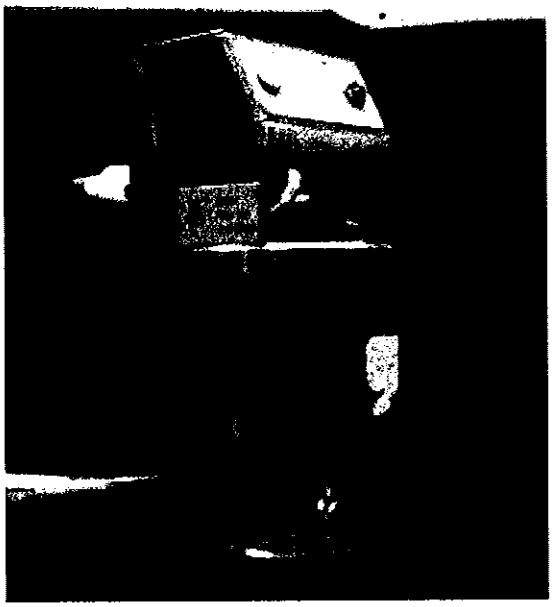
THE VERMONT DEPARTMENT OF HEALTH LABORATORY

# BREATH AND BLOOD TOXICOLOGY BULLETIN

April 2009

## Introduction to the Simulator

*By Darcy Richardson*



**Contact Information:**

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**Program Chief:**
Robert Drawbaugh

**Chemists:**
Darcy Richardson
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During every subject test performed by the DataMaster several checks are run to ensure that the instrument is operating properly prior to analyzing a subject's breath sample. One of these checks is called the "External Standard" on the BAC DataMasters and "Simulator Vapor" on the DataMaster DMT. These tests are analyzing a simulated breath alcohol sample provided by the simulator device attached to the instrument. Often the purpose of these tests and the simulator in general are not well understood. This article will provide a brief introduction to the simulator. As usual, if any further clarification is needed please feel free to contact us.

The simulator is a separate device which is attached to the DataMaster. It is not a part of the DataMaster instrument and is manufactured by a separate company. We currently use the Guth 34CNP simulator with our DataMasters in the field. There are however a variety of styles of simulator which are approved by the federal government and which function in the same manner. The simulator itself consists of a glass jar that is threaded to a simulator head. Descending from the simulator head are a stirring paddle, an immersion heater and a bubbler. Heater and power lights are on the simulator head. From the back of the simulator head are two quick connects which attach to the DataMaster to allow vapor in and out of the DataMaster. Additionally a cable extends from the side of the DataMaster to the back of the Simulator head to allow for continuous temperature monitoring of the simulator. The simulator is heated to 34°C to mimic a human breath sample and kept within +/- 0.5°C from that set point.

Simulator solution is prepared at the Vermont Department of Health Laboratory targeting a 0.100 ethanol concentration in water. Copper sulfate is added to prevent the growth of algae. The solution is certified by gas chromatography for use in the DataMaster. One bottle (500ml) of solution is poured into the simulator jar. As the jar is heated the ethanol in the water and the ethanol in the air above the water reach equilibrium. (See Henry's law for the science behind

this.) A portion of the vapor is pulled into the instrument and is analyzed as a check sample prior to a subject test being performed. This simply acts as a check to ensure that the instrument can recognize and quantify ethanol when it is presented. **The instrument is not calibrated at this time** and the result of the "External Standard" or "Simulator Vapor" is not compared in any way to the subject's breath sample. Calibration and certification of the DataMaster are only performed in the laboratory by Toxicology staff.

Although the vapor is re-circulated back to the simulator, each time a test is performed some of the ethanol is lost to the ambient air. This results in the simulator solution losing ethanol over time so that the concentration depletes. When the concentration depletes below our acceptable levels, the solution must be replaced. If the solution has dropped below the acceptable levels programmed into the DataMaster the test will abort. The instrument will not allow a test to be performed on a subject unless all checks pass, this includes the sample delivered by the simulator. An "External standard" or "Simulator Vapor" test which results below the acceptable range does not necessarily indicate that the DataMaster is not functioning properly. The depletion of the simulator solution is normal and expected and because of this all DataMaster Supervisors are trained in replacing the simulator solution. Simulator solution is replaced each time a Routine Performance Check is performed and as needed there after.

## DMT Supervisor Training

*By Amanda Bolduc*

On January 22nd and 23rd the Department of Health Laboratory Alcohol and Toxicology program held DataMaster DMT Supervisor training courses. Nineteen officers from nine agencies were trained in simple and routine maintenance on the new DMT instruments. DataMaster DMT Supervisors are responsible for performing periodic performance checks on the instruments, known as Routine Performance Checks (RPC). Should the instrument malfunction, the Supervisors are trained to perform some minor troubleshooting and repairs. The Supervisor is also responsible for performing a simulator solution change when the concentration has depleted beyond the acceptable limits. The Supervisor acts as a contact person between the VDHL DataMaster Technical Services and their agency. They oversee the onsite maintenance records and the general operation of the DataMaster DMT at each agency.

In addition to the DMT Supervisor, DMT Records Administrator (RA) training was also provided. Each agency was given the option of having an RA trained in and responsible for all onsite DataMaster DMT documentation. This could include providing additional copies of breath reports, discovery reports, summary reports or other DMT documents. Some agencies chose to assign a civilian at their agency to be responsible for this duty; most agencies opted to have the DMT Supervisor also assume the duties of the RA. The main focus of the RAs duties is to provide monthly updates to the State's Attorney's Offices in order to facilitate the discovery response process. Responding to discovery requests in the past had been a joint effort between the police department and the Laboratory as both agencies maintained records regarding the instrument. With the advanced software packed designed by the Lab, we have been able to have each instrument store and print nearly all of the information requested for discovery from memory. This has simplified and streamlined the discovery process.

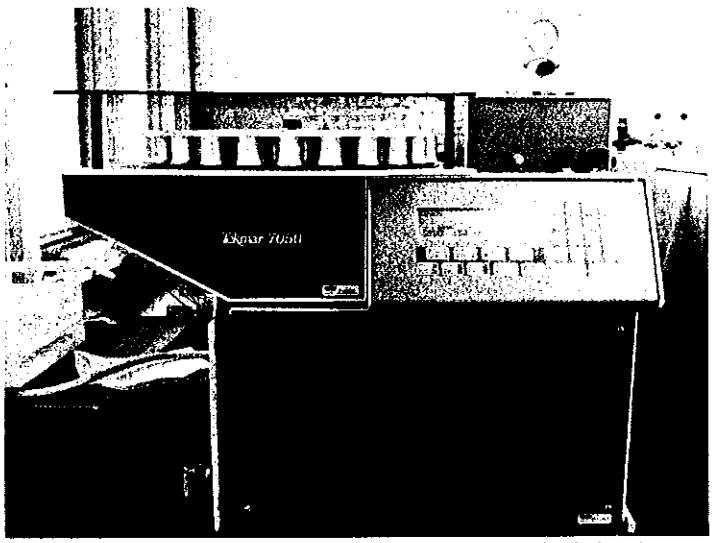
For more information regarding the types of reports available and what they mean, please contact a member of the Vermont Department of Health Laboratory Toxicology Program.

