Minnesota Department of Public Safety
Bureau of Criminal Apprehension

Forensic Science Service

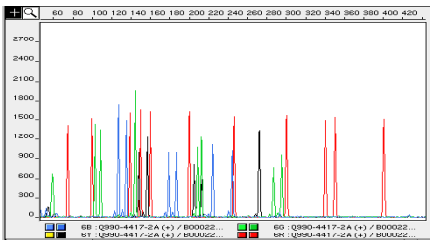
St. Paul Forensic Science Laboratory
Bemidji Forensic Science Laboratory

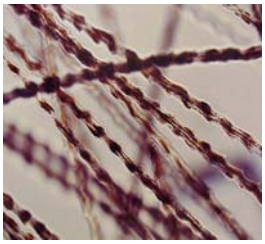
2005 Annual Report

MINNESOTA BCA FORENSIC SCIENCE SERVICE
2005 ANNUAL REPORT

TABLE OF CONTENTS

Message from the Director	2
General Laboratory Information	5
Biology/DNA	7
Breath Testing	11
Crime Scene Response	13
Drug Chemistry	14
Firearms and Toolmarks	16
Questioned Documents	17
Latent Prints	19
Support Services	21
Toxicology	23
Trace Evidence (Chemical Testing)	24
Trace Evidence (Microscopy)	25
Bemidji Forensic Laboratory	27





Message from the Director

☑ Forensic Science Service Mission, Vision and Values

- *Mission Statement:* "The BCA Forensic Science Service provides quality forensic science services for the Criminal Justice community and fosters partnerships that promote research, education and overall forensic science laboratory improvement."
- *Vision:* *"Seeking truth through science."*
- *Values:* *"Science is Neutral"*, "Honesty and Integrity", "Laboratory Excellence", "Accountability"

☑ Quality:

Our commitment to Quality is demonstrated through our Quality Assurance Program. The laboratory system Quality Manager is Debra Springer; she can be contacted at 615-793-2895 or debra.a.springer@state.mn.us

Both the St. Paul and Bemidji Laboratories are accredited under the ASCLD/LAB Legacy Program. Visit: http://www.ascld-lab.org/ for more information.

☑ Turn around time:

Section	section cases	Ave. TAT in days
Trace (glass, fibers etc.)	192	146.13
Drugs	5314	98.86
Questioned Documents	105	89.07
Nuclear DNA	1832	65.83
Latent Prints	1305	60.01
Mito-DNA	21	48.33
Crime Scene Team	78	46.32
Firearms/Toolmarks	924	40.58
Chemical Testing (arson)	175	31.12
Toxicology	2551	30.89
Mito-Trace (hairs)	6	12.00
Alcohol	6453	7.57

Our stated goal is a 30 day turn around time on all cases. The average turn around time doesn't tell the entire story. For example over 90% of alcohol cases are completed in two weeks. With DNA cases 8% are completed in less than 7 days, with 26% completed in less

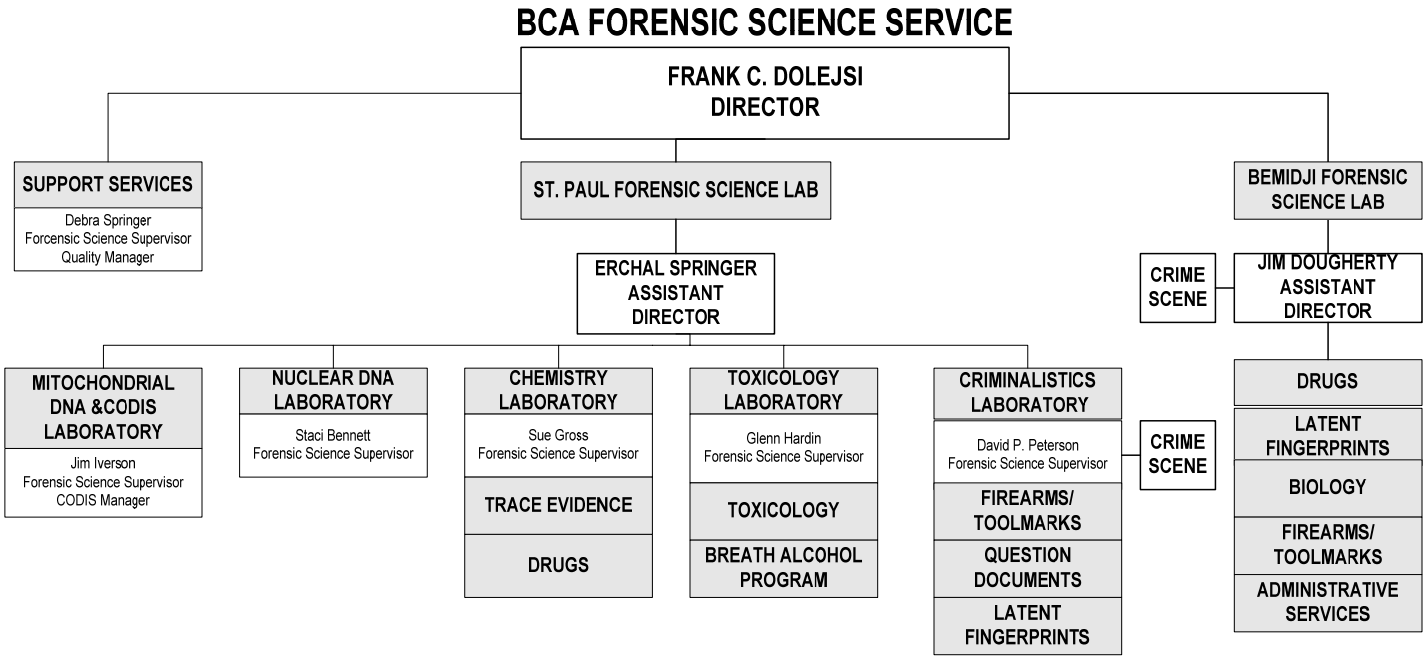
than 30 days. The bottom line is that we do work with our clients in high profile cases to meet their special needs. The following is a performance turn around time report for DNA:

Time	cases	within	thru
0 to 7 days	151	8%	8%
8 to 14 days	101	6%	14%
15 to 30 days	225	12%	26%
31 to 60 days	484	26%	52%
61 to 90 days	417	23%	75%
91 to 120 days	271	15%	90%
121 to 150 days	86	5%	95%
151 to 180 days	43	2%	97%
Over 180 days	54	3%	100%

☑ Outputs vs. Outcomes:

The BCA Forensic Science Laboratories examined over 13,000 cases in 2005 and there were 150 cases linked through the CODIS. During 2006 we will be looking at the work we do for our clients and evaluating if positive findings led to the charging and adjudication of the crime under which the evidence was purportedly submitted. This is being done so we can focus our services to provide more timely results. In addition, the BCA will be sending out client surveys in 2006 and your response and suggestions are greatly appreciated.

☑ Organization and contacts:



Contact Information:

Frank Dolejsi	651-793-1008	frank.dolejsi@state.mn.us
Erchal Springer	651-793-2914	erchal.springer@state.mn.us
Jim Dougherty	218-755-4723	jim.dougherty@state.mn.us
Jim Iverson	651-793-2970	jim.iverso@state.mn.us
Staci Bennett	651-793-2980	staci.bennett@state.mn.us
Sue Gross	651-793-2874	sue.t.gross@state.mn.us
Glenn Hardin	651-793-2751	glenn.hardin@state.mn.us
Dave Peterson	651-793-2969	david.p.peterson@state.mn.us

St. Paul 651-793-2900
Bemidji 218 -755-3826
bca.lab@state.mn.us

Frank C. Dolejsi, Director

General Laboratory Information

The BCA Forensic Science Service Laboratories provide identification and comparisons of physical evidence for law enforcement agencies in Minnesota. Staff scientists within various scientific disciplines prepare written reports and provide expert testimony to the courts on the findings and interpretation of their examinations. In conjunction with the BCA Training Unit, the scientists in the Laboratory provide specialized training to law enforcement agencies. The Laboratory Crime Scene Service is available to process crime scenes for physical evidence in death investigations.

