	1	N	Hydromorphone	1	N			
	2	N										
	3	Y	Heroin	Y	2	N	Hydromorphone	1	N	Morphine Sulfa	1	N
Heroin: Quinine (60:40)	1	Y	Hydromorphone	Y	1	N	Heroin	1	N			
	2	N										
	3	N										

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
Heroin: Quinine (50:50)	1	N										
	2	N										
	3	N										
Heroin: Quinine (40:60)	1	N										
	2	N										
	3	N										
Heroin: Quinine (30:70)	1	Y	TNT	N	1	E						
	2	N										
	3	N										
Ammonium Nitrate: Sugar (80:20)	1	Y	Am Nitrate	Y	4	O	Silver Nitrat	3	O	Ba Nitrate	3	O
	2	Y	Sugar	Y	2							
	3	Y	Sugar	Y	2							
Ammonium Nitrate: Sugar (60:40)	1	Y	Sugar	Y	3							
	2	Y	Am Nitrate	Y	3	O	Methanol	3	O	Silver Nitrat	2	O
	3	Y	Am Nitrate	Y	1	O	Sugar	1				
Ammonium Nitrate: Sugar (50:50)	1	Y	Am Nitrate	Y	3	O	Methanol	3	F	Silver Nitrat	2	O
	2	Y	Sugar	Y	2							
	3	Y	Am Nitrate	Y	4	O	Silver Nitrat	3	O	Ba Nitrate	3	O
Ammonium Nitrate: Sugar (40:60)	1	Y	Am Nitrate	Y	5	O	Silver Nitrat	3	O	Ba Nitrate	3	O
	2	N										
	3	Y	Sugar	Y	3							

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
Ammonium Nitrate: Sugar (30:70)	1	Y	Sugar	Y	3							
	2	Y	Sugar	Y	3							
	3	Y	Sugar	Y	3							
Ammonium Nitrate: Cumin (80:20)	1	Y	Am Nitrate	Y	3	O	Methanol	3	F	Silver Nitrat	2	O
	2	N										
	3	N										
Ammonium Nitrate: Cumin (60:40)	1	N										
	2	N										
	3	N										
Ammonium Nitrate: Cumin (50:50)	1	Y	Ethylene diamin	N	1	O						
	2	N										
	3	Y	Am Nitrate	Y	1	O	Methanol	1	F			
Ammonium Nitrate: Cumin (40:60)	1	N										
	2	Y	Ethylene diamin	N	1	O						
	3	Y	Ethylene diamin	N	1	O						
Ammonium Nitrate: Cumin (30:70)	1	N										
	2	N										
	3	N										
SPECIFICITY												
d,l-amphetamine sulfate	1	Y	Amphetamine Su	Y	1	N						

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	2	N										
	3	Y	morphine sulfate 5H2O	N	2	N	amphetamine HCl	1	N			
MDMA	1	Y	N-hydroxy MDA HC	N	1	N						
	2	Y	N-hydroxy MDA HC	N	1	N						
	3	Y	N-hydroxy MDA HC	N	1	N						
MDA	1	N										
	2	N										
	3	N										
MDEA	1	Y	N-hydroxy MDA HC	N	1	N						
	2	N										
	3	N										
morphine sulfate	1	Y	morphine sulfate 5H2O	Y	2	N	Hydromorphone	1	N			
	2	N										
	3	Y	morphine sulfate 5H2O	Y	1	N						
codeine sulfate	1	Y	morphine sulfate 5H2O	N	2	N	Codeine	1	N	Hydromorphone	1	N
	2	Y	morphine sulfate 5H2O	N	2	N	hydromorphone	1	N	Heroin	1	N
	3	Y	morphine sulfate 5H2O	N	2	Y	Codeine	1	N			
benzocaine	1	N										
	2	N										

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	3	N										
Lidocaine	1	N										
	2	N										
	3	N										
procaine	1	Y	Procaine HCl	Y	4	N						
	2	Y	Procaine HCl	Y	2	N						
	3	Y	Procaine HCl	Y	3	N						
acetylsalicylic acid (ASA)	1	Y	Aspirin	Y	3							
	2	Y	Aspirin	Y	3							
	3	Y	Aspirin	Y	3							
ibuprofen	1	Y	Ibuprofen	Y	3							
	2	Y	Ibuprofen	Y	1							
	3	Y	Ibuprofen	Y	3							
guaifenesin	1	N										
	2	N										
	3	N										
diphenhydramine	1	Y	Benzaphetamin	N	3	N	Ref Polystyrene	3		Methylamine HCl	3	N
	2	Y	Ref Polystyrene	N	3		Methylamine HCl	3	N	Benzene	2	F
	3	Y	Ref Polystyrene	N	3							
chlorpheniramine	1	N										
	2	N										
	3	N										
pseudoephedrine	1	Y	Pseudoephedrin	Y	4	N	Propoxyphene HC	2	N	Phenylacetone	2	N