## Staff Profiles:

### Amanda Bolduc:

Amanda Bolduc is a Chemist for the Toxicology Program. She holds a Bachelor's Degree in Biology with a minor in Chemistry from the University of Vermont and a Master's Degree in Forensic Science from National University in San Diego. Amanda joined the Health Department lab in May of 2005. Amanda's tasks at the Health Department are varied. They include testing blood and urine for the presence of drugs and alcohol, testing pediatric blood samples for lead, and working in the infrared breath testing program. Her main focus has been on the DataMaster DMT project.

## Tools of the Trade:



### Tekmar Autosampler:

This autosampler is used in the analysis for alcohol and other small volatile compounds in blood, urine and beverage samples at the Vermont Department of Health Laboratory. It allows the chemist to prepare the samples, start their analysis which can continue unattended for many hours. The autosampler uniformly heats and equilibrates each vial while moving them to the correct spots for injection into a gas chromatograph. The actual sample to be analyzed comes from the air above the liquid which has been saturated with alcohol or other volatile vapor. The autosampler does not perform any analysis but is a tool used by chemists to automate the process and allow them to multi-task.

THE VERMONT DEPARTMENT OF HEALTH LABORATORY

# BREATH AND BLOOD TOXICOLOGY BULLETIN

October 2008

## New Breath Alcohol Testing Equipment Installed

*By Amanda Bolduc*

After much anticipation, on July 1st, 2008 the Vermont Department of Health Laboratory (VDHL) successfully deployed 6 new DataMaster DMT instruments in Franklin and Grand Isle Counties, replacing the BAC DataMasters in those locations. Officer training was held at the State Police barracks in St. Albans in May. Approximately sixty officers were certified on the new instrument. In just the first two months of service, around 75 subjects were processed on the DMTs. The errors we have encountered thus far are minor and do not affect the accuracy of the testing. To date, the VDHL have provided affidavits regarding the reliability of the new instrument but have not had any requests for testimony.

The next phase of the DMT project is to deploy instruments in Chittenden County. We will be holding operator recertification classes in late October; we anticipate the need to train approximately 350 officers from over 13 different agencies. We will be replacing eleven instruments at each of the current DataMaster agencies in Chittenden County in mid-November. This will complete the implementation of the new instruments which were purchased with special funding from the legislature.

We would not have been this successful without the help of the VCJTC, the State's Attorney's Offices and the many law enforcement agencies with which we have worked. The Health Department Toxicology Program is appreciative to all who have made this change-over a smooth and successful one.

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## New Services Offered

The toxicology program continues to expand our offerings in blood drug testing in support of DUI-drug cases. Blood samples were previously sent to a contract lab in Pennsylvania for drug testing while we performed the alcohol testing in-house. As we continue to add more drugs to our test services, we look forward to being able to perform all drug testing at our laboratory. This will allow greater speed of service at a lower cost than is currently available to Vermont law enforcement officers and attorneys. Please see page 3 for our current list of offerings for drug testing. Marie Sawyer or Bob Drawbaugh can be contacted for additional information.

## Why are these tests different?

*By Darcy Richardson*

Often our program chemists are asked why two sequential breath alcohol tests taken from the same individual have different values. People speculate that two different results must mean that the alcohol concentration is going up or down or that the testing instrument is unstable. Neither of these reasons is likely to be the cause of two different results taken close in time from the same individual.

The time difference involved between two breath samples on the DataMaster is approximately three minutes. This is the amount of time it takes the instrument to perform its quality assurance checks and return to prompt the subject for a breath sample. This amount of time is not enough to show whether the person's BrAC is rising or falling simply because any alcohol rising or falling in this time period is too small for the instrument to differentiate. Time differences of 30 minutes or more between tests would be better suited for determining if alcohol concentration is rising or falling.

Instrument stability during a two test sequence can be looked at by observing the results of the "External Standard". Since the external standard is regulated by the instrument in the amount of air it delivers, each repetition should be the same. If the instrument was showing significant analytical instability, this would likely be reflected in the external standard values. Instability would most likely cause the blanks, external standards or internal standards to fail resulting in the test being aborted. Variation in the third decimal place can be attributed to electronic noise but larger variations between two breath samples are unlikely to be due to instrument stability.

The reason we see differences between two breath samples is simply that the breath samples are different. Although there are criteria in place in the instrument to assure a deep lung sample such as requiring at least 1.5 liters of breath to be delivered for a subject sample, there is very little control over how much air the subject actually delivers into the instrument. The most accurate representation of the alcohol in the body will be a test in which the subject has delivered all of the air they can. In those cases the instrument will be analyzing the air that is in closest contact to the blood and most closely represents the body burden of alcohol. Air that is sampled higher up in the lungs is diluted by room air and is lower in alcohol concentration than a breath sample that is taken from deeper in the lungs.

A striking example of this can be observed in a human subject test our program performed at the Vermont Police Academy. In this instance a drinking male subject was instructed to deliver all of the air he could. In the first test he performed he delivered 6.8 liters of air. *(It is appropriate to note here that this is quite a large lung capacity. He is an ex-marine and a marathon runner and*

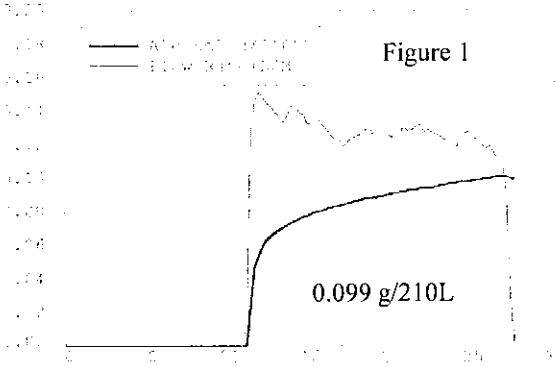


Figure 1

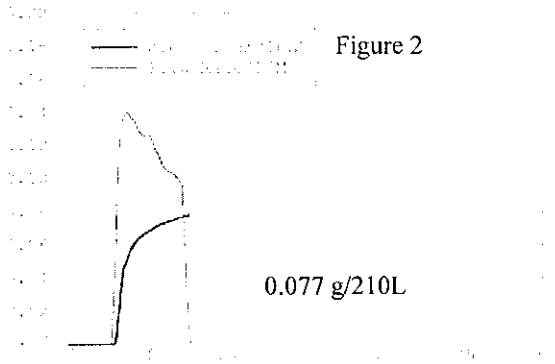


Figure 2

*this type of volume should not be expected on a regular basis.)* His first test indicates a BrAC of 0.099g/210Liters. As you can observe in Figure 1 the alcohol concentration (the dark black line) has reached a plateau and is dipping slightly at the end. This seems to be fairly typical when a subject has delivered a full breath. In the second test we told this same subject to stop blowing when he reached 1.5 liters. He stopped at 1.7 liters and his breath sample resulted in a test value of 0.077g/210Liters. As you can observe in Figure 2 the alcohol concentration is still on the climb

and a plateau has not yet been reached. Not only is the difference striking between the two tests, which were taken three minutes apart, but also it is important to note that the subject was able to deliver breath samples that were both over and under the legal limit.