CASES RECEIVED	1998	1999	2000	2001	2002	2003	2004	2005
Homicide & Attempted Homicide	105	122	97	95	103	71	107	115
Death Investigation	261	207	172	156	188	180	182	170
Controlled Substance	2,615	2,639	3,124	3,441	3,326	3,432	3,905	4,295
Criminal Sexual Conduct	510	514	506	551	689	718	695	735
Burglary/Robbery	526	441	479	337	455	612	570	776
Fire Investigation	140	185	166	132	178	159	164	151
Fraud/Forgery	130	152	124	78	87	94	84	96
DWI	8,147	7,702	7,466	5,633	5,200	5,168	5,029	5,257
All Other Criminal	956	1,073	1,314	1,365	1,553	1,565	1,747	2,293
Proficiency Testing	84	78	69	80	77	80	81	79
TOTALS	13,474	13,113	13,517	11,866	11,856	12,079	12,564	13,967

Specific scientific expertise is provided in the Laboratory sections. The following describes the types of examinations that can be done in each section:

- BIOLOGY/DNA

  The Biology scientists conduct several types of serological examinations on evidentiary materials, including the identification of blood, semen, saliva, and other body fluids. DNA testing is then performed in order to determine possible sources of the body fluids identified. This involves comparing the DNA types obtained from the questioned stains with the DNA types obtained from known blood and/or saliva samples from victims and suspects. Bloodspatter interpretation on clothing and at crime scenes can also be requested.

  DNA profiles of convicted felons are developed and stored in a DNA computer database. DNA profiles developed from evidence in criminal cases are also entered into the database. Searches are made to compare casework DNA profiles with other casework profiles as well as with the offender profiles.

- BREATH TESTING

  The Breath Testing section trains law enforcement personnel in breath-alcohol testing procedures, and evaluates and maintains breath-alcohol testing instruments.

- CRIME SCENE RESPONSE

  The Laboratory's Crime Scene Response Teams provide on-site death investigation crime scene processing services to all Minnesota law enforcement agencies.

- DRUG CHEMISTRY

  The Drug Chemistry scientists analyze and identify suspected controlled substances. This includes clandestinely manufactured products as well as legitimately manufactured pharmaceutical products. The scientists also identify controlled substances found in various psychoactive plant materials.

- FIREARMS AND TOOLMARKS

  The Firearms and Toolmarks section conducts many types of firearms examinations: whether a questioned bullet or cartridge case was fired from a suspect firearm; the caliber and type of firearm possibly used to produce fired bullets and cartridge cases when no firearm has yet been recovered; the proximity of the firearm to the target material; whether a firearm is functional; and whether submitted ammunition is a commercial load or reload. The section also maintains a NIBIN database which links firearms evidence from different crime scenes.

  The section also works with toolmarks to determine whether an evidentiary toolmark matches a recovered tool, the type of tool that may have been used to produce a toolmark, and whether a lock is in working order or how it may have been compromised. Serial number restorations on various item types are also performed.

- LATENT PRINTS

  The Latent Print section compares unknown latent prints with elimination and suspect prints for identification purposes, uses the Midwest Automated Fingerprint Identification Network (MAFIN) and Automated Fingerprint Identification System (AFIS) to find a source for unknown latent prints, and develops latent prints for agencies that lack the necessary facilities.

- SUPPORT SERVICES

  The Support Services Section provides support to all Forensic Science Service sections in the areas of Quality Assurance, Safety & Training, Laboratory Information Management System (LIMS), Evidence Handling, Administrative Services and Photography.

- QUESTIONED DOCUMENTS

  The Questioned Documents section offers examination services in the areas of signature, handwriting, and hand printing comparisons; typewriter comparisons; indented writing; inks; papers; mechanical impressions; photocopier comparisons; alterations and obliterations; reconstruction of documents that have been burned or otherwise damaged; and the identification of counterfeit documents.

- TOXICOLOGY

  The Toxicology section analyzes blood, urine, and other biological samples for alcohol and other drugs.

- TRACE EVIDENCE

  The Trace Evidence section makes comparisons to determine if there is a similarity between known and unknown samples of glass, paint, fibers, wood, soil, and other materials. Other examinations include the comparisons of shoeprints and tire tracks, as well as physical matches of broken or torn objects.

  Chemical testing examinations determine the presence of accelerants in fire debris.

Biology/DNA

Nuclear DNA Section

2005 was another busy year for the Biology Section at the BCA Laboratory. DNA analysis continues to be a significant tool in the investigation of many crimes. As a result, the Laboratory has had the opportunity to expand in many areas. The use of our databases has continued to prove invaluable with 150 investigations being aided through database hits in 2005. This brings the total investigations aided to 415 since the databases were started 15 years ago.

As a whole, over 1500 reports were issued by the Biology Section in 2005. This output was in no doubt aided by all of our scientist's devotion and diligence to casework. All four nuclear DNA scientists hired in 2004 completed their training in 2005 and have been working hard with the other scientists to tackle the case backlog. Two retired scientists

graciously continue to work at the laboratory aiding in serology casework. Additionally, a new nuclear DNA scientist was hired to work at the Bemidji Biology Laboratory. Training is underway and we are expecting the new scientist to be online by Summer 2006. The nuclear DNA section is striving to work at full capacity. With continued hard work and dedication, our goal is to eliminate the backlog in 2006.

Joe Cooksley examines evidence.

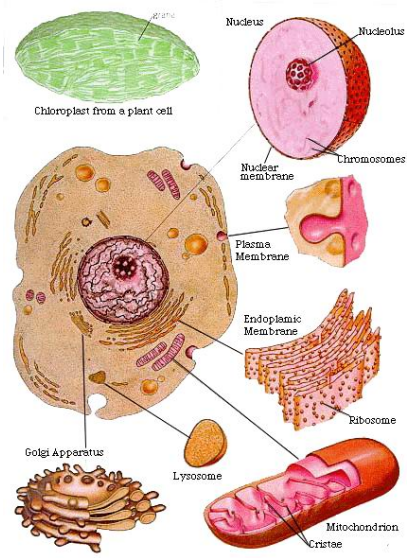
As always, interns and student workers continue to provide us with indispensable help, particularly in the area of research. In October 2005, one of our student workers presented the results of her research project on the Differex method of DNA extraction at the annual Midwestern Association of Forensic Scientists meeting in St. Louis. Other projects include establishing a lower limit for Quantifiler and contamination control. We look forward to employ new and eager students throughout 2006.

All of the scientists in the Biology Section look forward to the challenges of 2006. With the popularity of crime fighting on television, our field of forensics is always in the limelight. While not everything seen on TV is possible, updates in our analysis software and statistical programs will allow us to work more efficiently. As a team we will continue to investigate new technologies and be determined to provide the best DNA services available.

Ron Enzenauer examines a slide for sperm.

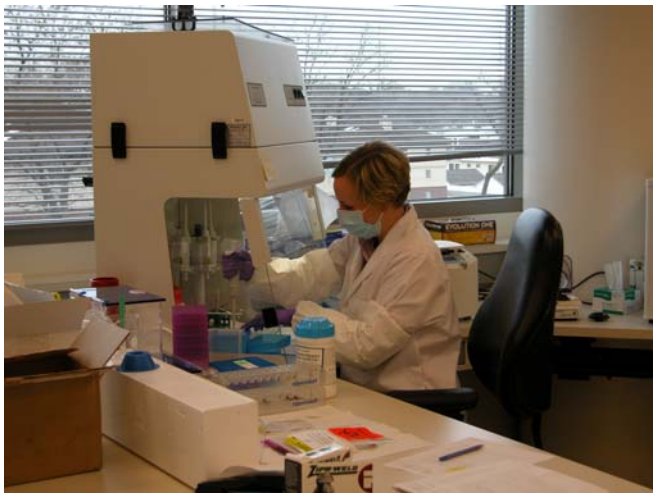
Mitochondrial DNA Section

In 2005, the BCA Lab opened a DNA laboratory dedicated to the testing of mitochondrial DNA (mtDNA). In cooperation with the FBI, the BCA became a partner in the Regional Mitochondrial DNA Testing Program. This program has established four laboratories around the country in order to increase the opportunities for law enforcement agencies to submit criminal cases for free mtDNA analyses.