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	2	Y	Pseudoephedrin	Y	4	N	Propoxyphene HC	2	N	Polystyrene	1	Ref
	3	Y	Pseudoephedrin	Y	2	N	Propoxyphene HC	2	N	Polystyrene	1	Ref
Dimethyl sulfone (DMS)	1	N										
	2	N										
	3	N										
Baking soda	1	Y	Baking Soda	Y	3		Silver Nitrat	3	O	Am Nitrate	3	O
	2	Y	Am Nitrate	N	1	O	Silver Nitrat	1	O	Baking Soda	1	
	3	Y	Baking Soda	Y	3							
Acetaminophen (ACE)	1	Y	Acetaminophen	Y	3							
	2	Y	Acetaminophen	Y	2							
	3	Y	Acetaminophen	Y	4							
urea	1	Y	Urea	Y	4							
	2	Y	Urea	Y	4		Phenylacetone	2	N	Phenyl propanolamine HCl	1	N
	3	Y	Urea	Y	5							
ferric nitrate	1	Y	Lead nitrate	N	4	O	Am Nitrate	3	O	Ba Nitrate	3	O
	2	Y	Lead nitrate	N	3	O	Potassium Nitrate	3	O	Ba Nitrate	3	O
	3	Y	Lead nitrate	N	3	O	Baking Soda			Am Nitrate		O
sodium perborate	1	N										
	2	N										
	3	N										
fertilizer (13% total N) prills	1	N										
	2	Y	Sulfur	N	4	E						

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	3	N										
fertilizer (13% total N) ground	1	N										
	2	N										
	3	N										
turmeric:cardamom (50:50)	1	N										
	2	N										
	3	N										
sodium hydroxide (lye)	1	N										
	2	N										
	3	N										
sulfuric acid	1	Y	Sulfuric Acid	Y	5	O	Tetrahydrofura	3	F	Acetonitrile	1	F
	2	Y	Sulfuric Acid	Y	5	O	Tetrahydrofura	3	F	Acetonitrile	1	F
	3	Y	Sulfuric Acid	Y	5	O	Tetrahydrofura	3	F	Acetonitrile	1	F
ammonium hydroxide	1	N										
	2	N										
	3	N										
citric acid	1	N										
	2	N										
	3	N										
RUGGEDNESS												
Performance check 5/20/2010	1	Y	Polystyrene	Y	5	Ref	Methylamine HCl	3	N	Benzene	3	F
5/19/2010	2	Y	Polystyrene	Y	5	Ref	Phenylacetone	3	N	methylamine HCl	3	N

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
5/21/2010	3	Y	Polystyrene	Y	5	Ref	Methylamine HCl	3	N	Benzene	3	F
cocaine HCl	1	Y	Cocaine HCl	Y	3	N						
	2	N										
	3	Y	Cocaine HCl	Y	1	N						
methamphetamine	1	Y	Methamphetamin	Y	4	N	1-benzylpiperazin	2	N	Ephedrine	2	N
	2	N										
	3	N										
caffeine	1	Y	Caffeine	Y	4		TATP	1	E			
	2	N										
	3	Y	Caffeine	Y	3							
ammonium nitrate (powder)	1	Y	Am nitrate	Y	4	O	Silver Nitrat	3	O	Ba Nitrate	2	O
	2	Y	methanol	N	3	F	Am Nitrate	1	O			
	3	Y	Am nitrate	Y	3	O	Methanol	3	F	Silver Nitrat	2	O
ammonium perchlorate	1	Y	Perchloric Aci	N	4	O	Am ClO4	3	O	Na Chlorate	1	O
	2	Y	Perchloric Aci	N	4	O	Am ClO4	1	O	Na Chlorate	1	O
	3	Y	Perchloric Aci	N	4	O	Am ClO4	2	O	Na Chlorate	1	O
RDX	1	Y	C4	Y	3	E	RDX4	2	E	RDX5	2	E
	2	Y	C4	Y	2	E	RDX4	1	E	RDX5	1	E
	3	Y	RDX4	Y	3	E	C4	2	E	RDX5	2	E
BP 87 Octane Gasoline	1	Y	Gasoline	Y	3	F	Polystyrene	2	Ref	Methylamine HC	2	N
	2	N										
	3	Y	Gasoline	Y	3	F	Polystyrene	2	Ref	Methylamine HC	2	N
BP diesel fuel	1	Y	Diesel	Y	3	F	Mineral Oil	3	F			

