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VOL. XXXVI, NO. 5 MAY 2003

- INTELLIGENCE ALERT -

2C-I - A NEW AMPHETAMINE TYPE STIMULANT IDENTIFIED IN DENMARK

[From the Europol *Drugs Intelligence Bulletin* 2002;2:7
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The Danish authorities have reported a seizure, in April 2002, of a tablet with the amphetamine type stimulant 2C-I (2,5-dimethoxy-4-iodophenethylamine). This is the only seizure report received by the Europol Drugs Unit on tablets with this particular active agent. However, other sources reveal that similar seizures have been made in Toronto, Canada and Milwaukee, USA.

In each case the tablet has been white with a diameter of 6 to 6.1 mm, a thickness of 2.7 mm and displaying the "i" logo. Shown is a photo [Photo 1] of the tablet seized in Denmark:

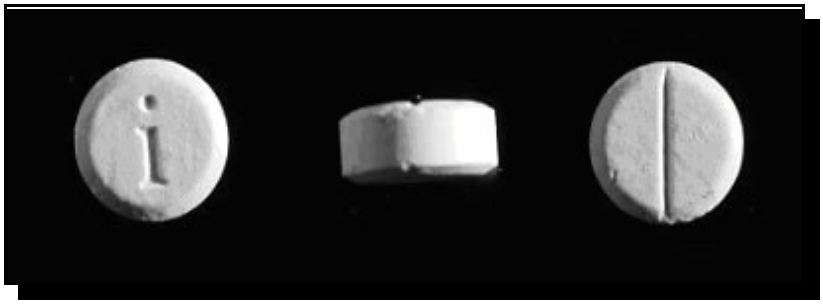

Photo 1

2C-I is chemically similar to 2C-B (regularly reported) but,

according to open source user reports, it has a slightly different effect. User reports refer to a delayed, deep and complex effect with 15-20 mg active substance. This may indicate a risk of overdose if sold as ecstasy, as occurs with PMA/PMMA.

Europol Drugs Unit kindly requests all law enforcement and forensic authorities to report details of seizures of tablets with this logo and/or active substance.

[Editor's Note: To contact the Europol Drugs Unit, email to: info@europol.eu.int]

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- INTELLIGENCE ALERT -

CANNABIS IN SUITCASE BOTTOMS/ COCAINE BRICKS WITH STAR/WAVE LOGOS IN THE CAYMAN ISLANDS

The Cayman Islands Forensic Laboratory (Cayman Islands Hospital, Grand Cayman) has received a number of suitcases where cannabis packages were concealed in false bottoms (see Photos 2 and 3). The exhibits were all seized by Her Majesty's Customs Narcotics Enforcement Team as a result of luggage screening at the Grand Cayman Airport. Although the technique is not new, there was a sudden increase in this form of smuggling in 2002. In each case, the bottom had been packed tightly with cannabis parcels, some tailor-cut to specifically fill the spaces. In addition, the parcels were glued in place and covered in carbon paper. All the cases had an aromatic sweet smell (source not identified). Analysis by microscope and GC/MS confirmed cannabis. Total net masses of cannabis varied from approximately 8 to 25 kilograms per suitcase.

Photo 2

Photo 3

In addition, the Forensic Laboratory recently received two embossed powder bricks, suspected cocaine. The bricks were seized by the Royal Cayman Islands Police Drug Task Force in Grand Cayman. Each brick weighed about 1 kilogram, and was multiply wrapped in plastic, yellow latex, additional plastic, then grease, and finally in brown tape. The bricks themselves had an

unusual logo consisting of a wavey line with a five-pointed star above and to the right of the wave (see Photo 4). Analysis GC/MS, IR, and UV confirmed 84 percent cocaine hydrochloride. These were the first bricks of this logo type submitted to the laboratory.

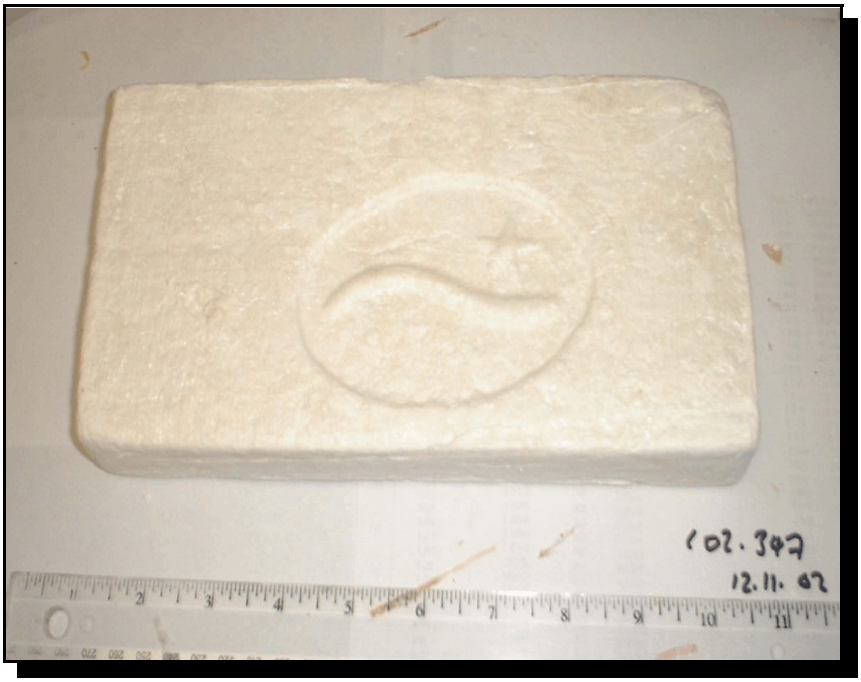

Photo 4

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- INTELLIGENCE ALERT -

MDMA TABLET WITH "MEDUSA" LOGO IN REDDING, CALIFORNIA

The Bureau of Forensic Services Redding Regional Laboratory (Redding, California) recently received a submission of one tablet, suspected Ecstasy. The tablet was seized by the Redding Police Department. The submitted tablet was round with pink and white speckles and had a woman's profile logo - commonly known as the "Medusa" logo (see Photo 5). Analysis by color tests and GC/MS confirmed MDMA (not quantitated). According to the website www.dancesafe.org, Medusa logo tablets contain (relative percentages) both MDMA (4.8 percent) and caffeine (95.2 percent); however, the submitted tablet was not tested for caffeine. This is the first time that a Medusa logo tablet has been encountered by the Redding Laboratory.

