

NISTIR 6518

**1999 Survey of Forensic
Reference Materials**

United States Department of Commerce
NIST Technology Administration
National Institute of Standards and Technology

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The Law Enforcement and Corrections Standards and Testing Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationally and internationally.

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November 2000



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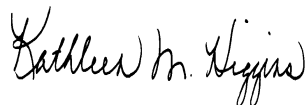
ACKNOWLEDGMENTS

The report reflects the insight and expertise of many people. The Office of Law Enforcement Standards (OLES) of the National Institute of Standards and Technology (NIST) wishes to acknowledge funding from the National Institute of Justice (NIJ) and the special contributions of individuals whose efforts and suggestions have significantly influenced this report. Notably, the nine members of the Technical Advisory Panel (TAP) for Reference Materials for Forensic Science deserve special recognition:

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This report benefitted greatly from the guidance and direction of Alim A. Fatah, Ph.D., Project Officer and Program Manager for Chemical Systems and Materials at the Office of Law Enforcement Standards. OLES would like to acknowledge the work of Aspen Systems Corporation, especially the efforts of Marie Pogozelski, Project Director and Manager of Aspen's Survey Operations Center, as well as William Tillstone, Ph.D., of the National Forensic Science Technology Center, who serves as a consultant to Aspen Systems. OLES also wishes to recognize the support services provided by Aspen's Communications, Word Processing, Library Services, and Health Programs Divisions, and the sponsorship of Dr. David G. Boyd, Director, Office of Science and Technology at NIJ.

Sincerely,



Kathleen M. Higgins, Director
Office of Law Enforcement Standards

FOREWORD

The Office of Law Enforcement Standards (OLES) of the National Institute of Standards and Technology (NIST) furnishes technical support to the National Institute of Justice (NIJ) program to strengthen law enforcement and criminal justice in the United States. OLES's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

OLES is: (1) Subjecting existing equipment to laboratory testing and evaluation, and (2) conducting research leading to the development of several series of documents, including national standards, user guides, and technical reports.

This document covers research conducted by OLES under the sponsorship of the National Institute of Justice. Additional reports as well as other documents are being issued under the OLES program in the areas of protective clothing and equipment, communications systems, emergency equipment, investigative aids, security systems, vehicles, weapons, and analytical techniques and reference materials used by the forensic community.

Technical comments and suggestions concerning this report are invited from all interested parties. They may be addressed to the Office of Law Enforcement Standards, National Institute of Standards and Technology, 100 Bureau Drive, Stop 8102, Gaithersburg, MD 20899-8102.

Kathleen M. Higgins, Director
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EXECUTIVE SUMMARY

As demands on the Nation's crime laboratories escalate in response to technological advances and new legal requirements for processing evidence, many forensic scientists face a critical deficiency of essential reference materials and collections required to perform their jobs. This disturbing conclusion is based on a comprehensive, scientific survey of public crime laboratories sponsored by the Office of Law Enforcement Standards of the National Institute of Standards and Technology and funded by the National Institute of Justice. The survey was conducted to assess the reference materials and collections that were available in forensic laboratories and to determine which were not available and in greatest demand. This report presents the results of that survey.

The survey included laboratories from every region of the United States. They ranged in size and services provided, from small, single-service drug analysis facilities to full-service laboratories. More than half were State crime laboratories. The majority of laboratories surveyed were accredited by the American Society of Crime Laboratory Directors.

More than 550 survey responses were processed, including 121 from laboratory directors and 431 from section supervisors within the laboratories. Because the questionnaire was customized for each of the two groups, the responses of the laboratory directors and section supervisors were analyzed separately.

The laboratory directors indicated that the most common uses of reference materials in their laboratories were for interpretation of test results, as training or instructional aids, and for classification of evidence. The vast majority of directors were aware of the guidelines established by Scientific Working Groups in various forensic disciplines and indicated that the most frequently used guidelines were those for DNA, controlled substances, and trace analysis. The survey found widespread support among laboratory directors for the creation of a national repository for standard reference collections.