This leads to the assertion that I've heard from attorneys on occasion that the "harder you blow the higher you go." This is true to a certain extent where "harder" is actually longer. When a full breath sample is delivered it's result will be higher than one where only a partial breath was given. As stated previously, a test that was analyzing deep lung air will be closer to the actual body burden of alcohol than one that just meets the minimum requirement.

It is important to remember when evaluating two breath samples that they are both unique samples that were delivered to the instrument. They are both accurately measured as to the alcohol content of the sample delivered but may show indicate different points in the lungs.

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| **Forensic Toxicology Services** |
|---|
| **Blood Confirmation Testing** |
| **Cannabinoids**<br>Delta-9-THC, Delta-9-Carboxy THC, Delta-9-Hydroxy THC *(marijuana)* |
| **Opiates**<br>Morphine, Codeine, Oxycodone, Hydrocodone, Hydromorphone,<br>6-Monoacetylmorphine<br>*(Lorcet, Oxycontin, Percocet, Vicodin)* |
| **Amphetamine**<br>Amphetamine, Methamphetamine, MDMA *(ecstacy)* |
| **Benzodiazepines**<br>7-Aminoclonazepam, 7-Aminoflunitrazepam, Alpha-hydroxyalprazolam,<br>Alprazolam (Xanax), Bromazepam,Chlorodiazepoxide, Clobazam,<br>Clonazepam (Klonopin),Clozapine, Desalkyflurazepam, Diazepam (Valium),<br>Estazolam,Flunitrazepam (Rohypnol),Flurazepam, Lorazepam (Ativan),<br>Lormetazepam, Midazolam,N-Desmethylflunitrazepam,Nitrazepam,<br>Nordiazepam, Oxazepam (Serax),Prazepam, Temazepam(Restoril),<br>Triazolam |
| **Cocaine**<br>Cocaine, Benzoylecgonine, Cocaethylene, Econine Methyl Ester |
| **Buprenorphine**<br>Buprenorphine, Norbuprenorphine<br>*(Suboxone,Subutex)* |
| **Methadone** |
| **Fentanyl**<br>Fentanyl, Norfentanyl<br>*(Fentora, Sublimaze, Duragesic)* |
| **Citalopram** *(Celexa)* |
| **Zopiclone** *(eszopiclone,Lunesta)* |
| **Cyanide** |

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October 2009

## Fatal Error Confusion

*By Amanda Bolduc*

The Vermont Department of Health Laboratory (VDHL) in conjunction with the Vermont Criminal Justice Training Council revised the *Infrared Breath Testing Device Student Manual* in December 2007. The VDHL also issued the *DataMaster DMT Addendum* in May 2008 to accompany the training on the new DMT instrument. In both of these manuals, the Error Messages and Responses section was rewritten. Error messages were reorganized into three types of errors: Fatal Errors, Non-Fatal Errors and Other Error Conditions. In previous editions of the manual errors were listed alphabetically.

As now defined in both manuals:

> **Fatal Errors:** Although a DataMaster Supervisor or the Vermont Department of Health Laboratory may be able to remedy these error messages, for the purpose of processing, the Officer should consider these "fatal errors" and proceed to a different DataMaster. If another DataMaster is not reasonable available, blood may be drawn. When encountering fatal error messages, post "Out of Service" on the instrument and leave a message for your DataMaster Supervisor.
>
> **Non-Fatal Errors:** The following errors may be remedied by the test operator. If after following these instructions the error remains, post "Out of Service" and leave a detailed message to your DataMaster Supervisor regarding when the error occurred and what steps where taken to try to remedy it. Proceed to a different DataMaster, if one is not reasonably available you may have blood drawn. If the error has been cleared, begin the testing procedure again.
>
> **Other Error Conditions:** The following error conditions should be documented but may not necessitate moving to a different DataMaster. A detailed message should be left for the DataMaster Supervisor to remedy the situation for future use.

When the manual was revised we reorganized the errors into the three categories to make teaching and learning easier. Some of the errors can be easily remedied by the operator. Many of these errors require the same remedy, which is part of the reason for grouping them. If the error is not one that the operator can quickly and easily remedy, we prefer that the operator not spend time trying to remedy the error thus resulting in naming the error a "Fatal Error." It may be more time efficient for an officer to move to a new location rather than retrying the breath test, even though the error may or may not reoccur upon retesting.

The term "Fatal Error" was not created by the manufacturer of the DataMaster nor does it indicate a system failure. The term was created by the Health Department Laboratory to indicate to the Officer that it is more time expedient to continue their processing at another agency.

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This is especially the case regarding the "Standard Out of Range" error. In the event that the simulator has depleted to the lowest acceptable limit (±5% tolerance on the DMT or the 0.090-0.110 tolerance on the BAC) and the officer retries the test, the standard result may report within range. However if the result does not come back within range, the officer has wasted their time, and will still need to move to a new DataMaster. Thus the recommendation from the Health Department is to simply move to another DataMaster when encountering the error.

The term "Non-Fatal" error was also created by the Health Department Laboratory. This term indicates to the officer that they may be able to remedy a situation and continue processing. Often this is something as basic as turning the instrument off for a minute, then turning it back on.

The errors listed under "Other Error Conditions" allow that a note may be left for the DataMaster Supervisor to make a minor correction not affecting the testing protocol, such as setting the time for daylight savings. These conditions do not necessitate an interruption to the processing.

The DataMaster instruments are designed in such a way that if the instrument is currently not capable of accurately collecting, analyzing and reporting a valid result, an error message will either be displayed or printed and a breath result will not be generated. If a Subject Test Report has all of the quality control tests and the breath result printed without any error messages, then it is a valid, accurate and reliable result.

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## "So, What do you need?" Performing Relation Back

*By Darcy Richardson*


Much of the testimony we provide in the courtroom on DUI is based on the premise of relation back. This can often be a matter of confusion about when the calculations are required and what information is needed for us to perform the calculation.

The matter of "when" is fairly simple. If the test result is below a 0.08 then a relation back will be required to determine whether the operator was operating their vehicle over a 0.08 at the time of operation. If the test is taken more than two hours from the time of the test, then the presumption is lost and a relation back must be performed to estimate the BrAC/BAC at the time of operation. This is a common scenario for blood samples. Additionally if there is information indicating that alcohol was consumed just prior to or after operation, then a relation back may be needed to account for any unabsorbed alcohol at the time of operation. This would also be the case for alcohol that was consumed after operation and would not be in effect at the time of driving but would be in effect at the time of testing.

The matter of "what" is slightly more complicated. At the minimum we need the time of operation, the time of the test and the test result. Whether the test is blood or breath doesn't matter, the calculation is the same. With this information we can provide a basic estimation of the BrAC/BAC at the time of operation. For this estimation we make the assumption that the alcohol consumed has been substantially absorbed into the blood stream at the time of operation. (i.e. nothing consumed within 30 minutes or after operation.)