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
	2	N										
	3	Y	Diesel	Y	2	F	Mineral Oil	2	F			
Performance check	1		Phenylacetone		4	N	Ref Polystyrene	4		1-Benzylpiperazine	3	N
6/4/10 Manatee County	2		Ref Polystyrene		5		Phenylacetone	4	N	1-Benzylpiperazine	3	N
	3		Ref Polystyrene		5		Phenylacetone	4	N	Propoxyphene HCl	3	N
PORTABILITY												
PREVIOUS ID:												
501: 7.5 mg Hydrocodone/500 mg Acetaminophen	1	Y	Acetaminophen	Y	4							
501: (Lortab)	2	Y	Acetaminophen	Y	4							
501	3	Y	Acetaminophen	Y	3							
502: 100 mg Propoxyphene/650 mg Acetaminophen	1	Y	Acetaminophen	Y	4							
502: (Darvocet)	2	Y	Acetaminophen	Y	4							
502	3	Y	Acetaminophen	Y	4							
503: 15 mg Oxycodone HCl	1	N										
503: (Roxicodone)	2	N										
503	3	N										
504: 30 mg Oxycodone HCl	1	N										
504: (Roxicodone)	2	N										
504	3	N										
505: Cocaine base	1	Y	Cocaine (FB)	Y	2	N	Benzoylecgonin	2	N	Benzoic Acid	1	O

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
505	2	N										
505	3	N										
506: 2 mg Alprazolam (Xanax)	1	N										
506	2	N										
506	3	N										
507: Cocaine base	1	Y	Cocaine (FB)	Y	3	N	Benzoylecgonin	3	N	Phenylacetone	2	N
507	2	Y	Cocaine (FB)	Y	2	N	Benzoylecgonin	1	N	Phenylacetone	1	N
507	3	N										
508: Lidocaine	1	Y	Lidocaine HCl	Y	2	N						
508	2	Y	Lidocaine HCl	Y	1	N						
508	3	Y	Lidocaine HCl	Y	1	N						
509: 10 mg Methadone HCl	1	N										
509: (Methadone)	2	N										
509	3	N										
510: Cocaine base	1	Y	Cocaine (FB)	Y	3	N	Phenylacetone	2	N	Benzoylecgonin	2	N
510	2	N										
510	3	Y	Cocaine (FB)	Y	4	N	Benzoylecgonin	2	N	Phenylacetone	2	N
511: Heroin	1	N										
511	2	N										
511	3	N										
50: Cocaine HCl	1	Y	Cocaine HCl	Y	1	N	Benzoylecgonin	1	N			
50	2	Y	Cocaine HCl	Y	3	N	Benzoylecgonin	2	N	Phenylacetone	1	N
50	3	Y	Cocaine HCl	Y	1	N						

Sample	Trial	Match Y/N	Primary ID	Correct? Y/N	# bars	Category	Other ID(s)/ Comments	# bars (2)	Category (2)	Other ID(s)/ Comments	# bars (3)	Category (3)
49B: Cocaine base	1	Y	Cocaine (FB)	Y	2	N						
49B	2	N										
49B	3	N										
44B: Cocaine base	1	Y	Cocaine (FB)	Y	1	N						
44B	2	Y	Cocaine (FB)	Y	1	N						
44B	3	N										
39: Heroin	1	N										
39	2	N										
39	3	N										
38: Heroin	1	N										
38	2	N										
38	3	N										
35: Heroin	1	N										
35	2	N										
35	3	N										
34: Heroin	1	N										
34	2	N										
34	3	N										
10: Cocaine base	1	Y	Cocaine HCl	Y	1	N						
10	2	N										
10	3	N										
9: NCSD, Fake cocaine base	1	Y	Acetaminophen		4							
9	2	Y	Acetaminophen		3							
9	3	Y	Acetaminophen		1							