MtDNA is found in great numbers in every cell of the body. Mitochondria are cellular organelles that are responsible for energy production; mitochondria produce the energy that allows cells to perform the functions necessary to sustain life. Due to the relatively large quantity of mtDNA in each cell, forensic scientists can perform testing on samples that do not contain sufficient nuclear DNA (nDNA) to utilize traditional DNA testing methods. While mtDNA testing does not provide nearly the discriminating power of nDNA, it is a true statement to say that "some information is better than none". For this reason, mtDNA is often referred to as the 'DNA of last resort'.

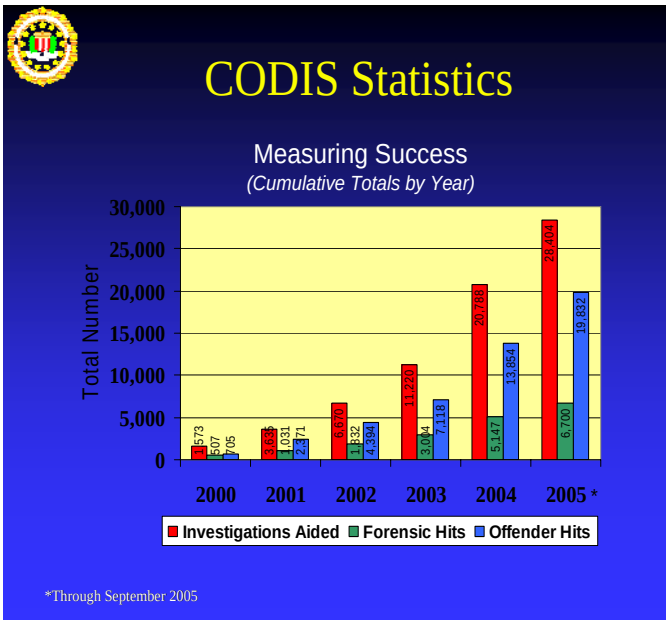
The BCA accepts mtDNA cases from law enforcement agencies around the country. Non-Minnesota agencies are asked to contact the FBI (Alice Isenberg, Program Manager, 703-632-7572) to see if their case will be accepted for analysis. Minnesota agencies should contact Jim Iverson at the BCA Lab (651-793-2970) for more information. As a general rule, cases are accepted for mtDNA testing if other DNA testing options have been exhausted or are unavailable. Scientific staff at the BCA Lab are eager to assist in evaluating genetic testing options in order to optimize the amount of information obtained from forensic evidence.



Julia Adams extracts Mitochondrial DNA.

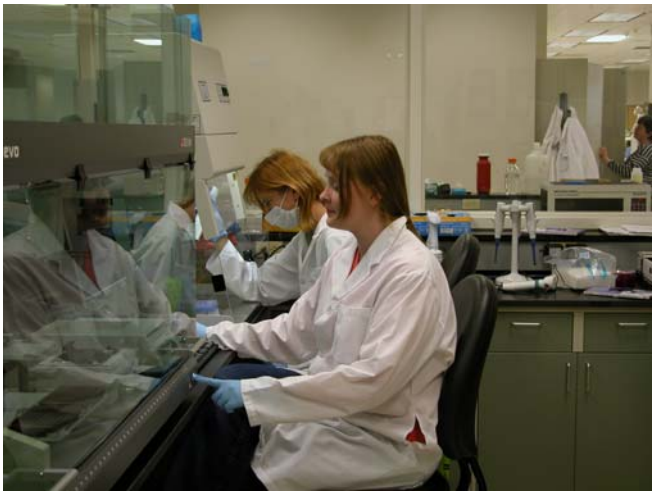
Offender DNA Database Section

In 2005, the BCA Lab was able to assist 150 criminal investigations using information obtained from the Combined DNA Index System (CODIS). The BCA has been profiling DNA collected from convicted offenders since 1990. Over the years, legislation has been passed requiring DNA profiling of offenders convicted of a wide range of crimes. In 2002, a law was enacted requiring DNA testing of all people convicted of a felony. In 2005, the 'all felons' law was made permanent and it has also required that persons arrested for violent crimes also provide DNA for testing (having first appeared in front of a judge and probable cause is determined). It has become very apparent that with the addition of more DNA profiles to the database, more unsolved crimes are being solved.



The 2005 legislature also was responsible for funding the analysis of offender/arrestee samples. Up until now, the BCA was able to utilize Federal funding in order to send samples to private vendors for analysis. While the use of this funding was a necessary step, delays inherent in the system caused a large back-log of unanalyzed samples. With State funding, the BCA has begun to hire and train scientists in order to attack the back-log. It is anticipated that the BCA will be current with all samples received by the summer of 2006. The goal of the CODIS unit is that all samples will be analyzed and placed into the database within thirty days of receipt.

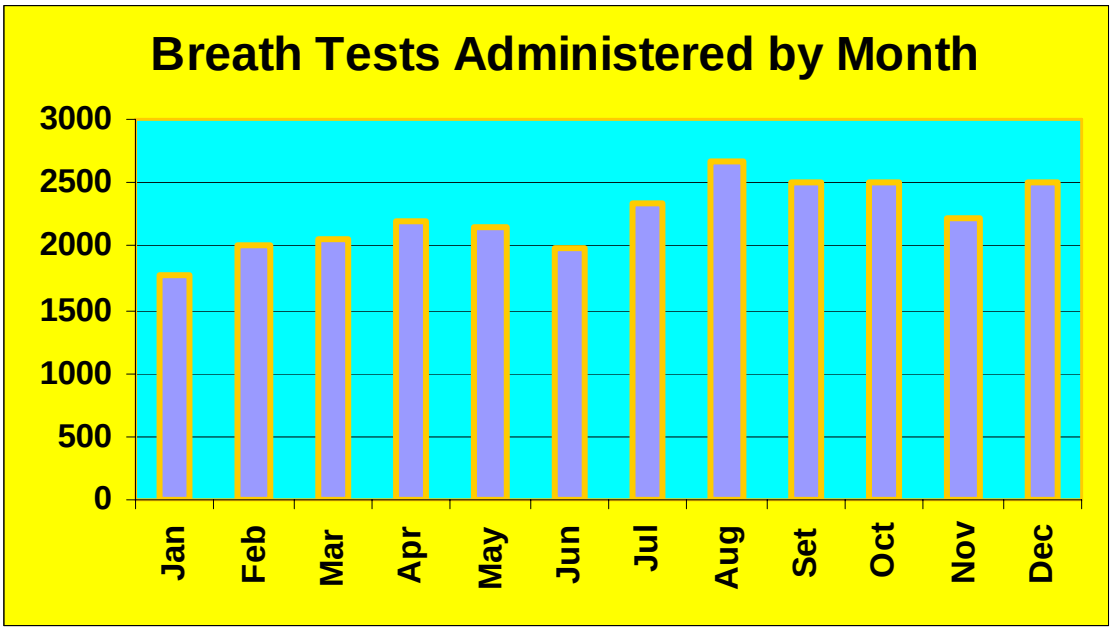
The CODIS program is a vital component of the DNA testing program of the BCA Lab. More and more crimes are being solved due to the use of this powerful tool.



Marlijn Hoogendoom and Andrea Torgerson process convicted offender samples.