Of course the more information that we have the better an estimation we can give. Information about the drinking history is relevant especially when drinking has been done just prior to, during or after operation. This information should include the type of alcoholic beverage, the amount of beverage consumed, the gender and weight of the individual. Height may also be relevant in cases where the weight is disproportioned to the height since a very lean or obese individual may develop a different BAC from a drink than an averagely proportioned individual of the same

gender. This information regarding drinking pattern, although helpful is not required in all cases, especially since self reported drinking patterns have a fairly low level of reliability. In instances where the argument is that there is alcohol unabsorbed, the weight and gender will be required to perform that calculation. Those factors are also required when an estimation of the number of drinks it would take to reach a certain level is desired. Additional information regarding whether a person has had gastric bypass or other medical conditions may be relevant as well if they would effect how alcohol is absorbed or eliminated.

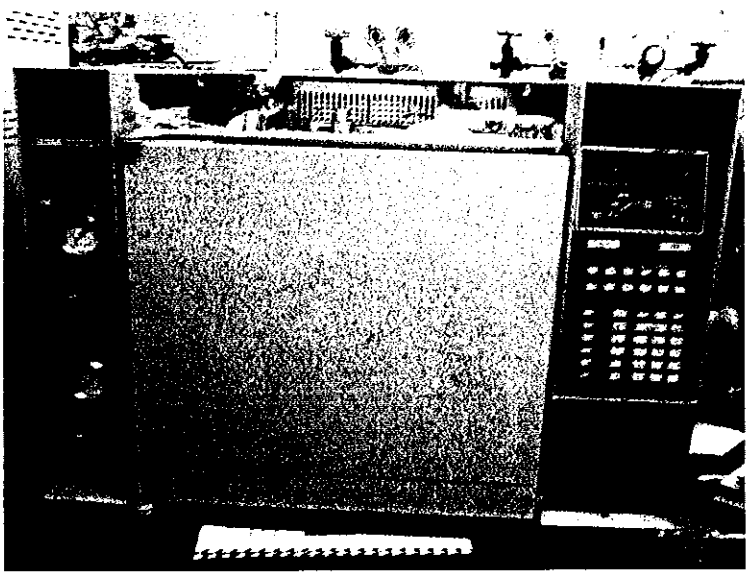
## Staff Profiles:

**Marie Sawyer**:

Marie Sawyer is a Chemist at the Vermont Department of Health Laboratory in the Toxicology Program. Marie's primary focus is in Chemical Terrorism Preparedness and the Drug Testing Section. She is the lead chemist for drug testing in urine and blood samples. She has a degree in Biology from the University of Vermont, and a certificate in Drug Chemistry from the University of Florida. She has been employed at the Health Department since 2001.

## Tools of the Trade:

**HP 5890 Gas Chromatograph:**



The 5890 Gas Chromatograph (GC) is used in the analysis of blood samples for alcohol and other small volatile organic compounds. A portion of vapor is withdrawn by the autosampler and proceeds through a 30 meter (approximately 98 feet) column in the GC. The vapor is carried by a non-reactive gas (helium). The detector is a Flame Ionization Detector (FID) which is very sensitive to low levels of compounds but destroys the sampled portion due to combustion. Different volatile compounds come off the column at different times known as retention times. The time identifies the compound and the response at the FID determines the quantity of the compound. The calculations are performed on a computer separate to the GC.

# Vermont Department of Health Laboratory
# Toxicology Program
# Memorandum

To: Bill Apao, Director, health Surveillance
Mary Celotti, Laboratory Director

From: Robert Drawbaugh, Toxicology Program Chief

Date: April 19, 2011
Re: DataMaster replacement money

As you may be aware, the type of DataMaster which is currently in use in Vermont is no longer being produced by the manufacturer. There are two models of similar style available from the same manufacturer. They are based on the same technology [ infrared absorption ] as those currently approved and in use, but in a slightly different configuration. There is also a new style with substantially updated electronics which is still based on infrared technology. All available DataMasters are in the same relative price range of $6,000 – $6,500 ea. The funds provided for new instruments is probably best used for purchase of approximately 20 new instruments with the remainder used for maintenance parts and operating supplies. There are at least two other manufacturers of breath testing equipment with models similar to those provided by the manufacturer of DataMaster instruments. Prices for those instruments are comparable to those for the different DataMaster models.

Since some level of change is mandated by the lack of availability of exact replacements of our current DataMaster type, there will be a number of issues to address in putting new instruments in place. There will be the need to identify who will be the cooperating State's Attorneys since any change will require them to answer challenges that have been earlier put to rest for cases based on current DataMaster testing. Also to be determined is whether we will have mixed types in a county or convert an entire county to the new style.

Additionally, it is expected that there will be some level of additional training for officers who will be using the equipment. The extent of the training needed and the certification of operators will probably be dependent upon the degree of difference between old and new. This could be an issue to be brought to the Criminal Justice Training Council.

Receipt of new instruments requires that we go through a thorough check of all of the components and a full certification process of each instrument before placing in the field for evidential use. This process takes two to three days. Preparation and distribution of 18 instruments to the field will take about two and one-half months, based on current staffing resources.

Based on the information provided above, it will be necessary to first decide on equipment type. Purchase pattern will depend somewhat on availability and delivery time. On the surface, it seems that two purchases of about 10 each would best work considering our storage and staffing limitations. One purchase in early winter and another in late spring would have a lower negative impact on our resources. Assuming timely resolution of the related issues and reasonable delivery time for instruments ordered, new instruments could be in use in selected areas by mid-winter.

**From:** Ryser, Hansueli [Hansueli.Ryser@draeger.com]
**Sent:** Wednesday, February 25, 2009 7:30 PM
**To:** Drawbaugh, Bob
**Cc:** Don Pouliot; Shaffer, Brian
**Subject:** Answers to your questions

Dear Bob:

I apologize for the late response. However, I was taking advantage of this week's R&D meeting with the entire 9510 engineering staff to address the questions you had during my visit.

**Reg. the calibration factors:**
R&D has assured me that we are able to print the actual calibration factors for the IR sensor and the EC sensor on any test report generated by the instrument!

The IR sensor's calibration factor stays the same from one calibration to the next calibration.

However, with the EC sensor there is something to consider. The EC sensor's natural behavior is that its output's amplitude gets smaller over time. This can result in a very little drop in measurement readings. In order to compensate for this natural drift, there are two (one or the other) commonly used algorithms which compensate for this phenomenon:

- To allow a time based compensation in x% per month

Or

- A correction of the EC's calibration factor based on the IR's measuring result whenever the instrument performs a cal-check (accuracy test)

Please note that in either case, the EC's calibration factor will change slightly. In case you'd prefer NOT to perform anyone of these EC **aging compensations** (maintaining the same calibration factor from one to the next calibration) the instrument would have to be re-calibrated about every 6 months.

**Reg. Simulator temperature probe:**
R&D has finalized the algorithm which monitors the simulator temperature probe. We have now given the order to produce the probes for the simulator/9510 combination. In other words, I trust that we'll have a simulator temperature probe ready for your tests in approximately 2-3 weeks. This will require an update of the instruments configuration-file.