The responses of the 451 section supervisors comprise the vital core of this survey. Their responses are especially significant because these supervisors are the frontline scientists in U.S. crime laboratories. Overwhelmingly, they expressed a critical need for basic information resources that should be available in every laboratory. These resources—books, journals, printed and computer databases, reference manuals—are readily available yet severely lacking in the laboratories. Under current accreditation standards, literature and electronic information are not considered essential items. Consequently, management may have less incentive to provide these items. But, it is clear from the survey results that bench scientists consider books, journals, printed databases, and computer databases essential to proper job performance.

The survey sought to determine which reference materials and reference collections the scientists needed most and which collections they felt they needed in the 21st century. All reference materials and collections are important to forensic scientists, of course, regardless of whether a material is used every day or once a year. Any material that facilitates the identification of crime scene evidence is critical. The reference materials and collections that the supervisors indicated they needed were organized into 23 primary groups of physical objects and 2 primary groups of drugs. Since the responses within these primary groups varied widely, from very specific to generic, many of the groups were further classified and organized into useful and meaningful subcategories.

The discrete physical **reference materials** that supervisors needed most were fiber, biological specimens, and DNA. Within the fiber group, the materials cited most often were fibers by end use (e.g., insulation, carpet fibers, and modacrylic fibers), synthetic fibers, and nonspecified natural fibers. The largest subgroups within biological specimens were blood toxicology and human sperm. The DNA requests were for qualitative and quantitative standards regardless of the analytical methods.

Other physical materials in the top third were ammunition, paint, explosives, accelerants, and glass. The largest concentrations within the paint group were physical specimens of automotive (domestic and foreign) and nonspecific (architectural and automotive) paints. Within the ammunition, explosives, accelerants, and glass groups, however, no individual subgroup accounted for a majority of the materials cited.

Drugs were analyzed separately, grouped by noncontrolled and controlled substances. Although crime laboratories are primarily concerned with the analysis of illicit drugs, requests for samples of noncontrolled drugs outnumbered those for controlled substances. One possible explanation may be that when laboratories do encounter noncontrolled substances, they do not have or cannot obtain the needed reference samples.

In **reference collections**, two of the top three reference materials cited—fiber and biological specimens—were also among the top three reference collections cited. The other primary groups cited in the top third of the collections were hair, ammunition, paint, accelerants, and firearms.

In the fiber group, which ranked first in both materials and collections, the need for reference collections was highest in the areas of synthetic fibers, nonspecified natural fibers, and generic fibers of all types. In the biological specimens area, collections of human and nonhuman blood and semen had the most citations.

An analysis of the other top primary groups in reference collections revealed a need for collections of both animal and human hair. Within the paint group, physical samples of both foreign and domestic automotive paint collections accounted for more than half of the citations. Within the accelerants group, ignitable liquids accounted for the majority of citations. In both ammunition and firearms, the top subgroups were general descriptions of ammunition and firearms collections. Since drugs were evaluated individually, not as collections, there was less interest in collections of drugs than in collections of physical objects.

Future collections—those that scientists indicated they would need in the century ahead—may be collections that already exist or collections that are no longer available through a commercial source or from the manufacturer. The fiber and paint groups remain on top of the list. Among the fiber subgroups, the most frequently cited future collections were nonspecified natural fibers, fibers by end use, and synthetic fibers. The supervisors indicated a continued need for foreign and domestic automotive paint specimens, along with nonspecific paint, including both automotive and architectural paint specimens. Laboratory personnel may not be aware that some of these collections are available through commercial firms and government agencies. It is also possible that their need for these collections can be traced to insufficient funds. Although not a subject of this survey, the problem of inadequate funding for public crime laboratories nationwide emerged repeatedly as a pressing issue that needs to be addressed.