Photo 5

- INTELLIGENCE ALERT -

HOMEMADE CHOCOLATE CONTAINING PSILOCIN/PSILOCYBIN IN NORTH RIDGEFIELD, OHIO

Photo 6

The Ohio Bureau of Criminal Identification and Investigation Laboratory (Richfield, Ohio) recently received eight pieces of homemade chocolate containing suspected psilocybin mushrooms (total net mass 145.76 grams; see Photo 6. Note that the four displayed pieces in the photo were split from one of the original eight pieces. The original pieces had shapes that suggested they were originally molded in an ice-cube tray) The exhibits were seized by the North Ridgeville Police Department, and were associated with an upcoming concert in the area. Inspection of each piece revealed the presence of vegetable matter (see photo), which was separated by particle-picking. Analysis of a methanol extract by TLC and GC/MS confirmed the presence of psilocin and psilocybin. This is the first submission of this type to this laboratory; however, a second submission containing over 150 similar homemade chocolate bars with suspected psilocin/psilocybin mushrooms was subsequently submitted; this latter seizure was made in Solon, Ohio and was also associated with the referenced concert.

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- INTELLIGENCE ALERT -

UNUSUAL OPIUM SAMPLE IN PHOENIX, ARIZONA

Photo 7

The Phoenix Police Department Laboratory Services Bureau (Phoenix, Arizona) recently received a rather unusual submission of suspected opium. The submission consisted of six plastic wrappers and one plastic vial, each containing a brown brittle substance having the smell of manure, total net mass 177 grams (for example, see Photo 7). The exhibits were seized by the Phoenix Police Department from a residence occupied by illegal immigrants from Honduras and Mexico. A Marquis-based field test of the substance was negative; however, the suspects admitted to grinding and snorting the material, so the investigating officer requested a complete laboratory analysis. A laboratory performed

Marquis-based screen gave a faint purple color (suggestive of an opiate). The sample was then dissolved/suspended in 0.2 N sulfuric acid, washed with chloroform, made basic with solid potassium carbonate, and then extracted with chloroform / isopropanol (4:1). A second Marquis test performed on the residue resulting from evaporation of the latter organic extract gave a bright purple color. Analysis of the extract by GC/MS confirmed codeine, morphine, papaverine, and noscapine (not quantitated). The adulterants were not identified, and it is unclear why the raw material gave a false negative with the Marquis, or why it had a smell resembling manure. This was the first opium sample received in recent history by the Phoenix Police Department Laboratory Services Bureau.

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- INTELLIGENCE ALERT -

OPIUM POPPIES SOLD OVER THE INTERNET FROM CALIFORNIA

The DEA Western Laboratory (San Francisco, California) recently received some usual submissions of suspected opium poppies, including some that were artificially colored (see Photo 8). The poppies were purchased over the Internet by the DEA San Jose Regional Office (combined net mass of three purchases 6.899 kilograms). The dried poppies were being advertised as "floral decorations". The purchases eventually led to the seizures of 3 boxes of dried poppies from a storage locker in Sacramento, and then an additional 42 boxes of dried poppies from a warehouse in Santa Paula (California). In total, the combined seizures equaled about 25,500 pods, with a net mass of about 120.8 kilograms. The poppy pods were similar in shape but ranged in height from ½ to 2 inches. The poppies were bundled in sets of 15-20 smaller poppies, or 3-10 larger poppies, either wrapped with rubber bands or contained in plastic flower sleeves. Most of the poppies were a natural light brown color, but (as noted above) many were dyed in different colors, including purple, blue, orange, pink, and yellow. Analysis by GC/FID and GC/MS confirmed morphine and codeine. Quantitation of a typical pod indicated 1.72 milligrams of morphine, which extrapolates to about 44 grams of morphine for the entire seizure. This is the first opium poppy case of this size and origin to be submitted to the Western Laboratory, and the first poppy case of any type in several years.

Photo 8

- INTELLIGENCE ALERT -

"HANDSHAKE" LOGO TABLETS CONTAINING *l*-METHAMPHETAMINE IN SPRINGFIELD, MISSOURI

Photo 10

The DEA North Central Laboratory (Chicago, Illinois) recently received 50 blue tablets with a "handshake" logo on one side, suspected Ecstasy (see Photo 9). The tablets were purchased in Springfield, Missouri by investigators from the Springfield, Missouri Police Department and agents from the DEA St. Louis Division Mobile Enforcement Team. The tablets were round, flat-faced on both sides with the blank side having a slight beveled edge, 8.0 mm in diameter, and weighed 235 milligrams each. Analysis by GC (with and without chiral derivatization with (S)-(-)-N-trifluoroacetylprolyl chloride (TPC)), FTIR, and GC/MSD indicated a mixture of *l*-methamphetamine (16 mg/tablet calculated as the hydrochloride salt), 3,4- methylene-dioxymethamphetamine (55 mg/tablet calculated as the hydrochloride salt), and ketamine (16 mg/tablet calculated as the hydrochloride salt).

Photo 9

The Laboratory also received an unrelated but highly similar submission of 93 blue-gray "handshake" logo tablets, also round, flat-faced on both sides with the blank side having a slight beveled edge, 8.0 mm in diameter, and weighed 240 milligrams each, also suspected Ecstasy (see Photo 10). In this case, the tablets were purchased in St. Louis, Missouri by agents from the DEA St. Louis Division. Analysis in this case, however, indicated a mixture of *d,l*-methamphetamine (17 mg/tablet calculated as the hydrochloride salt), 3,4-methylenedioxy-methamphetamine (55 mg/tablet calculated as the hydrochloride salt), and ketamine (17 mg/tablet calculated as the hydrochloride salt) - virtually identical except for the enantiomeric composition of the methamphetamine.

[Editor's Notes: Although the "handshake" logo is a known source, and mixed MDMA/methamphetamine/ketamine "Ecstasy" tablets have also been previously encountered, the presence of *d,l*-methamphetamine and especially *l*-methamphetamine in such tablets are certainly unusual findings. According to the analyst in this case, the laboratory has encountered several subsequent submissions of similar tablets.]

- INTELLIGENCE ALERT -

VERY LARGE PCP LABORATORY SEIZED IN BALTIMORE, MARYLAND

The DEA Mid-Atlantic Laboratory (Largo, Maryland) recently assisted the DEA Baltimore District Office, Bureau of Alcohol, Tobacco, and Firearms (ATF), Maryland Department of the Environment, and the Baltimore City Police Department in taking down a very large-scale phencyclidine (PCP) manufacturing operation. Two locations were involved; the first was a residence in northwest Baltimore where the actual synthesis was being performed, while the second was a business in Jessup, Maryland which was being used to purchase large amounts (i.e., 55-gallon drums) of listed chemicals such as piperidine, phenylmagnesium bromide, and cyanide (Jessup is located about 15 miles south of Baltimore). The large quantities received by the business were subdivided into smaller units for use by the laboratory. The business, which was involved in manufacturing industrial cleaners, tried to justify the purchase of these chemicals by claiming that they were better ingredients for their cleaning products.