Breath Testing

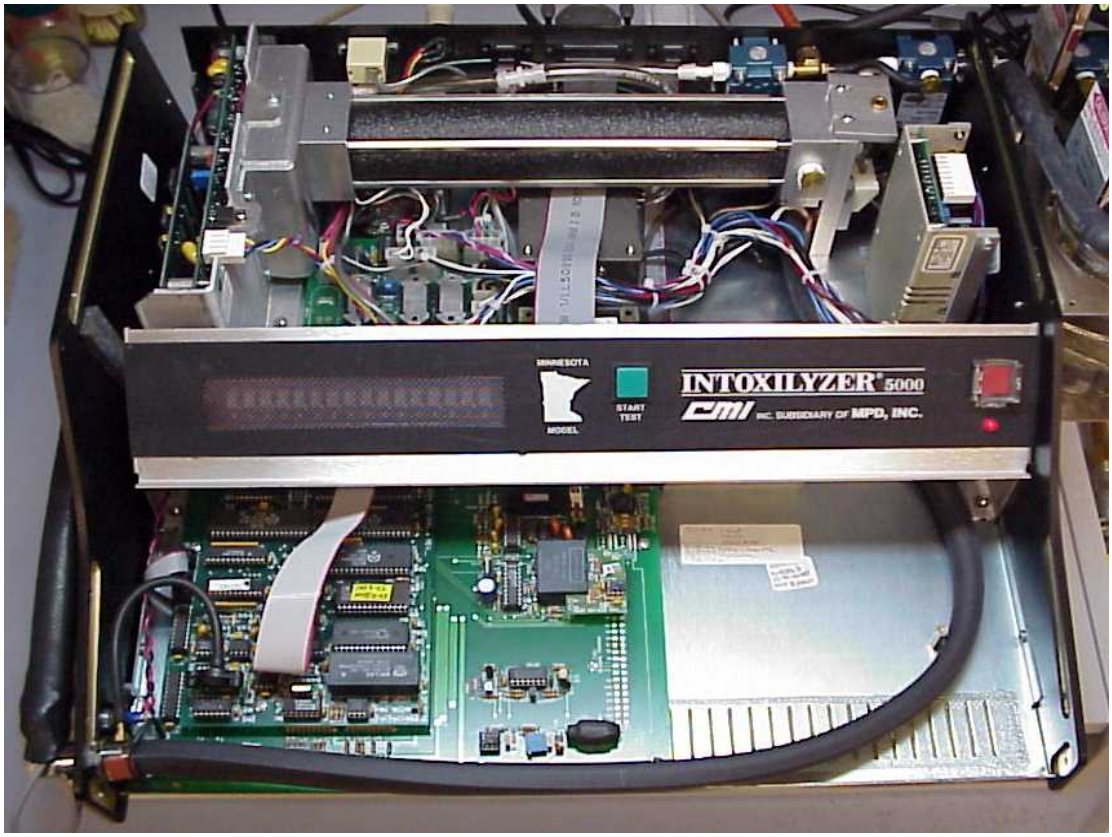
During 2005, breath test operators completed 26,927 evidentiary breath-alcohol tests using 199 Intoxilyzer 5000EN instruments located throughout Minnesota. August had the greatest number of tests with 2,678 and January had the fewest with 1,773. The average monthly number of breath tests administered was 2,344 in 2005.



Last year, after months of effort, new operating software was installed in the Intoxilyzer 5000EN. The first part of the process included evaluating and validating the software with extensive testing under a variety of conditions. After completion of the validation testing, a new rule was proposed for adoption, including a 30-day period for interested parties to offer comments on the new rule. As happened the last two times new rules governing chemical tests for intoxication were adopted, no comments were received. After the 30-day comment period elapsed, the proposed rule was submitted to the Office of Administrative Hearings for review by an Administrative Law Judge. After the rule approving the new software was adopted, the breath testing staff then spent several weeks traveling throughout Minnesota, replacing the chips containing the old operating software with chips containing the new operating software in every Intoxilyzer 5000EN instrument in Minnesota.

Also during 2004 the Breath Testing Section received 565 requests to provide expert testimony in court, and in 34 of those cases expert testimony was presented. Education continued to be a major focus of the Breath Testing Section. In the past year 291 new Intoxilyzer operators were certified and 1766 experienced operators were recertified. The Minnesota Supreme Court invited us to provide training on *Alcohol and the Intoxilyzer* to newly appointed judges as part of the week-long New Judges Orientation program as well as for experienced judges as part of the Judicial Conference.

We invested in our own continuing education as well by sending staff to annual meetings of the International Association for Chemical Testing and the Intoxilyzer User's Group.

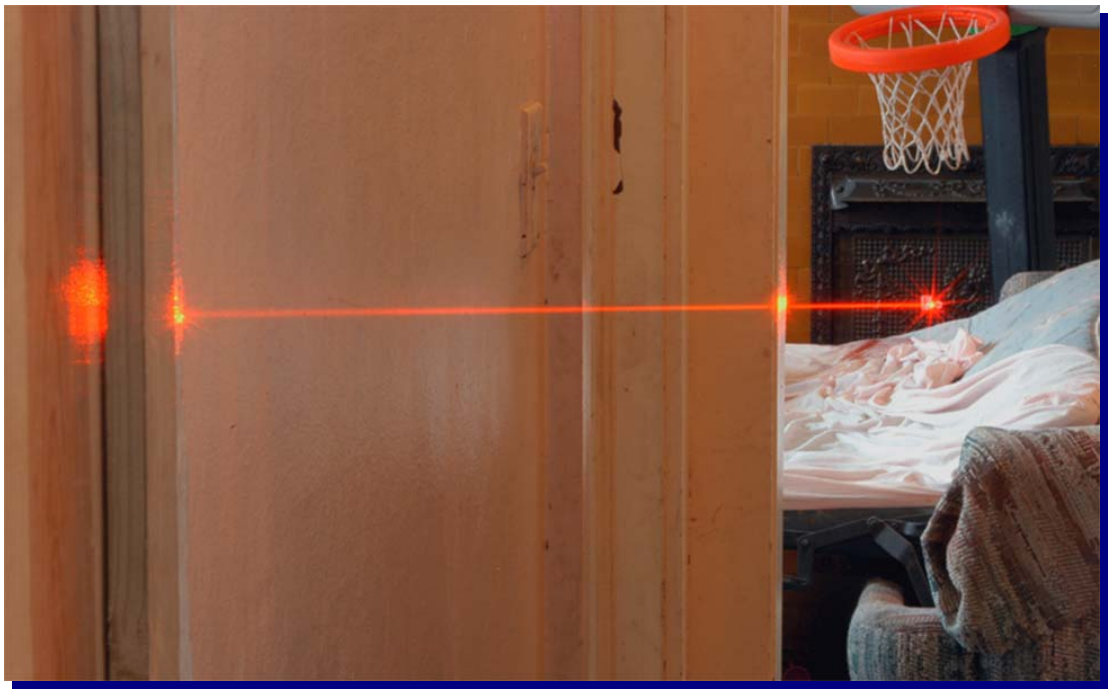


Inside an Intoxilyzer 5000EN Breath Testing Instrument

The BCA Laboratory website (www.dps.state.mn.us/bca) includes access to the list of Approved Preliminary Breath Testers (PBTs) and Evidentiary Breath Testing Instruments, the Intoxilyzer 5000EN operator training class schedules, class descriptions and registration form, and locations of all the Intoxilyzer 5000EN instruments in Minnesota and where to find a replacement unit. Please let us know if there is any additional information you would like to see on the website.

BCA Crime Scene Team

Trajectory of a Bullet Through a Crime Scene



The BCA Crime Scene Program successfully passed accreditation and is now certified by the American Society of Crime Lab Directors / Laboratory Accreditation Board. This was accomplished through the hard work and dedication of the forensic scientists.

The BCA Forensic Science Laboratory Crime Scene Team responded to eighty-six requests for crime scene assistance in the year 2005. Of these, there were fourteen homicides, three attempted homicides, one kidnapping, forty-five death investigations, nine officer-involved shootings, two hit and runs, five assaults, three criminal sexual assaults, one criminal vehicular operation, one missing person, one suicide and one attempted suicide cases. Twenty-seven vehicles were processed for forensic evidence.

In addition to responding to requests for assistance in processing crime scenes, continuing training and education was provided to crime scene team members. This is critical to the successful operation of the crime scene program to improve and verify the scientist's ability to identify, enhance, collect, package and document forensic evidence encountered at the scene of a crime. Team members were tested on their ability to produce sketches using an electronic measuring device, cast footwear impressions, and critically review field notes. Thirty forensic scientists assigned to the Crime Scene Team, twenty-two from St Paul and eight from Bemidji, successfully passed these tests.

In addition, Crime Scene Team Leaders received competency training in blood spatter analysis utilizing a mock crime scene.