This survey clearly identifies the specific reference materials and collections that crime laboratories require today, as well as those that will be needed in the years ahead. Based on these survey results, the Federal and State governments can target initiatives for developing reference materials and collections. The Scientific Working Groups sponsored by the Federal Bureau of Investigation and Drug Enforcement Administration may also use these results to produce and distribute these essential reference materials. In focusing attention on the vital reference and collection needs of the Nation's public crime laboratories, the survey is also likely to foster greater communication and cooperation within the forensic science community.

COMMONLY USED SYMBOLS AND ABBREVIATIONS

A	ampere	H	henry	nm	nanometer
ac	alternating current	h	hour	No.	number
AM	amplitude modulation	hf	high frequency	o.d.	outside diameter
cd	candela	Hz	hertz (c/s)	Ω	ohm
cm	centimeter	i.d.	inside diameter	p.	page
CP	chemically pure	in	inch	Pa	pascal
c/s	cycle per second	IR	infrared	pe	probable error
d	day	J	joule	pp.	pages
dB	decibel	L	lambert	ppm	parts per million
dc	direct current	L	liter	qt	quart
EC	degree Celsius	lb	pound	rad	radian
EF	degree Fahrenheit	lbf	pound-force	rf	radio frequency
dia	diameter	lbf \approx in	pound-force inch	rh	relative humidity
emf	electromotive force	lm	lumen	s	second
eq	equation	ln	logarithm (base e)	SD	standard deviation
F	farad	log	logarithm (base 10)	sec.	section
fc	footcandle	M	molar	SWR	standing wave ratio
fig.	figure	m	meter	uhf	ultrahigh frequency
FM	frequency modulation	min	minute	UV	ultraviolet
ft	foot	mm	millimeter	V	volt
ft/s	foot per second	mph	miles per hour	vhf	very high frequency
g	acceleration	m/s	meter per second	W	watt
g	gram	N	newton	λ	wavelength
gr	grain	N \approx m	newton meter	wt	weight

area=unit² (e.g., ft², in², etc.); volume=unit³ (e.g., ft³, m³, etc.)

PREFIXES

d	deci (10 ⁻¹)	da	deka (10)
c	centi (10 ⁻²)	h	hecto (10 ²)
m	milli (10 ⁻³)	k	kilo (10 ³)
μ	micro (10 ⁻⁶)	M	mega (10 ⁶)
n	nano (10 ⁻⁹)	G	giga (10 ⁹)
p	pico (10 ⁻¹²)	T	tera (10 ¹²)

COMMON CONVERSIONS

(See ASTM E380)

0.30480 m = 1 ft	4.448222 N = 1 lbf
2.54 cm = 1 in	1.355818 J = 1 ft \approx lbf
0.4535924 kg = 1 lb	0.1129848 N \approx m = 1 lbf \approx in
0.06479891 g = 1 gr	14.59390 N/m = 1 lbf/ft
0.9463529 L = 1 qt	6894.757 Pa = 1 lbf/in ²
3600000 J = 1 kW \approx hr	1.609344 km/h = 1 mph

Temperature: $T_{EC} = (T_{EF} - 32) \times 5/9$

Temperature: $T_{EF} = (T_{EC} \times 9/5) + 32$

1999 SURVEY OF FORENSIC REFERENCE MATERIALS

This survey of the Nation's public crime laboratories was conducted in response to a critical need identified by the Office of Law Enforcement Standards (OLEs) of the National Institute of Standards and Technology (NIST). That need—to determine the current status of, and need for, reference materials (RMs) and standard reference collections (SRCs) in U.S. crime laboratories—reflects significant developments that have transformed the judicial environment since the last such survey was conducted more than two decades ago. The 1977 survey, *Standard Reference Collections of Forensic Science Materials: Status and Needs*, was considered groundbreaking at the time. Its relevance has diminished, however, as new technologies and new legal requirements have changed the way crime laboratories operate. Scientific advances such as DNA analysis and digital image technology, along with legal requirements for scientifically evaluated evidence, have added to the workload of public crime laboratories, many of which are understaffed and operating with inadequate funds.