At the Baltimore residence, agents, officers, and chemists found forty-two 5-gallon buckets in the basement (see Photo 11). Thirty-nine contained various liquids, subsequently identified as benzene, phenylmagnesium bromide, and cyclohexanone; however, three contained a white powder that was presumptively identified as a cyanide salt (probably sodium or potassium, not formally determined). Other chemicals included three 50-pound bags of sodium metabisulfite, seven 800-mL bottles of phenylmagnesium bromide in ether, and thirteen empty 500-mL bottles that had contained piperidine (see Photo 12). A total of approximately 4.5 gallons of finished liquid PCP was identified, distributed between nine different beverage containers. In total, the identified chemicals indicated the use of the Maddox method of PCP synthesis. This combines the cyclohexanone, piperidine, cyanide salt, and sodium metabisulfite to form 1-piperidinocyclohexanecarbonitrile (PCC). The phenylmagnesium bromide solution is added to the PCC to form PCP. One bucket contained an ongoing reaction.

Analysis was conducted using GC, GC/MS and FTIR. The total amount of phencyclidine was calculated at 3.8 kilograms. The production capacity range was quite impressive. Based on the

Photo 11

Photo 12

least abundant precursor, piperidine, the theoretical yield was calculated as 16 kilograms, whereas based on the most abundant precursor, cyclohexanone, the theoretical yield was 355.9 kilograms. Assuming a modest concentration of 75 mg/mL, this operation therefore could have produced anywhere from 56 to 1255 gallons of liquid PCP. Of note, a Baltimore City Police Officer present at the site commented that the largest previous seizure of liquid PCP in Baltimore was only one gallon.

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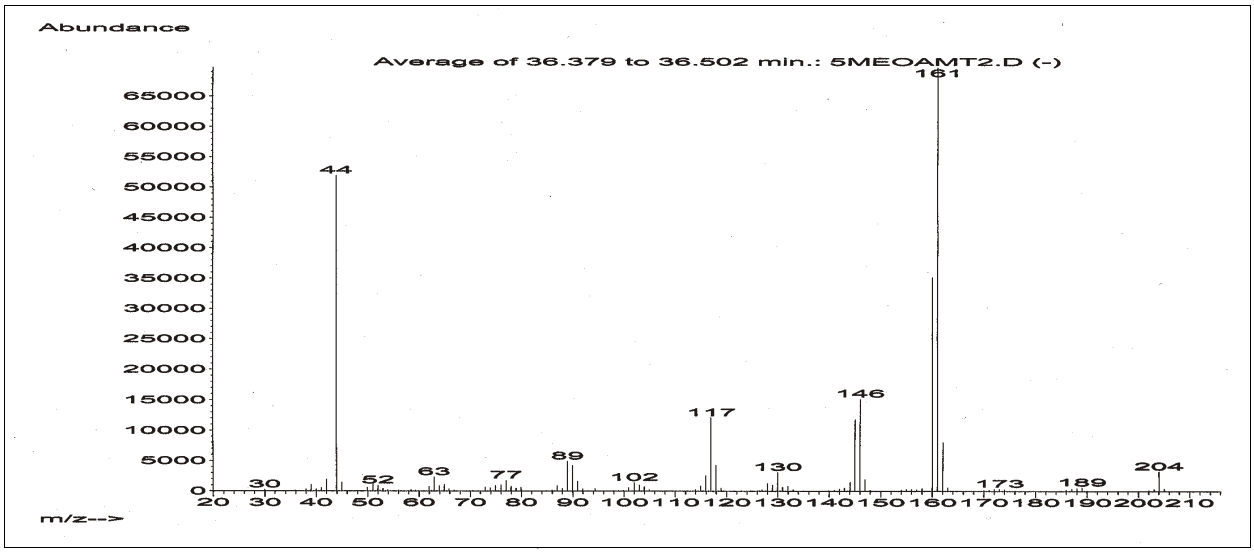
- INTELLIGENCE ALERT -

5-METHOXY-*ALPHA*-METHYLTRYPTAMINE (5-MEO-AMT) APPEARING IN SUGAR CUBES AND LSD-STYLE BLOTTER PAPERS

The DEA Special Testing and Research Laboratory (Dulles, Virginia) has recently received multiple reports of sugar cubes and LSD-style blotter papers containing 5-methoxy-*alpha*-methyltryptamine (5-MeO-AMT). Drug abuse literature (unconfirmed) suggests that this tryptamine is relatively potent. The mass spectra of 5-MeO-AMT is provided below; complete analytical data will follow in a later issue of *Microgram Bulletin* or *Microgram Journal*.



Mass Spectra of 5-Methoxy-*alpha*-methyltryptamine (5-MeO-AMT).

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- SCHEDULING UPDATE -

ALPHA-METHYLTRYPTAMINE (AMT) AND 5-METHOXY-N,N-DIISOPROPYL-TRYPTAMINE (5-MeO-DIPT, "FOXY") ARE EMERGENCY SCHEDULED

EVENT: Temporary placement of *alpha*-methyltryptamine (AMT) and 5-methoxy-N,N-diisopropyltryptamine (5-MeO-DIPT) into Schedule I through emergency scheduling provision

of the CSA

DATE OF EVENT: April 4, 2003

REPORTING ELEMENT: DEA Office of Diversion (OD)

WHEN REPORTED: April 8, 2003

SUMMARY: This is to provide you with an update on the Emergency scheduling of *alpha*-methyl-tryptamine (AMT) and 5-methoxy-N,N-diisopropyltryptamine (5-MeO-DIPT) into Schedule I of the CSA. AMT and 5-MeO-DIPT are tryptamine derivatives and share chemical and pharmacological similarities with the Schedule I tryptamine hallucinogens, *alpha*-ethyltryptamine (AET) and N,N-dimethyltryptamine (DMT), respectively. AMT and 5-MeO-DIPT are stimulant/hallucinogens abused for their abilities to induce hallucinatory states. AMT can produce nervous tension, irritability, restlessness, inability to sleep, blurry vision, pupillary dilatation, hallucinations and dextroamphetamine-like mood elevating effects. 5-MeO-DIPT can produce talkativeness, disinhibition, pupillary dilatation, nausea, jaw clenching, muscle tension and overt hallucinations with both auditory and visual distortions. There are no legitimate medical or scientific uses of AMT and 5-MeO-DIPT. The safety of human consumption of these substances has not been determined. Since 1999, law enforcement officials in several states have encountered AMT. The abuse by teens and young adults of AMT and 5-MeO-DIPT is an emerging problem. There have been reports of abuse of AMT and 5-MeO-DIPT at clubs and raves. Many tryptamine-based substances including AMT and 5-MeO-DIPT are illicitly available from United States and foreign chemical companies and from individuals through the Internet. There is also evidence suggesting the attempted clandestine production of AMT and 5-MeO-DIPT.

In response to this apparent growing problem and to avoid an imminent harm, a Final Notice temporarily placing AMT and 5-MeO-DIPT into Schedule I of the Controlled Substances Act (CSA) pursuant to the temporary scheduling provisions of the CSA was published in the Federal Register on April 4, 2003 (68 FR 16427). This adds to three other substances, namely N-benzylpiperazine (BZP), 1-(3-trifluoromethyl-phenyl) piperazine (TFMPP), and 2,5-dimethoxy-4-(n)-propylthiophenethylamine (2C-T-7), that were temporarily scheduled into Schedule I through a Final notice published in Federal Register on September 20, 2002 (67 FR 59161 and 67 FR 59163).