Please let me know should you have any questions about the above responses.

Thank you and best regards,

Hansueli Ryser

Vice President

Draeger Safety Diagnostics, Inc.
4040 Royal Lane, Suite 136
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**Vermont Department of Health**
**Public Health Laboratory**

# Breath and Blood Alcohol Analysis

A. Scope and Authority

In accordance with 23 V.S.A. Section 1203, the following are stated as requirements for performing and reporting results of breath and blood alcohol analyses.

B. Definitions

I. As used in this rule

1. "Alcohol" refers specifically to ethyl alcohol.

2. "Analysis" refers to the physical identification and quantification of alcohol within breath or blood samples.

3. "Method" refers to an analytical technique for performing chemical analyses. A method may require specific analytical instrumentation.

4. "Procedure" refers to the series of steps followed in the performance of analyses.

II. Severability

If any provision of any section of this rule or the application thereof to any firm, individual or circumstance is found by a court of competent jurisdiction to be illegal, invalid or void, the remainder of this rule shall be deemed unaffected and shall continue in full force and effect.

C. Methods for Alcohol Analysis

I. Breath Alcohol Analysis

Analyses shall be performed using the methods of gas chromatography or infrared spectrophotometry. In using either method the following specifications must be met:

1. Sampling equipment shall be capable of collecting a sample of expired alveolar air. When such sample is collected using a crimper device, it shall be stable for at least sixty (60) days and shall be of sufficient quantity as to make available a portion for independent analysis.

2. Analytical instrumentation shall be capable of analyzing replicate samples of breath containing a known amount of alcohol with a precision of plus or minus 5% from their mean when alcohol concentrations are reported to three significant figures.

3. Analytical instrumentation shall be capable of determining the blood or breath alcohol concentration of the person sampled with an accuracy of plus or minus 10%. The calculation of an equivalent blood alcohol concentration from the result of a breath alcohol analysis shall be based on a blood to breath alcohol concentration ratio of 2100:1.

4. Instrumentation shall be capable of determining the breath alcohol concentration of the person sampled within plus or minus 10% where the concentration is expressed as weight percent alcohol per 210 liters of expired air.

5. The analytical instrumentation shall be capable of detecting the presence of potentially interfering compounds which may be present in breath and which may otherwise interfere with accurate determination of an equivalent blood or breath alcohol concentration.

6. The analytical instrumentation and procedures used for analysis of breath alcohol content for evidentiary purposes shall be approved by the Commissioner of Health.

II. Blood Alcohol Analysis

Analyses shall be performed using the method of gas chromatography. The Following specifications must be met:

1. Samples shall be submitted in such a way as to provide two containers containing at least 5 ml of blood each. The sample containers shall include a suitable preservative which will render the alcohol concentration of the sample stable for at least sixty (60) days. The sample container shall provide a means to ensure sample security and shall be acceptable to the Vermont Department of Health Laboratory Director.

2. Analytical instrumentation shall be capable of analyzing duplicate portions of a blood sample with a precision of plus or minus 5% from their mean when alcohol concentrations are reported to three significant figures.

3. The instrumentation shall be capable of determining the alcohol concentration of a reference sample of known concentration with an accuracy of plus or minus 10%.

4. Analytical instrumentation and analytical procedures shall be approved by the Commissioner of Health and shall be capable of detecting the presence of potentially interfering compounds which may be present in blood and which may otherwise interfere with accurate determination of blood alcohol concentration.

III. Preliminary Alcohol Screening

Any preliminary alcohol screening device used by law enforcement officers in enforcing the provisions of Title 23 of the Vermont Statutes Annotated must conform to the National Highway Traffic Safety Administration (NHTSA) Model Specifications for Evidential Breath Testing Devices. [The latest specifications appear at 58 Federal Register 48705-48710.] The device used must be on the most recently published NHTSA Conforming Products List for instruments that meet such model specifications. [The latest list appears at 61 Federal Register 3078-3081.] All such instruments must be operated, maintained, and used in accordance with manufacturer specifications, recommendations, and instructions.

D. Collection and Security of Samples

I. Evidentiary Samples

1. Upon collection, shipping containers used for the submission of evidentiary Samples of breath or blood must be sealed and properly identified with, at minimum, the name of the tested subject and the date and time of collection. All seals shall be tamper-resistant. Samples shall be sent or delivered to the Vermont Department of Health Laboratory in a sealed condition, where, upon receipt, they shall be held in a limited access, secured storage area. Samples shall remain sealed until such time that they are opened by an analyst.

2. When in the custody of law enforcement personnel, all samples shall be kept in a secure area, until such time as they are sent or delivered to the Vermont Department of Health Laboratory.

III. Samples for Independent Analysis

1. Collection of blood samples for independent analyses require the use of kits provided by the Department of Health or use of kits appropriate for blood glucose analysis. These samples must be sent to the Department of Health Laboratory for storage until independent analysis is requested or the required storage time has been exceeded, unless they are to be analyzed at the facility in which they are drawn.

2. All samples for independent analysis shall be securely held by the Vermont Department of Health Laboratory. The Vermont Department of Health Laboratory, upon receipt of a written request from the tested subject or his/her attorney and payment of the handling fee, will send the requesting subject's sample to the independent laboratory of his/her choosing. The sample will be sent to the independent laboratory in a sealed condition.

**Vermont Department of Health**
**Public Health Laboratory**

# Breath and Blood Alcohol Analysis

A. Scope and Authority

In accordance with 23 V.S.A. Section 1203, the following are stated as requirements for performing and reporting results of breath and blood alcohol analyses.

B. Definitions

I. As used in this rule

1. "Alcohol" refers specifically to ethyl alcohol.

2. "Analysis" refers to the physical identification and quantification of alcohol within breath or blood samples.

3. "Method" refers to an analytical technique for performing chemical analyses. A method may require specific analytical instrumentation.

4. "Procedure" refers to the series of steps followed in the performance of analyses.

II. Severability

If any provision of any section of this rule or the application thereof to any firm, individual or circumstance is found by a court of competent jurisdiction to be illegal, invalid or void, the remainder of this rule shall be deemed unaffected and shall continue in full force and effect.

C. Methods for Alcohol Analysis

I. Breath Alcohol Analysis

Analyses shall be performed using the methods of gas chromatography or infrared spectrophotometry. In using either method the following specifications must be met:

1. Sampling equipment shall be capable of collecting a sample of expired alveolar air. When such sample is collected using a crimper device, it shall be stable for at least sixty (60) days and shall be of sufficient quantity as to make available a portion for independent analysis.

2. Analytical instrumentation shall be capable of analyzing replicate samples of breath containing a known amount of alcohol with a precision of plus or minus 5% from their mean when alcohol concentrations are reported to three significant figures.

3. Analytical instrumentation shall be capable of determining the blood or breath alcohol concentration of the person sampled with an accuracy of plus or minus 10%. The calculation of an equivalent blood alcohol concentration from the result of a breath alcohol analysis shall be based on a blood to breath alcohol concentration ratio of 2100:1.