In response to the rising demand for laboratory services, moreover, the number of public crime laboratories has increased rapidly, with little national or regional planning and coordination. Because the separation of Federal and State powers precludes the creation of a national system of crime laboratories, a growing number of independent laboratories also have emerged at the national, State, and local levels. This survey sought to enhance cooperation and communication among State, county, Federal, municipal, and regional crime laboratories by giving every public crime laboratory in the United States an opportunity to express its need for reference materials and standard reference collections.

Reference Materials and Collections

Access to reference materials and collections is essential to crime laboratory efforts to identify and assign values to materials, calibrate instruments, assess measurement methods, and provide training and education for law enforcement personnel. Furthermore, certified reference materials and collections improve efficiency, enabling cases to be closed more quickly and to withstand the critical scrutiny of expert witnesses.

A reference material (RM) is a material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. RMs aid forensic scientists in identifying items found at a crime scene by comparing them to a known material or substance. The number of RMs is limitless and may include paints, natural fibers, firearms, shoeprints, hair, glass, human body fluids, drugs, or cosmetics. An SRC is an accumulation of like substances that can be used to assist in the classification and individualization of evidential materials collected. SRC forms include physical specimens, spectra, photomicrographs, characterization data, and identification markings.

Currently, the major Federal crime laboratories—those of the Federal Bureau of Investigation; the Drug Enforcement Administration; the Bureau of Alcohol, Tobacco, and Firearms; and the U.S. Postal Service—maintain a limited number of RMs and SRCs. In addition, State and

municipal crime laboratories have purchased or developed a small number of reference materials and collections for training or investigative use.

This survey is a systematic, scientific study of the RMs and SRCs that crime laboratories need in order to expand their investigative capabilities and improve their efficiency. In the process, the survey also identifies what reference collections will be needed in the future. The results presented in this report will enable OLES to target initiatives for developing the reference materials and collections that are in greatest demand.

Survey Design

The 1999 *Survey of Reference Materials for Forensic Science* was intentionally designed to capture the opinions of frontline scientists in the Nation's public crime laboratories. To this end, data were gathered from the laboratories using a two-part, self-administered mail survey: one for laboratory directors and one for section supervisors. The first part, the laboratory director questionnaire, captured information on basic laboratory characteristics, the use of Scientific Working Group guidelines, the need for and usefulness of a national repository of reference materials, and the use of certified reference materials. The head of each department or unit within the laboratory (e.g., DNA Analysis, Questioned Documents, Trace Evidence) completed the second part, the Section Supervisor Questionnaire. While only one Laboratory Director Questionnaire was completed per facility, the manager of each unit or service within the laboratory was asked to complete a Section Supervisor Questionnaire. This design was necessary to capture the diversity of services provided by these crime laboratories, which ranged from a single-service drug analysis laboratory to a full-service facility.

To ensure that the laboratory directors and section supervisors had a shared understanding of the terms used in the questionnaires, standard definitions of a reference material and a reference collection were provided on the first page of each questionnaire. The survey instruments are presented in appendix A.

Findings: Laboratory Director Survey

The public crime laboratories surveyed for this report represent a diverse population. They varied in size from small municipal or county laboratories to large, statewide systems of laboratories providing specialized services.

The laboratory director questionnaire ascertained basic laboratory characteristics such as the type of laboratory (e.g., Federal, State, municipal); whether the laboratory was part of a system of laboratories (to determine if the survey covered other laboratories and if so, how many); whether the laboratory was accredited by the American Society of Crime Laboratory Directors (ASCLD) and if not, whether such accreditation would be sought in the future; and the organizational structure of the laboratory. The survey also asked laboratory directors if they were aware of the guidelines established by Scientific Working Groups (SWGs), formerly known as Technical Working Groups (TWGs), and if so, which of the SWG guidelines they currently use or plan to use in the future. The questionnaire then asked the laboratory directors about the need for a national repository for SRCs, the primary and top three uses of such a repository (ranked from a

predetermined list), what kinds of specimens or data should be archived at the repository, whether the director’s laboratory was a potential resource for physical specimens or data, and how a national repository should be funded. Finally, the survey asked laboratory directors to identify, from a predetermined list, how the laboratory uses RMs and SRCs.