The Drug and Chemical Evaluation Section within the Office of Diversion Control is collecting information to support the final scheduling actions for these substances.

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Selected Intelligence Brief

Information Bulletin: GHB Analogs. GBL, BD, GHV, and GVL.

National Drug Intelligence Center
319 Washington St., 5th Floor
Johnstown, PA 15901

[Unclassified; Reprinted With Permission (Minus Four Case Vignettes)]

Introduction

Because the criminal penalties associated with GHB (gamma-hydroxybutyrate) have been made more stringent and law enforcement pressure has rendered GHB more difficult to obtain, the distribution and abuse of GHB analogs have become an increasing concern. GHB analogs, which include GBL, BD, GHV, and GVL, are drugs that possess chemical structures that closely resemble GHB. The ingestion of any of these analogs produces physiological effects similar to the effects associated with GHB abuse--relaxation, mild euphoria, and drowsiness. Abusers who emerge from a deep sleep or coma caused by GHB analogs may become easily agitated and extremely combative. GHB analogs are of particular concern because they contribute to increasing numbers of auto accidents, sexual assaults, and deaths.

While federal law prohibits the sale of analogs for human consumption, GHB analogs are available legally as industrial solvents used to produce polyurethane, pesticides, elastic fibers, pharmaceuticals, coatings on metal or plastic, and other products. These analogs also are sold illicitly as supplements for bodybuilding, fat loss, reversal of baldness, improved eyesight, and to combat aging, depression, drug addiction, and insomnia. GBL and BD are sold as "fish tank cleaner," "ink stain remover," "ink cartridge cleaner," and "nail enamel remover" for approximately $100 per bottle--much more expensive than

comparable products. Law enforcement's efforts to identify the abuse of GHB analogs are hampered by the fact that routine toxicological screens do not detect the presence of these analogs. In addition, distributors continually develop new analogs to avoid law enforcement detection.

Analogs

GHB analogs often are abused in place of GHB or are used to produce GHB. Common GHB analogs include GBL, BD, GHV, and GVL. (See Table 1.) Both GBL and BD metabolize into GHB upon ingestion. GBL is the most common precursor used in the production of GHB. GVL is abused in place of GHB because it metabolizes into GHV, which produces physiological effects similar to GHB.

Table 1. GHB Analogs

Analog	Chemical Name/Alternative Name	Precursor for Production of	Metabolizes Into
GBL	gamma-butyrolactone furonone di-hydro dihydrofuranone	GHB	GHB
BD	1,4-butanediol tetramethylene glycol sucol-B butylene glycol	GBL	GHB
GHV	gamma-hydroxyvalerate methyl-GHB	0	*
GVL	gamma-valerolactone 4-pentanolide	GHV	GHV

*GHV is not used as a precursor and is not metabolized into another drug.

Abuse

GHB analogs are distributed as liquids and consumed orally. When ingested, these analogs produce effects such as relaxation, mild euphoria, and drowsiness. Such effects are similar to those associated with GHB abuse and may resemble the results of alcohol intoxication. GHB analogs also may increase libido, suggestibility, passivity, and cause amnesia--traits that make users vulnerable to sexual assault and other criminal acts. Users awakening or emerging from coma may exhibit extreme combativeness, a condition which is also observed among those in withdrawal from addiction to GHB and its analogs. GHB analogs are known to produce side effects such as topical irritation to the skin and eyes, nausea,

vomiting, incontinence, loss of consciousness, seizures, liver damage, kidney failure, respiratory depression, and even death. GHB analogs are physically addictive, causing addicts to experience severe withdrawal symptoms if they miss a dose or attempt to stop using the drug.

Some GHB analog abusers begin consuming dietary supplements believing the claims made by manufacturers, and then find themselves addicted to the product. GHB analogs typically are abused in place of GHB by users who want to experience the effects associated with GHB and who find the analogs more widely available or easily obtained. Often users are unaware that they are consuming an analog and mistakenly believe that the substance they are ingesting is GHB. Many users mix the analogs with flavored beverages to mitigate their salty flavor and unappealing odor. Some users, however, simply ingest the drugs straight or mixed with water. It is often difficult or impossible to detect the presence of GBL, BD, GHV, or GVL when they are mixed with other liquids because these analogs are all clear and colorless. A quick test that indicates the possible presence of GHB analogs or GHB in a clear liquid involves shaking the liquid. If it becomes cloudy, GHB analogs or GHB may be present.

Because GHB analogs either are metabolized into GHB by the human body or produce similar physiological effects when ingested, healthcare providers often are unable to distinguish between the abuse of GHB and GHB analogs. Thus, the rising abuse of GHB, evidenced by the increase in Drug Abuse Warning Network (DAWN) emergency department mentions, reflects increased GHB analog use as well. (See Table 2.)

Table 2. Emergency Department Mentions for GHB and GBL in 22 Major U.S. Cities, 1994 - 2000.

Year	Total
1994	56
1995	145
1996	638
1997	762
1998	1,282
1999	3,178
2000	4,969

Source: Substance Abuse and Mental Health Services Administration, Drug Abuse Warning Network.

Distribution

GHB analogs are readily available, and various methods are used to distribute these drugs. Because of legislation (see Legislation section), GHB analogs are legally available only in products not intended for human consumption. Abusers and distributors may obtain commercial products such as chemical solvents legally and then illegally consume or distribute them. Illegal distribution of GHB analogs often occurs at raves, concerts, nightclubs, health clubs, gyms, and on college campuses. At these venues GHB analogs usually are sold for $10 to $20 per capful (approximately 1 teaspoonful). When distributors sell these drugs, they may fail to specify which analog they are selling, or they may misrepresent the analog as GHB.

GHB analogs also are distributed at disreputable stores that sell health food and nutritional supplements. The analogs also may be marketed on the Internet and then shipped to purchasers via package delivery services. Typically, analogs are marketed as dietary supplements, sleep aids, and cleaning products. They are packaged in bottles containing 4 to 20 ounces and sold for $40 to $100 each. The products that are distributed as dietary supplements usually contain GVL as the active ingredient, while the cleaning supplies usually contain GBL or BD. The concentration of the analog varies; therefore, the size of a dose may range from one-half teaspoon to one-half ounce, and the number of doses per bottle may range from 24 to 48.

Individuals who illegally produce GHB analogs for human consumption often list alternative chemical names to disguise the ingredients. Most users recognize the analog by the brand name or through advertisements that tout the product as a replacement for a similar product that has been removed from the market. Products that contained BD or GBL such as RenewTrient II, Serenity, Inner-G, Soma Solution, and Blue Nitro are no longer sold, primarily because of law enforcement pressure, but comparable products with similar brand names are available.

GHB analogs often are sold with disclaimers that they are not for human consumption; however, many of the products have labels implying that the product may be ingested. One product marketed as an industrial solvent has a label that states "Warning! Accidental ingestion of [product] will produce GHB in your body. If you ingest some by mistake, don't take alcohol or any other drug!" Another product label states "Warning: Accidental ingestion may cause...euphoria...increases tactile sensitivity...". Many of the products are marketed as "Great Household Bargains" (GHB) in order to increase their exposure to individuals seeking GHB analogs.