4. Instrumentation shall be capable of determining the breath alcohol concentration of the person sampled within plus or minus 10% where the concentration is expressed as weight percent alcohol per 210 liters of expired air.

5. The analytical instrumentation shall be capable of detecting the presence of potentially interfering compounds which may be present in breath and which may otherwise interfere with accurate determination of an equivalent blood or breath alcohol concentration.

6. The analytical instrumentation and procedures used for analysis of breath alcohol content for evidentiary purposes shall be approved by the Commissioner of Health.

II. Blood Alcohol Analysis

Analyses shall be performed using the method of gas chromatography. The Following specifications must be met:

1. Samples shall be submitted in such a way as to provide two containers containing at least 5 ml of blood each. The sample containers shall include a suitable preservative which will render the alcohol concentration of the sample stable for at least sixty (60) days. The sample container shall provide a means to ensure sample security and shall be acceptable to the Vermont Department of Health Laboratory Director.

2. Analytical instrumentation shall be capable of analyzing duplicate portions of a blood sample with a precision of plus or minus 5% from their mean when alcohol concentrations are reported to three significant figures.

3. The instrumentation shall be capable of determining the alcohol concentration of a reference sample of known concentration with an accuracy of plus or minus 10%.

4. Analytical instrumentation and analytical procedures shall be approved by the Commissioner of Health and shall be capable of detecting the presence of potentially interfering compounds which may be present in blood and which may otherwise interfere with accurate determination of blood alcohol concentration.

III. Preliminary Alcohol Screening

Any preliminary alcohol screening device used by law enforcement officers in enforcing the provisions of Title 23 of the Vermont Statutes Annotated must conform to the National Highway Traffic Safety Administration (NHTSA) Model Specifications for Evidential Breath Testing Devices. [The latest specifications appear at 58 Federal Register 48705-48710.] The device used must be on the most recently published NHTSA Conforming Products List for instruments that meet such model specifications. [The latest list appears at 61 Federal Register 3078-3081.] All such instruments must be operated, maintained, and used in accordance with manufacturer specifications, recommendations, and instructions.

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OUTLINE OF TOXICOLOGY [ DataMaster] PROGRAM CONTRACT FOR SERVICES PROPOSAL

The services would be needed on a part – time [ 0.5 FTE] basis to support the DataMaster Service aspect of our program. The level of responsibilities would be consistent with a high level technician or chemist A, PG 17 ( ~ $13 / hr base ) Estimated compensation to cover base and overhead would be $20/hr. A non-bid contract for $9999 would fund approx. 25 weeks ( ~½ yr ). This would be a short term adjustment to program staffing needs. Such a contract would give us an opportunity to assess the level of support needed on an ongoing basis. If possible, perhaps the contract could be renewable or a longer term contract established through the bid process.

Requirements would include:

Valid driver's license and means of transportation to travel around the state;
Basic computer use skills;
Demonstrated basic math skills;
Basic electromechanical equipment adjustment and repair skills;
Demonstrated ability to read and apply detailed process instructions;
Demonstrated ability to keep accurate, detailed records of work performed;

Examples of duties and services to be provided are:

basic In-lab DataMaster (DM) mechanical and electronic adjustments
DM calibration
DM certification
DM on-site installation and testing
Basic DM field service adjustments and repairs
Perform DM preventive maintenance procedures
Perform on-site data download procedure
Provide support for DM Supervisor basic and refresher training courses
Provide technical support ( repetitive testing; data gathering ) for instrument performance test procedures
Perform printer conversions on older s/n instruments
Packaging and shipping of DM RPC and regular-use supplies
Help with DM file revision and maintenance

OUTLINE OF TOXICOLOGY [ Alcohol ] PROGRAM TEMPORARY STAFF POSITION PROPOSAL

It has been noted that there are times when our consultative/testimony resources are not available to State's Attorneys and others to help them decide when a dui case should go forward and to provide them with needed testimony for hearings and trials. Current resources include only one chemist with .95 FTE commitment to consultation, testimony in the courtroom, testimony by telephone, testimony by affidavit, retrieval and organization of records for response to discovery requests, and other associated activities. The remaining .05 FTE is assigned to blood alcohol analysis and support for the DataMaster service activities. The backup for technical consultation and testimony is currently provided by the Toxicology Program Chief. This work represents .20 -.25 FTE for that position. Requests for testimony and affidavits has increased somewhat over the past year while discovery requests have increased by about 75%. Many of these responses are labor intensive and legally sensitive. We are also experiencing an increasing number of requests for testimony which are time conflicts e.g. two hearings on the same day at opposite ends of the state; need for testimony in person in one court and telephone testimony in another court at the same time. It is proposed that to better meet these needs; lower the cost of this testimony to the State and to improve the turn-around time for discovery request responses in particular, we establish a 0.5 FTE temporary position to perform some of these duties. In order to gain knowledge and experience necessary to provide the type of testimony needed regarding breath alcohol testing the individual would also provide some support to the DataMaster service activities.

Qualifications and requirements include:

Meet Basic dept. of Personnel requirements qualifying for the Chemist B level
Valid driver's license and means of transportation to travel to all areas of the state
Basic computer skills
Knowledge of basic gas chromatography analytical techniques
Understanding of the principles of chemical and physical analysis
Knowledge of the physiologic aspects of alcohol and alcohol metabolism
Demonstrated ability to effectively express scientific principles and interpret scientific data to the lay public in a courtroom setting

# Alcohol Program Transfer Considerations

There are three major facets of the alcohol program as it exists in the Department of Health. If the program is to be managed in a similar way when transferred to the Department of Public Safety, the resources needed to continue the services as currently provided are expected to be roughly as they exist now. A description of most of the activities, functions and resources follows.

## Breath Alcohol Testing [ DataMaster (DM) ]

The functions required to maintain this aspect of the program include:

Establish criteria for breath testing instrument performance and operational characteristics;
Establish criteria for breath testing instrumentation placement, use and field maintenance;
Instrument receipt, evaluation, certification, installation, maintenance [ including annual preventive maintenance on all instruments in the field ] and repairs on an as-needed basis;
Maintain inventory of supplies, parts, tools and test equipment for uninterrupted instrument service;
Distribute DataMaster supplies to all law enforcement agencies which are breath test sites;
Preparation, characterization and distribution of alcohol solutions for reference standards;
Train law enforcement officers during dui certification course in the operation of the DataMaster; [ 3-4 times per year ]
Train select law enforcement officers as on-site DataMaster Supervisors who do periodic instrument performance testing and basic maintenance;
Create and maintain SOPs for all general processes;
Monitor instrument performance data and create summary reports;
Stay current with emerging issues re: breath testing equipment and advise department administration and others re: best equipment and strategies for VT, including attendance at the annual DataMaster User's Meeting;
Maintain complete and accurate file of all information regarding each individual breath test Instrument, reference solution used and written information regarding the type of instrument in use e.g. manufacturer's manuals, technical bulletins and correspondence.
Receive, store and ship blood alcohol specimens collected on the defendant's behalf as an independent check of breath testing done for the state
Acquire [ or prepare ] and distribute independent blood alcohol kits to law enforcement agencies and participating hospitals and clinics, to provide un-expired kits to all sites;

Resources needed for these tasks currently include one full-time electronics technician trained by the instrument manufacturer in maintenance and repair of the equipment in use, approximately 0.05 FTE of chemist time and oversight by the Program Chief; transportation for the technician on an as-needed basis; shipping and receiving staff for distribution of supplies to DM sites and blood collection kits; dedicated computer and software; laptop computer for field use; adequate shop and office space for the technician; an inventory of tools and test equipment for the technician.