The overall response rate, based on the number of laboratory director questionnaires returned, was 34.3 % (121 of 352). Exhibit 1, which presents the percentage of responses by type of laboratory, indicates that more than half of the responses came from State crime laboratories.

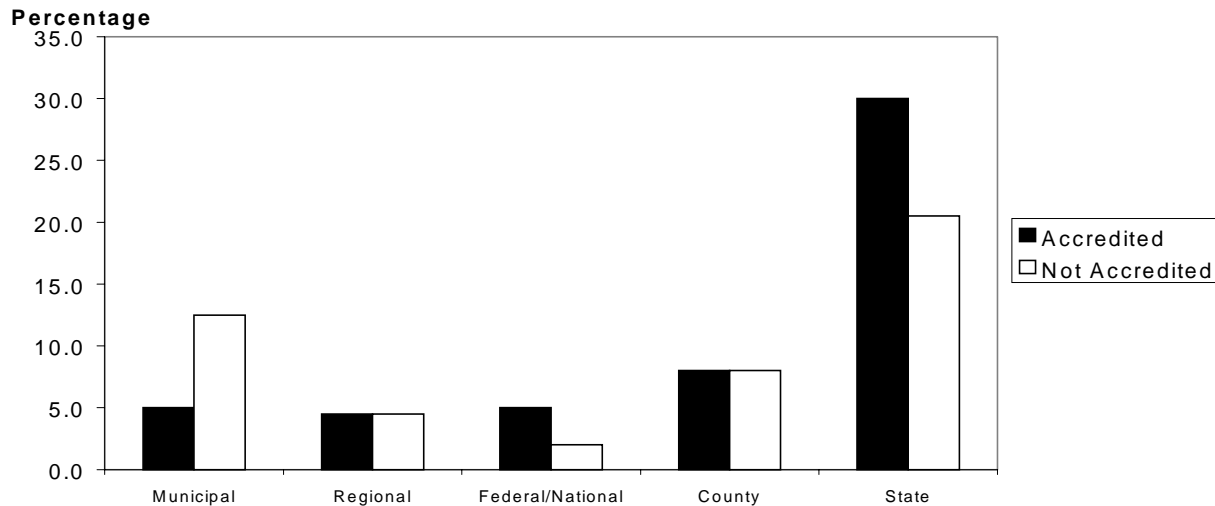
Exhibit 1. Response by type of laboratory

Type of lab	Percentage	Number
State	51.2	62
Municipal	17.4	21
County	16.5	20
Regional	8.3	10
Federal/National	6.6	8
Total	100.0	121

Slightly less than half of the laboratory directors (48.8 %, n=59) indicated that their laboratories were part of a system. Of those who reported being part of a system, slightly more than a quarter (28.8 %, n=17) incorporated data from other system laboratories in their surveys. Each of these 17 laboratories included data for between one and seven additional laboratories, for a total of 60 other laboratories. Most of the laboratories that included other system laboratories in their responses (15 of the 17) were State laboratories. With the 60 additional system laboratories included, the adjusted response rate for the survey was 51.4 % or 181 laboratories. Statistics cited for the laboratory director survey, however, are based on the 121 surveys completed.

When asked about accreditation by ASCLD, slightly more than half of the laboratories (52.9 %, n=64) reported that they were accredited. The majority of laboratory directors whose laboratories were not accredited indicated that they would be seeking accreditation in the future (89.3 %, n=50). Since physical plant is one factor in accreditation, some laboratories need to obtain funding for either a new facility or renovation of the existing facility. The highest proportion of accredited laboratories was found among State laboratories, nearly a third of which were accredited (30.6 %, n=37). ASCLD accreditation by type of laboratory is presented in Exhibit 2.

Exhibit 2. ASCLD accreditation by type of laboratory



Only a few laboratory directors (10.7 %, n=6) indicated that they were not planning to seek accreditation for their laboratories. Two of those laboratories were municipal and four were State facilities. One laboratory did not respond to the question.