In March of 2005, in the aftermath of the alarming shootings, the BCA Crime Scene Team from the Bemidji Regional Office was asked to assist the FBI in processing the Red Lake High School. It was a team effort from the start. Security was provided by officers from various law enforcement agencies throughout northern Minnesota and North Dakota. The BCA Crime Scene Team worked along with two FBI crime scene processing teams over a three day period covering the entire school. The school was divided into several "mini" scenes and each team was assigned a number of sections. Although each team worked independently in their assigned sections, they also assisted each other and coordinated their efforts to assure that the entire scene was processed in a consistent manner.

The overall response to this incident was an example of how team work and cooperation between several agencies can work to get an overwhelming task completed professionally and in a timely manner.

In 2006 the crime scene team will continue to maintain and enhance its abilities through rigorous training and testing. The team will maintain its goals of providing high quality services to law enforcement agencies throughout Minnesota.

Drug Chemistry

The Drug Chemistry section is composed of eleven scientists; eight located in Saint Paul and three in Bemidji. The primary responsibility of the Drug Chemistry section is to analyze items of evidence for the presence of controlled substances. The items of evidence are usually submitted as powders, rock-like material, drug paraphernalia, plant material, tablets and/or capsules (clandestinely or legitimately manufactured), and liquids.

The Saint Paul Drug Chemistry section received 3,229 cases in 2005, which was a slight increase from the 3,115 in 2004. The section was able to make a significant impact in the backlog by reporting out 3,816 cases—over 1,000 more cases then the previous year. The Bemidji Drug Chemistry section also noticed a slight increase in their case submissions from 1,003 in 2004 to 1,211 cases received in 2005. Additionally, Bemidji observed a positive impact on their case backlog with the section reporting 1,497 cases—over 600 more then the previous year.

Methamphetamine continued to be the most prominent controlled substance reported at both locations. Of the 5,803 items submitted for analysis in Saint Paul, 3,214 items were reported as containing methamphetamine. Of the 2,484 items submitted for analysis in Bemidji, 1,438 items were reported as containing methamphetamine. Cocaine was once again the second most reported controlled substance at 21.2% in Saint Paul and 15.2% in Bemidji. Simply stated, 75% of the caseload for both Saint Paul and Bemidji is methamphetamine and cocaine.

Due to the staggering number of items reported as methamphetamine and cocaine, a pilot study of reporting preliminary results on methamphetamine and cocaine was proposed to further alleviate the section backlog. The Saint Paul Drug Chemistry section and Stearns County partnered in a pilot study focused on reducing the section's backlog. The idea behind the partnership is to provide prosecutors with preliminary identification and weight within two weeks of the submittal date. If the case is scheduled for court, then further confirmatory analyses will be performed. If preliminary examinations do not reveal the presence of either methamphetamine or cocaine, confirmatory analysis will be done. A similar study is being conducted with the Bemidji section and Itasca County. If the studies are found to be successful, the sections could expand this to other counties.

Khat cases only make up a small percentage of our caseload, however, this year we saw Khat being submitted differently then in years past. This year, a handful of Khat cases were submitted not as the characteristic fresh bundle of leaves, twigs and shoots, but rather in the form of ground up dry leaves. The dried plant material, known as Graba, can be ground to make tea or a chewable paste. Khat (Catha edulis) is a 10 to 20 foot flowering evergreen shrub primarily grown in East Africa and the Arabian Peninsula. It contains a number of chemicals, two of which are controlled substances: Cathinone (Schedule I) and Cathine (Schedule IV). The Saint Paul laboratory reported out nine items as containing cathinone and/or cathine and Bemidji had one.

Picture 1: Bundles of Khat wrapped in banana leaves.

Picture 2: Ground-up dried Khat --"Graba".

Drug Chemistry's primary goal for 2006 will be to continue making strides towards prompt turn around times. The section understands how important timely results are for the investigation and prosecution of controlled substances. Saint Paul continues to have part-time help from a retired BCA scientist and has acquired more instrumentation. Bemidji's new scientist begin issuing reports this fall. With all of this said, the section is hopeful that they will service all of their customers with timely results.

Firearms and Toolmarks

There are three trained firearm examiners in St. Paul. A fourth examiner and a technician are assigned to the Bemidji Laboratory, which services the northern region of the state.

The Firearm and Toolmark Section conducts tests on bullets, cartridge cases and firearms, restores serial numbers on firearms and vehicles, and identifies tools used to make unknown toolmarks. A comparison microscope is used for many of the examinations in the section.

The Firearm Section of St. Paul, in 2005, continued to maintain a low case backlog with a resulting short turn around time of the submitted cases. The average turn around time for the St. Paul Firearm Section was less than 28 days. The Bemidji Firearm Section turn around time has decreased by 40% from 2004.

The Firearm Section is unique from the other laboratory areas in that they require extensive collections of reference firearms, ammunition, books and literature. These collections are used constantly in their examinations. The firearm collection is used in part for law enforcement or training purposes, for serial number location and structure, making inoperable guns functional to allow them to be test fired, and for disassembly and comparison to evidence guns. The ammunition collection is used to test fire firearms submitted and to assist in determining information (like brand or caliber) on evidence ammunition components. The Firearm Sections of Bemidji and St. Paul have a combined total of over 5000 reference firearms and approximately 75,000 rounds of ammunition.

The majority of cases submitted to the Firearm Sections in 2005, continues to be NIBIN cases. The NIBIN program (National Integrated Ballistic Information Network) is sponsored by the BATFE (Bureau of Alcohol, Tobacco, Firearms and Explosives). This is a computer database program that captures images of fired cartridge cases and bullets that are recovered from crime scenes or are test fired from recovered firearms. When new entries are made into the database, the program compares the images and shows the scientist possible matches. The scientist must then acquire the actual evidence and make comparisons to verify whether a match or "hit" exists.

In 2005, the BCA entered 1080 bullet or cartridge case images into the Bemidji or St. Paul databases resulting in 69 "hits". This indicates that approximately 6% of the evidence entered into the database is linked to another shooting or to a firearm. Many of the linked crimes or guns were between different law enforcement agencies.

The most significant case for the Firearms Section in 2005 involved the examination of the firearm evidence from the Red Lake school shootings. The firearms examiner in the Bemidji Laboratory examined eight firearms, 27 projectiles and 76 cartridge cases collected from the crime scenes. The examinations and resulting comparisons of the evidence took the Bemidji scientist approximately 60 hours to complete.

Forensic scientists in the Firearm and Toolmark Section, participated in training and continuing education activities: two scientists were able to attend the annual AFTE Training Seminar and one scientist was able to attend Smith and Wesson armorer courses in Springfield, Massachusetts.

Scientists in the section taught Firearm and Toolmark Evidence Collection courses and a Serial Number Restoration course for Minnesota law enforcement personnel. These courses were coordinated by the BCA Police Training Section. One scientist assisted in training firearms examiners for the BATFE National Firearms Examiner Academy.

The scientist assigned to the Bemidji Laboratory is continuing to train a firearms examiner for the state of South Dakota and, beginning in 2005, the St. Paul Laboratory started training a firearms examiner for the Hennepin County Sheriff's Office.

Looking ahead to 2006, the Firearm and Toolmark Section is looking forward to better serving the law enforcement community by providing training and through a continued reduction in the turnaround time of cases. And, as always, the section hopes to find time to conduct research related to the firearm and toolmark field in order to assist other firearm examiners, law enforcement agencies, and the criminal justice community.

Firearms examiner using a comparison microscope to compare cartridge cases.

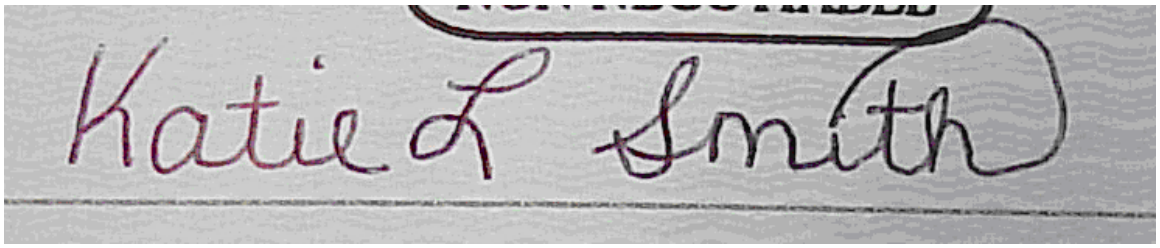
Questioned Documents

The beginning of the fiscal year 2005, the Questioned Documents section was staffed by two fully trained scientists. By December the turnaround time was reduced to approximately 3 months. The Questioned Documents section continues to offer examination services in such areas as signatures, handwriting and hand printing, typewriters, indented writing, ink, paper, mechanical impressions, photocopiers, alterations and obliterations, counterfeit documents, and the reconstruction of documents that have been burned or damaged.