In addition to the distribution methods discussed previously, supplies, kits, and recipes for producing GHB using the GHB analog GBL are marketed and sold on the Internet.

Tests for GHB Analogs

Seized GHB analogs frequently are not identified because detection of such analogs requires specific field and laboratory testing. Three different color tests--cobalt nitrate, Marquis reagent, and Mandelin reagent--are useful for detecting the presence of GHB analogs. (Contact forensic laboratories to obtain specific instructions regarding utilizing these test kits.) Both the Marquis reagent and the Mandelin reagent tests are available commercially.

Routine toxicological screens do not detect GHB or GHB analogs; thus, law enforcement officers and medical personnel must order specific blood and urine tests when they suspect GHB analog abuse. The most common urine tests screen only for the "NIDA-5," five of the most commonly abused categories of

drugs--amphetamines (amphetamines, methamphetamine), cocaine (powdered cocaine, crack), cannabinoids (marijuana, hash), opiates (heroin, opium, codeine, morphine), and phencyclidine (PCP). GHB in the blood or urine can result from the ingestion of GHB, GBL, or BD. To yield a reliable result, tests for GHB and GHB analogs must be performed not long after ingestion. Urine tests for GHB and GHB analogs must be performed within 12 hours after ingestion, and blood tests must be performed within 5 hours.

Federal, state, and local forensic laboratories may not routinely test for GHB in blood or urine. For example, the Florida Department of Law Enforcement (FDLE) began testing for GHB in urine on December 1, 2000, but tests are performed only if the suspect exhibits symptoms indicating the presence of GHB. FDLE does not have the resources to conduct blood tests; if blood tests are needed, the samples to be tested must be sent to outside laboratories--some of which are located in other states.

Because GHB analogs produce effects similar to GHB, driving under the influence of the analogs is just as dangerous as driving under the influence of GHB. As a result, some agencies have adopted aggressive strategies for identifying drivers who may have consumed GHB. The Pinellas-Pasco Medical Examiner's Office in Florida conducts GHB tests on drivers who are suspected of driving under the influence (DUI). In 2000 GHB was detected in approximately 8 percent of the suspected DUI cases that the office examined.

Legislation

On February 18, 2000, the "Hillory J. Farias and Samantha Reid Date-Rape Prohibition Act of 1999" (Public Law 106-172) was signed into law, legislating GHB as a Schedule I controlled substance. GBL was also regulated under this law as a List I controlled chemical. Illicit use of GHB analogs may now be prosecuted as Schedule I substances under 21 U.S. Code § 813.

GHB analogs are treated as controlled substances under Federal law only if intended for human consumption. According to 21 U.S.C. § 813, "a controlled substance analog(ue) shall, to the extent intended for human consumption, be treated, for the purposes of any Federal law as a controlled substance in Schedule I." Thus, authorities can prosecute drug offenses involving GHB analogs in the same manner as offenses involving GHB. (See 21 U.S.C. § 802(32) for the definition of a controlled substance analog(ue).)

Outlook

Deterring the distribution and abuse of GHB analogs poses unique challenges. Some analogs have legitimate purposes and are legally available. Distributors of illicit GHB analogs will continue to develop new products to disguise their activities, and illicit producers will continue to develop new GHB analogs for the same reasons. Web sites advertising these products will continue to be deceptive and ever-changing. Distributors will develop new disguises for GHB analogs in addition to marketing them as cleaning fluids and dietary supplements. Sharing current information and associated trends relating to GHB analogs among medical personnel, law enforcement officers, and laboratory personnel is essential to stemming the distribution and abuse of these analogs.

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SELECTED REFERENCES

[Note: Selected references are a compilation of recent publications of presumed interest to forensic chemists. Unless otherwise stated, all listed citations are published in English. If available, the email address for the primary author is provided as the contact information. Listed mailing address information (which is sometimes cryptic or incomplete) exactly duplicates that listed by the abstracting services.]

1. Piette V, Parmentier F. **Analysis of illicit amphetamine seizures by capillary zone electrophoresis.** J Chromatogr A 2002;979:345. [Editor's Notes: Presents a CZE methodology for analysis of typical drugs found in Ecstasy tablets. Contact: Laboratory of Drug Analysis, Scientific Institute of Public Health - Louis Pasteur, Rue Juliette Wytsman 14, B-1050 Brussels, Belgium.]

2. Briellmann TA, Dussy FE, Bovens MG. **Forensic analysis of heroin and cocaine seizures.** Chimia 2002;56:74. [Editor's Notes: Presents a survey and overview of seizures in Switzerland (date range not specified in abstract). Contact: Institute of Forensic Medicine, Pestalozzistrasse 22, CH-4004 Basel, Switzerland.]

3. Tishmack PA, Bugay DE, Byrn SR. **Solid-state nuclear magnetic resonance spectroscopy - pharmaceutical applications.** Journal of Pharmaceutical Sciences 2003;92(3):441. [Editor's Notes: A mini-review of the title topic, focusing on solid pharmaceutical drug formulations. Contact: dbugay@ssci-inc.com]

4. Kelly SA, Glynn PM, Madden SJ, Grayson DH. **Impurities in a morphine sulfate drug product identified as 5-(hydroxymethyl)-2-fufural, 10-hydroxymorphine and 10-oxomorphine.** Journal of Pharmaceutical Sciences 2003;92(3):485. [Editor's Notes: The referenced impurities were isolated by semi-prep HPLC and identified via MS and NMR. The presence of sugars in the drug formulation was implicated in the formation of the impurities. Contact: sean_kelly2@merck.com]

5. DeBoer D, Goemans WPJ, Ghezavat VR, vanOoijen RD, Maes RAA. **Seizure of illicitly produced para-fluorofentanyl: Quantitative analysis of the content of capsules and tablets.** Journal of Pharmaceutical and Biomedical Analysis 2003;31(3):557. [Editor's Notes: Presents a GC/MS methodology for the title analysis; HPLC/UV was also used to quantify caffeine being used as an adulterant. The samples derived from an illicit laboratory in the Netherlands. Contact: D deBoer, Inst Nacl Desporto, Lab Anal Dopagem & Bioquim, Av Prof, P-1600190 Lisbon, Portugal.]

6. Khalil S, Kelzieh A. **New polyvinyl chloride membrane electrode without inner reference solution for the determination of methadone.** Journal of Pharmaceutical and Biomedical Analysis 2003;31(3):601. [Editor's Notes: Presents a direct potentiometric method for analyzing methadone in pharmaceutical preparations. Contact: S Khalil, Techers Coll Riyadh, Dept Chem, POB 4341, Riyadh 11491, Saudi Arabia.]