Scientific Working Group Guidelines

The vast majority of laboratory directors (90.9 %, n=110) indicated that they were aware of the guidelines established by SWGs in various forensic disciplines. Laboratory directors were asked whether they currently use some or all of the SWG guidelines or plan to use them in the future. The top three SWG guidelines being used were SWGDAM for DNA (33.48 %, n=75), SWGDRUG for controlled substances (16.07 %, n=36), and SWGMAT for trace analysis (14.29 %, n=32). The widespread use of the DNA guidelines can be attributed to several factors. SWGDAM, which was created in 1988, has the oldest established guidelines, and use of those guidelines is mandatory for receipt of Federal funds for DNA analysis.

The relatively low usage of the guidelines for SWGFEX for explosives (4.46 %, n=10) and SWGIT for image technology (2.23 %, n=5) can be traced to the fact that compliance with these guidelines is voluntary. In addition, some SWGs, such as SWGDE for digital evidence, have not yet published their guidelines. Furthermore, while laboratory directors are probably aware of the SWG guidelines, they may have only limited knowledge about whether the guidelines are actually used in the laboratories, since the directors are not responsible for writing the manuals and guidelines that are used in the laboratories. Exhibit 3 presents the use of each SWG's guidelines.

Exhibit 3. Use of Scientific Working Group guidelines

Scientific Working Group	Currently use some/all guidelines		Plan to use guidelines in future		No plan to use guidelines in future	
	Percentage	Number	Percentage	Number	Percentage	Number
DNA (SWGDM)	33.48	75	1.80	5	0.0	0
Drugs (SWGDRUG)	16.07	36	16.19	45	10.26	8
Trace (SWGDMAT)	14.29	32	15.83	44	10.26	8
Firearms (SWGDMG)	10.71	24	14.39	40	11.54	9
Fingerprints (SWGDMF)	10.27	23	10.79	30	14.10	11
Documents (SWGDMOC)	6.25	14	10.07	28	14.10	11
Explosives (SWGDMEX)	4.46	10	10.79	30	7.68	6
Image Technology (SWGDMIT)	2.23	5	8.99	25	16.67	13
Digital Evidence (SWGDMDE)	2.23	5	11.15	31	15.38	12

National Repository

When asked about the need for a national repository for standard reference collections, most laboratory directors (91.1 %, n=109) felt that such an archive was needed. Not surprisingly, the vast majority (97.1 %, n=104) believed that the creation of a national repository was either very important (58.4 %, n=62) or somewhat important (38.7 %, n=41). When asked to elaborate on why they thought the repository was important, the primary reasons were to improve standards and uniformity, improve forensic science, and assist individual laboratories that lack resources (see exhibit 4). The verbatim responses of the laboratory directors are presented in appendix B.

Exhibit 4. Importance of a national repository

Importance	Percentage	Number
Improve standards and uniformity	23.4	18
Improve forensic science	19.5	15
Assist individual laboratories lacking resources	14.3	11
Save time and resources	13.0	10
Better access to rare collections	10.4	8
Improve knowledge of what is available	6.5	5
Not practical and too expensive	5.2	4
Useful depending upon need	3.9	3
Miscellaneous	3.9	3

Laboratory directors were also asked to choose, from a predetermined list, which of nine possible uses for a national repository were the primary ones. Training and instructional uses (13.9 %) were cited most frequently, followed by a tie between classification (13.4 %), and interpretation of test results (13.4 %). In a follow-up question, they were asked to rank the top three uses of such a repository. Overall, the laboratory directors ranked the following uses as their top three selections: interpretation of test results, baseline calibration, and acceleration of analysis (see exhibit 5).