This year the Questioned Document section has seen an increase in counterfeit currency cases. High resolution scanners and printers are enabling counterfeiters to produced fake bills that are of very high quality. However, the newly formatted twenty dollar bill has made

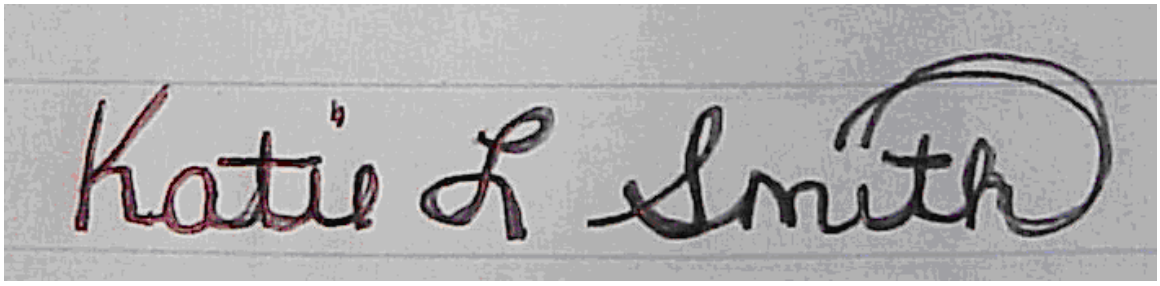
the counterfeiter's job more difficult, despite the technological revolution. We are anxious to see if the introduction of the newly formatted ten dollar bill this year will be as successful.

The majority of Questioned Document cases still involve handwriting examinations. They may include abductions, threats, and notes but the majority of the handwriting cases are involved with forgeries. These may involve checks, credit cards and other documents involved with the increasing amount of identity theft being seen around the nation. Besides examining the handwriting on the documents for authenticity, the Questioned Document Section must examine documents for tracings and/or simulations (Figure 1, Figure 2 and Figure 3). The ever increasing capability of computer software and printers, that produce professional looking documents, is adding a new dimension to the examination of documents.



Questioned Signature

Questioned Signature Using Side Lighting and Filters



Model Signature Used for Tracing

Latent Prints

2005 was another busy year for the Latent Print Section. We continue to participate in a state grant that focuses on the processing and analysis of latent print evidence and adjudication of auto theft cases. This grant provides funding for training and equipment for law enforcement personnel throughout Minnesota. Scientists Scott Ford and Marty Koolen held fifteen classes demonstrating how to efficiently process vehicles and evidence to maximize the potential of recovering valuable latent print evidence from auto thefts. One hundred and twenty-nine officers from many different agencies attended these classes last year.

Two Basic Latent Print Courses were taught in East Grand Forks and in Mankato, and two Advanced Latent Print Courses were taught in Bemidji and St. Paul. These popular 3-day classes promote more pre-processed evidence and better quality latent print lifts and photographs that are submitted to the Latent Print Section by law enforcement agencies. In part, due to these courses and the efforts from the Auto Theft Grant, there was approximately a 17% increase in the number of cases with Latent Print assignments from the previous year.

The MAFIN (AFIS) database is used to search unknown latent prints to known fingerprints that are entered into the system. This network contains the criminal fingerprint records from the cities of Duluth, Minneapolis and St. Paul; Hennepin, Ramsey and St. Louis counties; and the states of Minnesota, North Dakota and South Dakota. The Latent Print Section also has access to IAFIS, which is the national database maintained by the FBI. Fifty suspects were identified last year in a variety of cases, including two robberies and five homicides. An example of a more typical case involves Scientist Gary Walton searching latent prints from a clandestine lab investigation from Pipestone County. In addition to the known suspects involved in the case, an additional three suspects were identified. In addition to these searches, approximately 300,000 known fingerprints from fingerprint cards entered daily in to the system were compared against latent images in the Unsolved Latent File, resulting in the identification of twenty-six suspects in previously unsolved cases.

The Latent Print Section conducted several research projects last year. Scientist Josh Bergeron examined the use of liquid nitrogen to aide in the processing of duct tape. With the help of BCA Intern Katie Pietsch, the liquid nitrogen was used to lower the temperature of the tape so the adhesive properties would fail. This allowed for the separation of the tape that was bound adhesive to adhesive and adhesive to non-adhesive and is non-destructive to the latent prints on the adhesive surfaces. BCA Student Workers Kristin Tebow and Trisha Evans assisted Scientist Glenn Langenburg in a study examining error rates of latent examiners during comparison training exercises. Analysis of the performance of ninety-two participants with more than one year experience doing latent comparisons resulted in an erroneous identification rate of 0.034%. A follow-up experiment involving verification of the comparisons, which is an integral part of latent print analysis, resulted in no erroneous identifications being verified. Further research on this subject continues. Scientist Scott Ford is continuing his research into studying the fingerprint patterns and minutiae arrangements, trends and frequencies. BCA Intern Jody Panchyshyn is helping in recording the frequencies and arrangements of minutiae in mapped quadrants of different fingerprint

patterns to identify trends. The aim is to help in AFIS searches by limiting the number of respondents and elevate potential matches higher on the search queue.

An interesting case from last year was a controlled substance investigation in which a handgun was submitted for analysis. Officers from the scene searched the suspect's vehicle and found small amounts of cocaine along with a stolen Ruger 9mm pistol. Scientist Scott Ford processed the firearm and developed a partial fingerprint on the trigger of the handgun. This is unusual due to the fact that the small surface area on a trigger usually prohibits developing suitable latent prints. Scott examined the partial print and identified it to the suspect's right index finger.

Latent fingerprint on the trigger

Scientist Dave Peterson was promoted to Supervisor of the Criminalistics Group last year and while we are very proud of Dave, it does leave a vacant position open in the St. Paul office. The Bemidji office also has one vacancy that hopefully will be filled soon. Scientist Justin Bundy attended courses held in Denver, Colorado focusing on the comparison of latent palm prints and also how to better prepare and present testimony in a court of law. Scientists Marty Koolen, Glenn Langenburg and Gary Walton were able to attend the 90th Annual educational Conference of the International Association for Identification that was held in Dallas, Texas. Glenn gave several presentations at the Conference involving his continued research on the methodologies of latent print analysis (ACE-V) and the comparison error rates of latent print examiners during comparison training exercises. Glenn also lectured on deposition factors of fingerprints in a blood matrix. These factors were quantified and measured under controlled conditions and may be able to provide an investigator with important information about the deposition of bloody prints. Scientist Josh Bergeron was one of the speakers at the Minnesota Division of the International Association for Identification held in Rochester, Minnesota. His presentation examined different distortions that commonly occur in latent prints which helps the analyst in their examination and understanding of the mechanisms that cause these different distortions.

Support Services

Support Services is under new direction. Debra Springer, the former Criminalistics Supervisor, moved to the Support Services section in November 2005. The primary focus of the Support Services group is to provide the laboratory with assistance in day-to-day activities which affect all scientific sections of the laboratories in St. Paul and Bemidji. Areas that make up this section include quality assurance, safety and training, laboratory information system management (LIMS), evidence intake, administrative support, purchasing, photography, and our newest addition, DNA offender sample intake and tracking.

Quality Assurance (QA)

Work conducted by the Minnesota BCA Forensic Science Service is of the highest quality possible to meet the needs of the criminal justice community. Laboratory Quality Assurance programs are designed to provide a quality system to demonstrate that results are accurate, impartial and relevant. The laboratory quality system is designed meet or exceed the requirements for laboratory accreditation established by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). The Bemidji Laboratory and St. Paul Laboratory both maintain separate accreditations by ASCLD/LAB. The laboratory quality system functions to evaluate laboratory methods and procedures, case files, staff technical competency and proficiency, and to document these evaluations through laboratory internal quality auditing, quality assurance reporting, and quality assurance reviews.