7. Sun GX, Wang Y, Sun YQ. **The quantitative determinations of glycyrrhizic acid, glycyrrhetinic acid, morphine, and sodium benzoate in compound liquorice tablets by HPCE.** Journal of Liquid Chromatography & Related Technologies 2003;26(1):43. [Editor's Notes: Presents a CZE/UV method to perform the title analysis. Contact: Sun GX, Shenyang Pharmaceut Univ, 103 Wenhua Rd, Shenhe Dist, Shenyang 110016, Peoples R China.]

8. Jarikote DV, Siddiqui SA, Rajagopal R, Daniel T, Lahoti RJ, Srinivasan KV. **Room temperature ionic liquid promoted synthesis of 1,5-benzodiazepine derivatives under ambient conditions.** Tetrahedron Letters 2003;44(9):1835. [Editor's Notes: Presents a novel synthetic approach to the title compounds. Contact: Srinivasan KV, Natl Chem Lab, Div Organ Chem Technol, Dr Homi Bhabha Rd, Pune 411008, Maharashtra, India.]

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10. Gelfman DE, Teder O. **Method and apparatus for detection of illegal substances in commerce.** U.S. Pat. Appl. Publ. US 2003 33,851 (Cl. 73-19.01; G01N7/00), 20 Feb 2003, Appl. 927,895, 10 Aug 2001. [Editor's Notes: Presents a device for collecting and analyzing particulates of drugs, explosives, and toxic materials. The analytical basis is not specified. Contact: No address information was provided.]

Additional References of Possible Interest:

1. Robertson MD, Marinetti LJ. **Carisoprodol - Effects on Human Performance and Behavior.** Forensic Science Review 2003;15(1):1. [Editor's Notes: A minor review of the title compound, focusing on impaired driving performance. Contact: Independent Forensic Consulting, Beaumaris, Victoria, Australia.]

2. Logan BK, Couper FJ. **3,4-Methylenedioxymethamphetamine - Effects on human performance and behavior.** Forensic Science Review 2003;15(1):11. [Editor's Notes: A minor review of the title compound, focusing on impaired driving performance. Contact: Forensic Laboratory Services Bureau, Washington State Patrol, Seattle, Washington (zip code not provided in the abstract).]

3. Stout PR, Farrell LJ. **Opioids - Effects on Human Performance and Behavior.** Forensic Science Review 2003;15(1):29. [Editor's Notes: A minor review of the title compound, focusing on impaired driving performance. Contact: Navy Drug Screening Laboratory, Naval Air Station Jacksonville, Jacksonville, Florida (zip code not provided in the abstract).]

4. Mozayani A. **Phencyclidine - Effects on human performance and behavior.** Forensic Science Review 2003;15(1):61. [Editor's Notes: A general review of PCP, including information on its detection, identification, and analysis. Contact: Harris County Medical Examiner's Office, Houston, Texas (zip code not provided in abstract).]

5. Vickers AK, Rood D. **Advances in column technology.** Gas Chromatographic Techniques and Applications 2001;(No Volume #):91. [Editor's Notes: Presents a review of advances in GC column technology. Contact: Agilent Technologies / J&W Scientific, Folsom, CA 95630.]

6. Przybyl AK, FlippenAnderson JL, Jacobsen AE, Rice KC. **Practical and high-yield syntheses of dihydromorphine from tetrahydrothebaine and efficient syntheses of (8S)-8-bromomorphide.** Journal of Organic Chemistry 2003;68(5):2010. [Editor's Notes:

Dihydromorphine is prepared in 92% yield. Contact: Rice KC, NIDDKD, Med Chem Lab, NIH, Bldg 8, Room B1-22, 8 Ctr Dr, MSC 0815, Bethesda, MD 20892.]

7. Zagnoni PG, Albano C. **Psychostimulants and Epilepsy.** Epilepsia 2002;43(Supp. 2):28. [Editor's Notes: A minor review of the correlation between seizures and illicit drug use. Contact: Unita Operativa di Neurologia, ASL 15 Cuneo, Italy.]

8. Da Matta Chasin AA, De Carvalho DG, Pedrozo MDFM, De Souza MC, Sanson LN. **Occurrence of lidocaine in samples of crack/cocaine seizures in the metropolitan region of Sao Paulo and in biological fluids analysed in the Forensic Toxicology Laboratory, Medical Legal Institute (IML) in Sao Paulo from January to June of 2000.** Bull TIAFT 2003;33(1):7. [Editor's Notes: Includes analysis data from seized drugs; however, primary focus is analysis of biological fluids. Contact: IML, Medical Legal Institute, Sao Paulo, Brazil.]

9. Song YR, Wang DF, Hu YP, Chen XX, Jiao YG, Hou DY. **Direct separation and quantitative determination of clenbuterol enantiomers by high performance liquid chromatography using an amide type chiral stationary phase.** Journal of Pharmaceutical and Biomedical Analysis 2003;31(2):311. [Editor's Notes: Focus is on profiling clenbuterol enantiomers in human serum. Contact: Song YR, Beijing Normal Univ, Dept Chem, Beijing 100875, Peoples R China.]

10. Myers S. **Forensic science.** Nature 2003;421(6925):872. [Editor's Notes: Presents a minor overview of the development of forensic DNA laboratories; includes some general comments of interest on the "real-life value" of forensic laboratories. Contact: No address information was provided.]

11. Petersen JR, Ohorodudu AO, Mohammad A, Payne DA. **Capillary Electrophoresis and its application in the clinical laboratory.** Clinica Chimica Acta 2003;330(1-2):1. [Editor's Notes: Presents an overview of CE use and potential in clinical laboratories, comparing and contrasting to traditional electrophoretic and HPLC methods. Contact: Department of Pathology, University of Texas Medical Branch, Galveston, TX (zip code not provided).]

12. Matsumoto T, Sano T, Matsuoka T, Aoki M, Maeno Y, Nagao M. **Case Report: Simultaneous determination of carisoprodol and acetaminophen in an attempted suicide by liquid chromatography - mass spectrometry with positive electrospray ionization.** Journal of Analytical Toxicology 2003;27(2):118. [Editor's Notes: Presents the analysis of carisoprodol, meprobamate, and acetaminophen by LC/MS. The focus is biological testing of urine and plasma. Contact: Aichi Prefectural Police Hdqrs., Criminal Investigation Laboratory, 1-1 Sannomaru 2-chome, Naka-ku, Nagoya 460-8502, Japan.]

13. Li J. **Determination of cocaine and its metabolites.** Zhongguo Yaowu Yilaixing Zazhi 2002;11(2):90. [Editor's Notes: A review on the detection of cocaine and its metabolites. This article is written in Chinese. Contact: Normal College of Vocational Technology, Peking United University, Beijing 100011, Peop. Rep. China.]

14. Cordani P. **Self defense test strip package for drug testing in food and drinks.** U.S. Pat. Appl. Publ. US 2003 26,731 (Cl. 422-58;G01N31/22), 6 Feb 2003, Appl. 923,507, 6 Aug 2001. [Editor's Notes: Discusses a test-strip in the shape of a drinking straw or stirrer for discreetly determining the presence of (undeclared) drugs (presumably date-rape drugs). Contact: No address information was provided.]