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Transition recommendations for Dept. of Public Safety include creating adequate and appropriate space for this function; reviewing all aspects of this function and planning for any changes to how it is to be performed well before any physical transfer of responsibilities; identifying funding source(s) and a budget for maintaining the program; assigning a dedicated vehicle for the Technician's travel.

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## Blood Alcohol Testing

The functions required to maintain this aspect of the program include:

Acquire [ or prepare ] and distribute blood alcohol collection kits to all law enforcement agencies and participating hospitals and clinics;

Provide adequate refrigerated storage for blood specimens for one year or more;

Maintain supplies for sample preparation for headspace analysis;

Participate in at least one proficiency testing program;

Establish protocols for blood drug testing at reference laboratories.

Resources needed to maintain this process include at least two chemists trained in the analytical procedure, requiring about 0.2 FTE of their combined time; enrollment in a proficiency testing program; a source of blood collection kits and personnel for distribution of kits; dedicated headspace/ flame ionization detection gas chromatography system, chromatograph should have a chromatography software package that allows for complete data evaluation and data interaction tracking archive; supplies and equipment for sample preparation, quality control and biohazardous waste disposal.

Transition recommendations for Dept. of Public Safety include: training of at least one Public Safety chemist to perform blood alcohol testing and complete a demonstration of competency before the transfer of responsibilities; acquire a new set of blood alcohol kits with DPS lab address and distribute them as needed; identify or acquire a chromatography system and perform all QA test protocols before a transfer; create necessary SOPs and any other related documentation to be consistent with other DPS lab procedures.



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## Consultation and Testimony

The functions required to maintain this aspect of the program include:

Provide consultation re: breath and blood alcohol testing technology and issues and physiological aspects of alcohol intoxication, including retrograde extrapolation calculations and interpretation when provided with case specific information, for officers, prosecutors and defense attorneys;

Provide testimony for legal proceedings, both civil license suspension or criminal dui, in courts throughout the state either in person or by telephone;

Provide training in the operation of breath test equipment [ DM] at the Police Academy as part of officer dui certification course;

Provide training in all aspects of breath and blood testing and physiological aspects of alcohol intoxication to prosecutors and others

Prepare affidavits, both case specific and general, for use in dui prosecutions;

Prepare discovery response packages for distribution;

Maintain currency in the science and technology of blood and breath alcohol testing as well as physiological aspects of alcohol intoxication by reading the current scientific literature, participation in related professional organizations and continuing education programs;

Prepare and present technical papers at conferences; submit for publication

Provide technical and operational consultation to department administration, legislature, etc.

Resources needed to maintain these functions include: 1 FTE of chemist time having a general background in chemistry or biology and specific training in toxicology and blood alcohol physiology and pharmacology, specific training and experience in gas chromatography, specific training in breath test instrumentation principles and operation and training for providing expert testimony; additional trained chemist is recommended for backup availability for testimony; one vehicle for travel for testimony; funding for on-going training and attendance of related professional organization conferences; personal computer for creating legal documents; access to the internet for case-related research and an e-mail account; access to a printer and fax machine; at least one Notary Public available to notarize affidavits.



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## General Considerations and Some Recommendations

Clerical support is required for all aspects of the program:

Prepare and/or mail general program correspondence to law enforcement agencies, state's attorneys' offices, defense attorneys, etc.;
Receive and record subpoenas and other notices of legal proceedings, update 'court calendar' as needed;
Receive, record discovery and affidavit requests;
Distribute discovery response packages;
Notarize and distribute affidavits;
Distribute monthly packages of any new documents specific to each individual DM to State's Attorneys' offices;
Distribute blood alcohol test results to law enforcement officers and State's Attorneys' offices;
Maintain all files and contacts regarding independent blood alcohol samples received and shipped for analysis;
Prepare independent alcohol test kits and documentation for shipping to independent laboratories;

It is recommended that Public Safety identify a breath testing or alcohol program manager who will be assigned to the Dept. of Health for program orientation and training for roughly 1/3–time for no less than 6 months prior to transition of the program

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It can be expected that relocation of the program will cause, at least for a short time, greater scrutiny and challenge than is currently experienced by the health department. It is therefore important to provide adequate resources to do it well.

Two positions, a chemist and an electronics technician should be transferred to Public Safety with the program responsibilities.

## Additional Information for Perspective

The current workload includes about 250 evidentiary blood alcohol specimens per year; We are on track to prepare about 1,000 affidavits this year; we are anticipating that we will process about 125 discovery responses this year; we have recently been receiving on average 100 notices of hearing, trial or deposition per month in from one to four counties per day; – approximately 35 -45% of those require appearance ; approximately 500 independent blood alcohol kits are received with just over 50% of those being sent out to an independent laboratory.

There are 77 DataMaster instruments in the program with 67 of them deployed for evidential use, including 4 mobile vans.

Each evidential instrument is visited at least once per year by the technician for preventive maintenance.

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DUI certification training is provided 5 times per year; DM Supervisor training at least 4 times per year. It requires a minimum of 6 months of dedicated training to prepare a chemist for performing the tasks of the breath and blood alcohol program and for providing the basic aspects of expert testimony as relates to the program. It takes approximately one year to train for providing the full spectrum of expert testimony.

It has been a proposed project to begin replacement of older or less reliable DataMaster instruments for a number of years. That project will get underway in 2006. It is anticipated that instrumentation that will be purchased will be somewhat different from that currently in use. This will create some inconsistency within the state and will probably generate a flurry of new legal challenges as well as introduce new opportunities to streamline some of the program workload.

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Chief Joseph Anthony
Thetford Police Dept.
PO Box 126
Thetford Center, VT 05075-0126

Dear Chief Anthony:

We would like to acknowledge and applaud your recent request for a BAC DataMaster breath alcohol testing instrument to be installed in your facility. Placing additional resources in your area for access by members of various agencies would be a welcome addition. We also want to commend you on your initiative to take the DataMaster Supervisor's course in preparation for having an instrument placed with you. I have shared your request with the Governor's Highway Safety Program and our administration. The program does not have any available instruments to place in new sites at this time. We are hoping to get some level of minimal funding to allow the purchase of a few new instruments in the near future. When the funding becomes available we expect to be able to accommodate your request.

Thanks for your continued interest in developing additional resources for improving dui intervention activities. We look forward to working cooperatively with you on this matter.