Laboratory internal quality control audits are one aspect of laboratory Quality Assurance. The audits are conducted yearly for the St. Paul Laboratory, and for the Bemidji Laboratory. The laboratory has many members who have had formal training in Quality Assurance auditing given through ASCLD/LAB, the FBI, or through the College of American Pathologists. In 2005, these expert auditors were utilized within the laboratory to complete the annual internal quality control audits of each of the laboratory sections, and laboratory support services. By having this large pool of talent, coordinated by laboratory Quality Assurance, the laboratory was able to spread out the work, and maintain independence of the auditors. This is only one example of laboratory Quality Assurance coordination of resources to maintain laboratory quality.

Safety and Training

The Safety and Training program for 2005 continued to be involved in the following areas: bio-hazardous wastes, chemical safety, respiratory protection, safety audits, and various training areas such as courtroom testimony, crime scene, right-to-know, evidence handling, and general lab operations.

Other areas of involvement include:

Citizen's Academy – this academy educates business leaders in the community and shares the capabilities of the BCA to enhance community confidence.

Forensic Partnership Program – This program links Medical Examiner staff with the BCA in an effort to educate death investigators throughout Minnesota. Investigators receive training in crime scene processing techniques and in the capabilities of the forensic laboratory.

Internship Coordination – The BCA laboratory has an extensive internship program available to qualified undergraduate and graduate students. The coordination of this program involves overseeing the entire application and interview process.

Laboratory Information Systems Management (LIMS)
The laboratory computer evidence tracking system allows for quick and accurate organization of laboratory case information and records. This system is constantly evaluated and maintained. The BCA system incorporates auto e-mailing to law enforcement agencies and access to report information by departments through secure access to the BCA lab report website at: Https://BCALAB.dps.state.mn.us/BCALAB

This decreases laboratory turn-around times and allows departments to access reports via their own computers. Currently, about three hundred Minnesota law enforcement agencies have access to this site.

Several changes have been incorporated into this site for 2005. In addition to reports, evidence submission receipts can now be viewed. Cases can now be retrieved by Lab case number, the submitting agency's case number or the name of a person involved in the case.

Departments that have not taken advantage of the BCA lab website can contact the BCA laboratory for assistance.

Evidence Intake
Evidence being submitted to the laboratory enters through evidence intake area. Our Forensic Evidence Specialists take in the evidence using our Laboratory Management Information System (LIMS) and direct it to the appropriate laboratory section. Evidence Specialists assist in maintaining communication between the analysts and the investigators. Evidence is also returned to submitting agencies through the Evidence Intake area. Our Evidence Specialists also develop film for the Minnesota State Patrol.

Administrative Support
Case files are maintained, organized and filed by our Administrative Support section, as well as information from phone messages, e-mails and faxes. The laboratory receives numerous calls and requests and our Administrative Support Team ensures that they are correctly routed and that our scientists receive the information.

Purchasing and Ordering
This section is responsible for purchasing and tracking equipment, instrumentation, and general laboratory supplies that keep the laboratory operational on a daily basis.

Photography
The photography section develops film, digital media and prints photographs for the BCA and the Minnesota State Patrol. When photos are requested, CD's in jpeg format are produced and sent to law enforcement agencies. Law enforcement agencies can request enlargements and reprints through the laboratory photography section.

If departments use digital formats for taking pictures for laboratory exams, CD's with photos can be sent to the laboratory for development. Examples of photographs may include but are not limited to fingerprints, shoeprints, and tire tracks. Enlargements are also made for court purposes.

DNA Offender Sample Intake and Tracking
In November 2005, Laboratory Administration filled two new Criminal Intelligence Analyst (CIA) positions. These positions were created due to new predatory arrestee legislation. The primary purpose of the statute was to receive DNA samples from all felony predatory arrestees. When the samples are received, they are split, read for sample quality/validity, and entered in the CODNA program, as arrestee samples. The CIA's will track the progress of various criminal proceedings of the arrestees, tracking if they are found guilty, not guilty, or if the charges are dismissed. If the arrestees are convicted, the samples will be entered as a convicted offender and also entered into the CODIS database.

Toxicology

Last year 6453 blood and urine samples were analyzed for alcohol, and 2551 were analyzed for drugs. Of these samples, 5890 were from arrests for driving while impaired (DWI), the rest were from felony cases and death investigations. Marijuana was the most common drug found, followed by methamphetamine, benzodiazepines (diazepam, lorazepam, etc.), cocaine, opiates, and other drugs.

Loading Samples on a
Headspce Gas Chromatograph

We are now offering a wider array of drug tests, including antidepressants, antipsychotics, and sedative/hypnotics, many of which can impair driving-related skills.

The Minnesota Supreme Court invited us to provide training on *Alcohol and the Intoxilyzer* to newly appointed judges as part of the week-long New Judges Orientation program as well as for experienced judges as part of the Judicial Conference. We provided instruction at the Drug Recognition Expert (DRE) recertification course, and also lectures at various area universities and colleges.

We invested in our own continuing education as well last year. During 2005 Toxicology staff attended workshops and scientific sessions at the annual meetings of the Society of Forensic Toxicologists and the American Academy of Forensic Sciences.

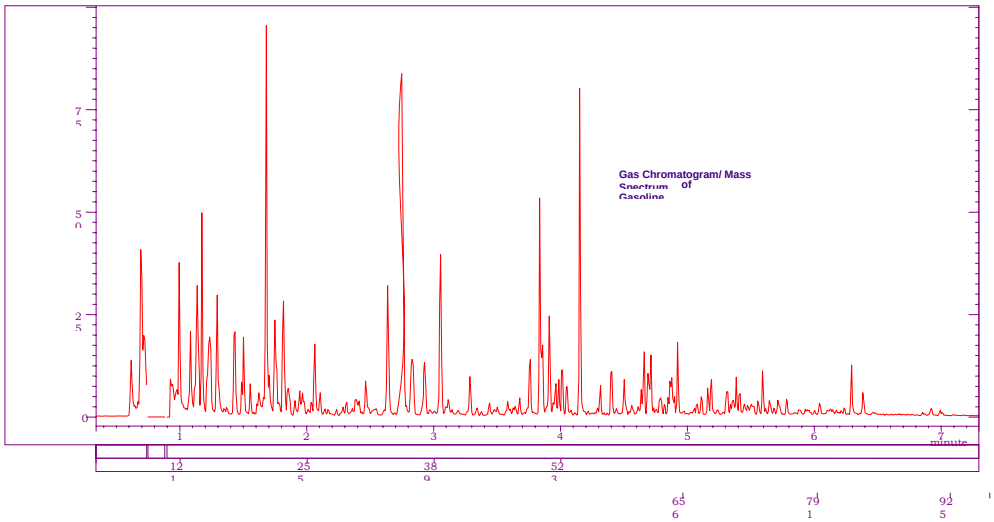
One set of interesting cases last year involved an individual who was arrested for driving while impaired by drugs on two occasions within less than a month of each other. In both cases the subject's urine specimen was found to contain citalopram (an antidepressant) and zolpidem—a hypnotic schedule IV controlled substance, commonly prescribed for insomnia, that impairs driving-related skills comparable to an alcohol concentration of 0.08 or greater.

Trace Evidence - Chemical Testing

In 2005, the Chemical Testing Section saw an increase in the number of cases submitted. During this time, 159 cases were submitted containing a total of 606 items or 3.8 items per case. This is an increase of approximately 10%.

In 2005, Chemical Testing received a new Gas Chromatograph/Mass Spectrometer (GC/MS). The new instrument is currently finishing validation and will be put into service soon.

Gasoline is the ignitable liquid that is found in approximately 90% of the positive investigative samples submitted to the laboratory. This is consistent nation-wide. Gasoline is relatively cheap, easily accessible and easily ignited. Many people feel that arson is not a serious crime. Who does it hurt? What are the costs? Insurance pays for that anyway. Right?