15. Brennan J, Dillon P, OKennedy R. **Production, purification and characterisation of genetically derived scFv and bifunctional antibody fragments capable of detecting illicit drug residues.** Journal of Chromatography B - Analytical Technologies in the Biomedical and Life Sciences 2003;786(1-2):327. [Editor's Notes: The referenced antibodies were created to detect morphine, and were applied to saliva. Contact: J Brennan, Dublin City Univ, Sch Biotechnol, Appl Biochem Grp, Dublin 9, Ireland.]

16. Mancinelli R, Guiucci MS. **Procedural and interpretative problems in the determination of drugs of abuse.** Annali dell'Istituto Superiore di Sanita 2002;38(3):305. [Editor's Notes: Presents an overview of the state of the art of analytical toxicology. This article is written in Italian. Contact: Laboratorio di Biochimica Clinica, Istituto Superiore di Sanita, Rome, Italy.]

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EMPLOYMENT OPPORTUNITIES

1. Johnson County Sheriff's Office Criminalistics Laboratory (2 Positions) (Third and Final Posting)

Position 1: DNA Technical Leader/ Forensic Chemist
Location: Mission, Kansas (Kansas City metropolitan area)
Salary: $50,564.80 to $72,280.00 per year
Application Deadline: Open Until Filled

Duties: This position will serve as the laboratory's DNA Technical Leader and section coordinator. The major duties of this position include overseeing the technical operations of the Biology Section to ensure compliance with the American Society of Crime Laboratory Directors/Laboratory Accreditation Board Standards (ASCLD/LAB) as well as the Quality Assurance Standards for Forensic DNA Testing Laboratories standards. In addition, this position will have some casework responsibility; including evaluating the nature, origin and significance of physical evidence both in the laboratory and at crime scenes; performing physical, chemical, biochemical and genetic analysis of biological material associated with evidence using DNA analysis methods; maintaining laboratory records, preparing written technical reports of analysis, and providing effective expert testimony in courts of law. This position will oversee the training of laboratory examiners and the evaluation and implementation of new scientific techniques for the DNA section of the laboratory. The successful applicant will also be a commissioned Deputy Sheriff.

General Requirements: Candidates must meet the educational and experience requirements for a DNA Technical Leader as published in Section 5.2 of the Quality Assurance Standards for Forensic DNA Testing Laboratories (U.S. Department of Justice, Federal Bureau of Investigation, 07/15/98). These guidelines are available on-line at: http://www.cstl.nist.gov/biotech/strbase/dabqas.htm Candidates without a Master's degree must already possess a waiver of the degree requirements as provided in section 5.2.1.1 of the above standards. The successful candidate must also meet the minimum qualifications of a Deputy Sheriff.

The applicant will be required to successfully complete the Kansas Law Enforcement Training Center curriculum. Also, the applicant will be required to successfully complete a laboratory training program in biology and a qualifying test before beginning independent casework responsibilities.

Position 2: Firearms and Tool Mark Examiner
Location: Mission, Kansas (Kansas City metropolitan area)
Salary: $50,564.80 to $72,280.00 per year
Application Deadline: Open Until Filled

Duties: The major duties include examining firearms for function; comparison with bullets and cartridge cases; serial number restoration; GSR examination of clothing associated with firearm cases; and tool mark examinations. Other duties may be assigned based upon the qualifications of the successful applicant. The successful applicant will become a commissioned Deputy Sheriff and will be required to complete the Kansas Law Enforcement Training Center curriculum. Also, the successful applicant will be required to successfully complete a qualifying test before beginning independent casework responsibilities.

General Requirements: A minimum of three years of experience in firearm and tool mark examination. Experience must include the completion of a two-year, full-time training program under the direction of an experienced firearms and tool mark examiner. In addition, the successful candidate must have a least one-year of experience doing independent casework examination and being qualified as an expert witness in a court of law in the area of firearms and tool mark examination. Experience with the National Integrated Ballistic Information Network (NIBIN) and familiarity with the Association of Firearms and Tool Mark Examiners' (AFTE) Guidelines and the American Society of Crime Laboratory Directors/Laboratory Accreditation Board's (ASCLD/LAB) Standards is desired. Applicants must also meet the minimum qualifications of a Deputy Sheriff.

Application Procedures for both Positions: Applications can be obtained by contacting the Sheriff's Department Personnel Division at the following address.

Johnson County Sheriff's Department, Personnel and Training, 125 N. Cherry, Olathe, KS 66061; Phone: (913) 791-5511 (or Toll Free at: (866) 262-3744)

Additional Information about this position can be obtained from Director L. Keith Kerr at the Crime Laboratory by calling: (913) 826-3209.

The Johnson County Sheriff's Department does not discriminate on the basis of race, color, national origin, sex, religion, age, or disabled status in employment or the provision of programs and services.

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SCIENTIFIC MEETINGS

1. **Title: Mid-Atlantic Association of Forensic Sciences (MAAFS) Annual Meeting** (Second and Final Posting)
Sponsoring Organization: Mid-Atlantic Association of Forensic Sciences
Inclusive Dates: May 5 - 9, 2003
Location: Annapolis, MD (Sheraton Barcelo)
Meeting Registration Procedure, Deadline, and Costs: [See website]
Recommended Lodging (Registration Deadline and Costs): [See website]
Contact Individual's Name, Phone Number, and email Address: [See website]
Website: [www.maafs.org/annualmeeting.htm]

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2. **Title: Annual New England Seminar in Forensic Sciences** (Second Posting)
Sponsoring Organization: Colby College, Special Programs
Inclusive Dates: August 10 - 14, 2003
Location: Colby College, Waterville, ME
Meeting Registration Procedure, Deadline, and Costs: [See website]
Recommended Lodging (Registration Deadline and Costs): [See website]
Contact Individual's Name, Phone Number, and email Address: Jesse Davis, 207/872-3386 (FAX -3383), summer@colby.edu
Website: [www.colby.edu/spec.prog/cme.html]

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3. **Title: 29th Annual Meeting of the Northeastern Association of Forensic Scientists** (First Bimonthly Posting)
Sponsoring Organization: Northeastern Association of Forensic Scientists
Inclusive Dates: November 5 - 8, 2003
Location: Crowne Plaza Hotel, Pittsfield, MA
Meeting Registration Procedure, Deadline, and Costs: [Not Provided]
Recommended Lodging (Registration Deadline and Costs): [Not Provided]
Contact Individual's Name, Phone Number, and email Address: Jennifer F. Limoges, 518/457-0054 (FAX 485-8502), jlimoges@troopers.state.ny.us
Website: [Not Provided]

4. **Title: SWAFS 2003 Training Conference** (First Bimonthly Posting)
Sponsoring Organization: Southwestern Association of Forensic Scientists
Inclusive Dates: November 3 - 6, 2003
Location: Radisson Plaza Hotel, Fort Worth, TX
Meeting Registration Procedure, Deadline, and Costs: [Not Provided]
Recommended Lodging (Registration Deadline and Costs): [see: www.radisson.com/ftworthtx 800/333-3333]
Contact Individual's Name, Phone Number, and email Address: Michelle O'Neal, 817/920-5700, x163, fortworth2003@swafs.org
Website: [www.swafs.org]

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THE DEA FY - 2003 STATE AND LOCAL FORENSIC CHEMISTS SEMINAR SCHEDULE

The remainder of the FY - 2003 schedule for the DEA's State and Local Forensic Chemists Seminar is as follows:

June 9 – 13, 2003
September 15 – 19, 2003

Note that the school is open only to forensic chemists working for law enforcement agencies, and is intended for chemists who have completed their agency's internal training program and have also been working on the bench for at least one year. There is no tuition charge for this course. The course is held in Northern Virginia, near the Washington/Dulles International Airport. For additional information, eligibility requirements, or to enroll, see the September 2002 issue of *Microgram Bulletin*, or call 703 668-3337.