Cordially Yours,

Robert Drawbaugh, Chief
Toxicology Program

DataMaster RECORD PLACEMENT REVIEW

Instrument –specific records currently kept on site:

1. Instrument operator's use log
2. maintenance log
3. individual officer's use log
4. original routine performance check worksheets

Instrument-specific records currently kept at VDHL

1. any original receipt documentation
2. all lab certification records – worksheets and tickets
3. any special or general service documentation e.g. ROM change or refurbish
4. all service records which require adjustment, replacement of parts, re-certification, etc.
5. copies of reviewed Routine Performance Check worksheets and tickets
6. installation worksheets
7. any instrument-specific record that reflects on performance or describes site issues, changes or concerns

Non-instrument-specific/ instrument-related records currently kept at VDHL

1. simulator solution records
2. simulator service records

Instrument-specific records that could be transferred to or retained at the DM use sites:

1. any field service record generated by either the DataMaster Supervisor or by VDHL staff
2. installation worksheets
3. Routine performance check worksheets

Potential impact of relocating records [ source of info. for discovery ]:

1. delay in receipt of info requested in discovery
2. reduction of number of records to file and store
3. reduction of number of records to copy for discovery request response

In the next few months, the Vermont Department of Health Laboratory (VDHL) will begin replacement of some of the current BAC DataMaster instruments used in the field. Implementation of the new evidentiary breath testing devices (i.e. DataMaster DMT) will begin in Franklin county. The DataMaster DMT will replace the BAC DataMasters in all current locations in Franklin county as well as adding an instrument at the Sheriff's Office.

The DMT model is the latest breath testing device released from National Patent Analytical Systems (NPAS) Inc in Mansfield, Ohio. Fundamentally the DMT is much like the current BAC DataMaster. It continues to use infrared technology in the identification and quantitation of ethanol in a breath sample and continues to meet the current rules and regulations in regard to breath and blood alcohol analysis.

Visually the instrument is smaller and more compact. It has a large full color touch screen and operates on a Windows based platform. It uses an external inkjet printer to produce f an 8"x11" Breath Analysis Report for each case as well as other reports of results of maintenance and testing.

The VDHL Toxicology program has been working in conjunction with the manufacturer to develop an instrument that will meet the needs of our state as well as to address some of the most common challenges met in the courtroom. The custom software addresses many common issues such as ensuring an adequate observation period. With it's built in timer only allowing a breath test to be taken after 15 minutes time has elapsed, discussions regarding which time piece was used will be minimalized. Additionally, the software will allow officers to provide more information as to why an observation period may have been restarted or why a test was considered a refusal. This information will be printed on the Breath Analysis Report and will help provide a more complete picture of the testing as it occurred. These features will provide a broader picture of the processing, produced in a neat and complete package.

The most striking feature of the software is the visual display of breath flow and alcohol concentration which will print on each breath analysis report. This graphic, which is recorded in real time, will help explain potential differences between two breath tests of the same subject and provide objective data on whether a subject was trying to provide an adequate breath sample.

Each instrument has been subjected to rigorous in-house testing to ensure an accurate and reliable instrument. The testing documentation for each instrument installed will be provided to the State's Attorney Office for review and discovery. This will encompass all testing that was performed on the instrument prior to installation.

We are optimistic for a smooth transition and will be working closely with all those involved to ensure that officers and attorneys will have sufficient training to effectively use the instruments and the test result they produce.

Evaluating Alcohol Concentrations in DUI Cases

The ideal in any DUI would be to have the evidential breath test occurring right at roadside. Unfortunately this does not occur. If a substantial amount of time elapses between the time of operation and the time of the test., typically greater than two hours, the test result needs to be interpreted to account for the amount of alcohol eliminated

When dealing with a DUI in which no alcohol was consumed in the 30 minutes prior to operation, only that alcohol which would have been eliminated between the time of operation and the time of the test needs to be accounted for. This is termed retrograde extrapolation, otherwise known as relation back. A conservative rate of 0.015g/210L of alcohol eliminated per hour is used as standard practice in these calculations. The literature indicates that the average population eliminates alcohol between 0.018-0.022 per hour. The use of 0.015 per hour helps ensure that the resulting estimate errs low (on the side of the defendant). This is because the amount of alcohol eliminated will be added back to the test result so the higher the elimination rate, the higher the related back value and *vice versa.* A simple estimate may be performed by multiplying the number of hours elapsed by 0.015 per hour and adding it to the test result.

When determining the alcohol concentration at the time of operation it is important to know as much as possible about the individual's drinking pattern. Of particular interest is the time of the last drink. If a drink is consumed at the time of operation or just prior to operation, some or all of that alcohol will be unabsorbed at the time of operation. This alcohol will continue to be absorbed after operation and may be reflected in the breath test result even though it may not have been affecting the individual at the time of operation.

To understand the impact of this last drink the chemist will use a calculation utilizing the Widmark equation. This equation, named after one of the first alcohol researchers, calculates the potential rise in BAC/BrAC in an individual based on the volume and type of alcohol consumed and the individual's gender and weight. This is commonly used and well accepted within the scientific community. This is the only non-experimental way of determining a meaningful estimate of the impact of a drink on an individual's BAC/BrAC.

Although many organizations have attempted to provide wheels or charts to determine the impact of a drink on a person's BAC, these all tend to fall

short due to their overgeneralization. We have reviewed the calculator on www.1800duilaws.com and have found it to be as flawed as the wheels and charts commonly available. It is important to note that not only do the calculations per individual return as underestimates, the alcohol concentrations listed on this site as "average" for wine, beer or liquor are incorrect and do not reflect the actual concentrations found in commercially available alcoholic beverages. Use of the information from this website could be misleading to an individual attempting to determine the affect of a number of drinks on their BAC/BrAC.

Once the maximum contribution of the drink is calculated using the Widmark equation the chemist will consider the timing and rate of consumption of this beverage to determine what if any alcohol concentration should be subtracted from the retrograde estimate. It is common for "defense experts" to subtract the full amount of any alcohol consumed within 30 minutes of operation. They may explain this by stating that none of it would be absorbed or that since they cannot accurately determine what part would be absorbed they will disregard all of it. There is a vast amount of literature which indicate that the bulk of a drink is absorbed very rapidly with the remaining smaller percentage taking the rest of the time to absorb. Absorption and elimination of alcohol occur simultaneously and begin immediately after consumption. For these reasons it is not reasonable to assume that none of the alcohol consumed within 30 minutes would be absorbed at the time of operation. These calculations need to be performed on a case by case basis as the times and rates of consumption are individual. For example, a shot consumed just prior to operating a vehicle would have a very different impact at the time of operation than a glass of wine finished 29 minutes prior to operation.

In conclusion, when dealing with a DUI in which no alcohol was consumed in the 30 minutes prior to operation, only that alcohol which would have been eliminated between the time of operation and the time of the test needs to be accounted for. When a drink is consumed within 30 minutes of operation, a chemist will be needed to perform a calculation using the Widmark equation. Due to the complexity of these estimates, a chemist should be consulted to evaluate the information available. The chemist can and should be asked for the scientific basis on any adjustment they have made to a simple retrograde extrapolation. The chemist should also clearly articulate the assumptions upon which their conclusions are based.