GC/MS of Known Gasoline

Let's start with the costs associated with an arson fire. Taxpayers pay directly for fire fighters, police and paramedics that respond to all fires. Fire suppression, overhaul (process of putting out hot spots), investigation (reconstructing the fire scene, interviewing witnesses, etc), arrest and prosecution are also costs from an arson fire. These are all at taxpayer expense and remove fire, police and prosecutorial personnel from other tasks.

The property loss is covered by insurance, but we all pay the premiums for that insurance due to the crime. It costs each of us every time there is an arson fire through homeowners, renters, auto insurances and others.

So, these are some of the costs that affect everyone every time there is an arson fire, but what are the real costs. In 2005, there were 38 deaths associated with fires (arson and accidental) in Minnesota. This is a preliminary number from the State Fire Marshal's Office.

Thirty-eight is a number, but there is a face to the number. At the end of September of 2005, we received a case which involved three agencies – the MN State Fire Marshal's Office, the MN BCA Crime Scene Team and Woodbury Police Department.

Four members of a family were caught in an early morning fire. Three died in the fire; one still clings to life – a 10 year old. Due to the circumstances surrounding the fire, Chemical Testing was asked to rush the analysis. Based upon the investigations, arson was suspected. Items of evidence were received from this case until mid-October. The chemical testing report was reviewed and approved in mid-November. In all, 35 items were analyzed for ignitable liquids. The investigation is still continuing as the New Year dawns.

This case is used to illustrate that arson is a crime with a heavy loss – life, property, time and resources. Once we understand this, maybe we can all work to **"STOP ARSON".**

Trace Evidence - Microscopy

The Trace Section made substantial headway on its backlog. Combined with training new analysts the section reported 192 cases this year.

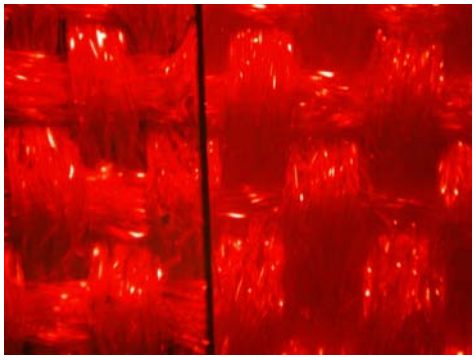
Both hair scientists have completed their training at the FBI Laboratory in Quantico, Virginia for human hair comparisons. They are part of the Mitochondrial DNA regional lab housed in the BCA. The two fully trained scientists are performing microscopic hair examinations on FBI cases. Hair exams are very exacting and time-consuming. If hairs are found to correspond, then Mitochondrial DNA exams are performed on a portion of the hairs.

Training in the Trace section is extremely important in order to have qualified and proficient BCA analysts. It can take 2 years or more to complete this process. Courses in paint analysis, Infrared Spectrophotometry and Scanning Electron Microscopy were taken by two analysts who are working hard to increase their fields of competency.

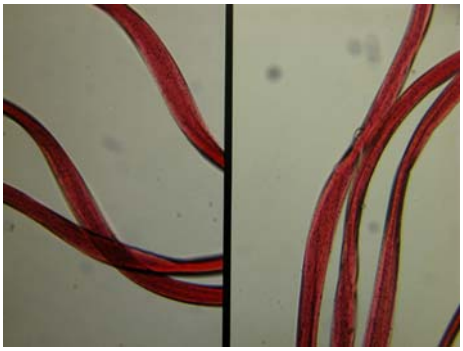
New equipment included updating our Perkin-Elmer FTIR (Fourier Transform Infrared Spectrophotometer) in an attempt to improve its usefulness and efficiency and in the purchase of a muffle furnace to anneal glass samples.

Besides the work that continued on various homicide cases, many other unusual cases were examined. One involved the use of a graduation gown that was used in two related arson cases. The gown was torn into strips which were used as wicks for "Molotov cocktails" with gasoline as the flammable liquid. Small amounts of melted and semi-melted cloth from the red gown were found in the bottle necks at the scenes which were compared to the suspect's graduation cap made from the same fabric as the gown. The weave, microscopic fiber comparisons, color and infrared spectra were identical when the two fabrics were compared leading the analyst to conclude a possible common origin. It colorfully illustrates the range of instrumentation available to analyze paint, fibers and other evidence.

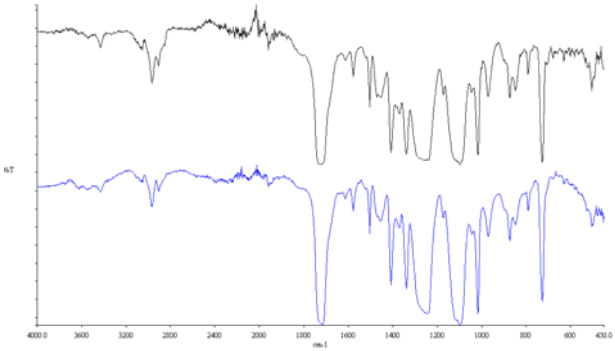
Wick fragment and graduation cap



Weave (wick on left, cap on right)



Red fibers from wick (left) and cap (right)

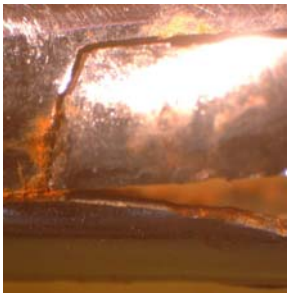


Infrared Spectra, wick (top) vs. cap

A second case was an unusual physical match case. While assaulting a person with a golf club is strange enough, having the shaft shatter and a 1” piece break off in the victim’s knee is quite unique. When the metal piece was removed surgically, it was found to be approximately 1” long. As shown by the photographs, this metal piece was physically matched back to the splintered end of the golf club shaft proving the piece was once part of the club.

Metal piece from the Victim’s knee

Splintered end of the golf club shaft



Microscopic view of the physical match
(club shaft surrounds the piece on three sides)

Message from the Assistant Director in Bemidji

The Bemidji laboratory reached a major milestone in January of 2005, when we officially earned accreditation through the American Society of Crime Lab Directors Lab Accreditation Board (ASCLD-LAB). Although the Bemidji lab has followed the same policies and procedures as the St. Paul lab since opening our doors in 2001, we did not have the opportunity to be inspected by ASCLD-LAB until 2004. In addition to being accredited in

Nuclear DNA, Controlled Substances, Latent Prints, and Firearms, both the Bemidji and St. Paul labs earned accreditation in Crime Scene processing.

The laboratory in Bemidji went through some growing pains during 2005. We were able to add two new scientists in the areas of DNA and Drug Chemistry. As a result of those hires and new staff hired in 2004, three of the eight forensic scientists assigned to the Bemidji lab were in training during most of 2005. The new Drug Chemist began doing casework in October and the Chemistry section set to work on reducing a 500 case backlog. As a result of their hard work, the year 2005 ended with a backlog of 200 drug cases and a turn around time of less than forty-five days. Training continued into 2006 for the new latent print examiner and DNA scientists.

I am often asked the question, "Are you keeping busy in the Bemidji Lab?" My response is always, "Yes, very." I remind people that we are not a full service laboratory and do not perform examinations in Trace, Question Documents, or Toxicology. However, in the sections for which we do provide service, the percentage of the cases submitted to the BCA in 2005 that were examined in Bemidji were:

Drug Chemistry	1210 of 4436 cases or	27%
Latent Prints	314 of 1439 cases or	22%
Firearms	168 of 928 cases or	18%
Nuclear DNA	299 of 2135 cases or	14%
Crime Scenes	30 of 84 cases or	36%

Perhaps the biggest case the Bemidji Lab was involved in during 2005 was the Red Lake High School shooting. In addition to the Crime Scene Team spending four days assisting the FBI in processing the scenes, all the Firearms and Latent print evidence was examined in the Bemidji Laboratory.

The goals for the Bemidji Laboratory for the following year will be to continue to provide high quality customer service and further reduce the backlog in all areas. We also intend to bring back the evidence collection class we offered during our first year for officers in northern Minnesota.