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Computer Corner #170

Technical and Administrative Reviews

by Michael J. Phelan
DEA Special Testing
and Research Laboratory

One of the essential elements of a digital evidence laboratory quality assurance program is a thorough review of the draft reports of examination. The review process should utilize a check and balance philosophy to ensure that the final reports are both technically sound and administratively consistent with laboratory policies. Digital evidence examination reports are often quite complex because the findings are usually both numerous and varied. Reports typically include a mixture of statements of fact and examiner opinions.

DEA's review process operates on two different levels. A Group Supervisor or senior examiner performs the first level (technical) review, while the Laboratory Director usually conducts the second level (administrative) review. The technical review covers seven reporting areas, as follows:

Report Identification

First, the descriptive identification information is checked. Case numbers, exhibit numbers, laboratory numbers, file title, and report distribution are compared to the original documentation and verified.

Case Examination File

Second, the case examination folder is reviewed to ensure completion of all appropriate internal laboratory forms. DEA's Digital Evidence Laboratory makes extensive use of "check the box" or "fill in the blank" forms to ensure that the evidence is adequately characterized for both identification and examination purposes. A typical examination first requires a form describing all objects to be examined. A second form that describes the computer, its peripherals, and pertinent hardware or firmware information (including CMOS clock setting and hard drive geometry information) is checked. A third form that focuses on the hard drive(s), detailing the number of hard drives, storage capacity, partition numbers, and file structures is reviewed. A fourth and final form that details all of the parameter settings used by the examiner to acquire a copy of the original evidence is also checked.

Chain of Custody

The third reporting area covers the chain of custody, which is reviewed by comparing the submitted evidentiary paperwork to the report narrative. Appropriate signature completion blocks are reviewed on the incoming chain of custody document. Computer make, model, and serial number documentation, along with hard drive make, model, and serial number are verified. Other incoming evidence documentation, such as United States Postal Service registered mail or Federal Express shipping numbers, and counts of objects submitted for examination, are also reviewed. Most of this information is recorded on the internal laboratory forms as well as in the report of examination narrative. All of this information must be accurately recorded.

This information is very important, because a typical chain of custody suppression motion will most likely focus on any discrepancies in this area. [This is because it is the least technical and therefore one of the best understood aspects of evidence handling and analysis by defense attorneys.]

Report Organization

Fourth, the report is reviewed for general content. At DEA, this consists of an inspection of the organizational format and standard findings paragraph. DEA's organizational review consists of a simple check of layout format to insure that all findings paragraphs are numbered in accordance with DEA laboratory policy, and also that the report synopsis is concise and to the point. The standard findings paragraphs can be extensive, and will reflect individual laboratory examination protocols. DEA's standard findings paragraphs usually consist of the following: 1) A statement documenting the duplication of the original evidence to make a working copy, and the recording of an archive copy onto a tape; 2) A statement documenting a computer virus scan (and the results); 3) An enumeration of the key word search terms; 4) A listing of all file names, with associated date and time stamp information; and 5) The documenting of the sealing of the archive backup tape in a numbered DEA heat seal evidence envelope.

Findings Assessed

Fifth, the case specific findings detailed in the body of the report of examination are reviewed. Typically, findings are stored on a CD in a format that is easily accessed by the Case Agent. The report of examination should clearly identify where the finding of interest (such as a file or file fragment) was found on the original evidence (directory and file name, or hard drive sector). Additionally, the location of the file copy of the finding on the report's accompanying CD needs to be documented. Occasionally, findings are printed onto paper, and initialed and dated by the examiner. The findings should be organized into simple paragraphs to simplify reader understanding and focus. A one-sentence summary of each finding is included in the report, to indicate to the reader what kind of information has been recovered and included on the CD. This synopsizing process facilitates the rapid review of the material by the Case Agent. For example, financial information belonging to the XYZ business, or e-mail belonging to badguy@domain.com was found in the "My Documents" folder, and was copied to the "My Documents" folder on the findings CD. Findings must also be documented in the examination notes. A technical review of the findings should assess the wording used by the examiner. Technical jargon such as free space, slack area, and carve, if needed, should be kept to a minimum and explained in layman's terms when possible.

CD Check

Sixth, a CD containing the findings must be checked to ensure that the findings (files or file fragments) referenced in the

report of examination are all present and can all be opened. It is important that every file cited in the report of examination be precisely named as stated in the report, and located exactly where the report states it to be. Also, the CD containing the findings must be appropriately labeled, initialed, and dated by the examiner. The CD is the equivalent of a paper attachment.

Methodology Review

Seventh, the examination checklist needs to be reviewed. Have the broad examination milestones such as file browsing, keyword searching and file execution tasks been completed? Findings and conclusions must be consistent with the methodology and software tools utilized. Both the base examination software (such as Encase, Ilook, or Forensic Tool Kit) and any specialty examination software (such as e-mail reader software or data carving software) need to be documented.

Administrative Review

A second individual, usually the Laboratory Director, conducts the administrative review. The administrative review spot checks the previously described technical review areas, and also looks at the overall scope of examination to determine if the level of effort was commensurate with the type and seriousness of the case. Administrative reviews also critically assess the language used in the report, to ensure that all assertions and conclusions are supportable and can be easily understood by non-technical personnel.

This two-tier review process is an excellent method of ensuring both quality control and uniformity of effort within the laboratory. Reviews are time consuming, averaging 30-45 minutes per report.

A third tier can be added to the process by establishing a quarterly peer review committee to further check the work of the technical and administrative reviewers. The use of peer review committee is a well recognized quality assurance technique in most forensic laboratories, and is highly recommended.

Typical Problems Detected

The typical types of problems that are detected in the review process fall into two categories. New examiners often have problems with their writing styles, i.e.; their reports are too technical and/or contain unnecessary, overstated, or unsupported statements. More senior examiner personnel occasionally become lackadaisical or complacent, and the examination note quality or details in their report writing become deficient. The findings CD may not be thoroughly checked, or files may not be accessible or properly labeled. DEA has found the dual review process invaluable in producing a reliable product on a consistent basis.

Questions or comments?
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