Exhibit 5. Primary use of a national repository identified by laboratory directors

Primary use of a national repository	Ranking	Primary use selection	
		Percentage	Number
Interpretation of test results	1.70	13.4	79
Baseline calibration	1.71	9.5	56
Acceleration of analysis	2.00	7.6	45
Individualization	2.02	11.7	69
Classification	2.04	13.4	79
Training or instructional aids	2.09	13.9	82
Share cost and expense of materials and collections	2.15	11.7	69
Research	2.19	10.9	64
Clearinghouse	2.21	7.0	41
Other	2.40	0.8	5

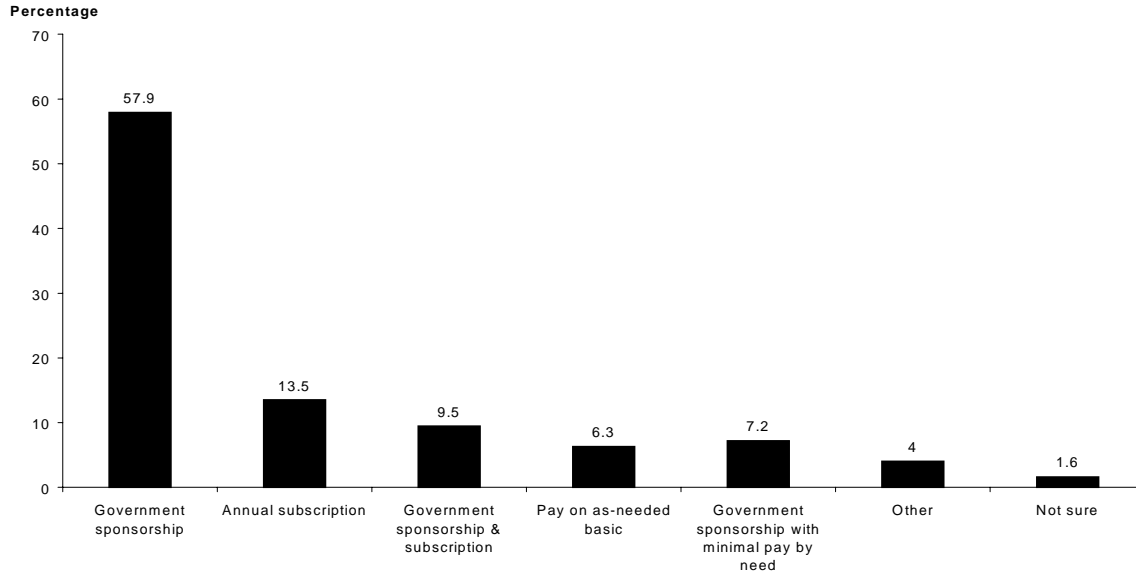
When these data are sorted by type of laboratory, however, the top three rankings vary. For directors of Federal laboratories, the top rankings were interpretation of test results, training or instructional aids, and classification. Among State laboratory directors, the number one ranking went to interpretation of test results, followed by baseline calibration and classification. For county laboratory directors, research was followed by interpretation of test results, and several primary uses were tied for third place. Regional laboratory directors rated baseline calibration and shared expenses as the repository’s primary use. Municipal laboratory directors judged baseline calibration as the leading use of a national repository.

In response to questions about the contents of a national repository for forensic science, most laboratory directors (88 %, n=106) felt that the repository should include both physical specimens and technical data. More than half (55.5 %, n=61) were willing to contribute both physical specimens and technical data to the national repository, and a small group (18.2 %, n=20) were prepared to contribute technical data only.

Another question asked how a national repository should be funded. Not surprisingly, more than half (57.9 %, n=73) of laboratory directors believed the repository should be funded by Government (see exhibit 6). A minority of laboratory directors (13.5 %, n=17) thought the repository should be funded by annual subscription, while a smaller group (9.5 %, n=12) favored a combination of annual subscription and Government sponsorship. It is interesting that nearly a quarter of the laboratory directors realized that they would have to provide some of the funding

themselves; a few years ago, the percentage in favor of Federal Government sponsorship would have been much higher.

Exhibit 6. National repository funding



Current Use of Reference Materials

The final question asked laboratory directors how their laboratories currently use reference materials. As exhibit 7 indicates, the foremost uses were interpretation of test results, training or instructional aids, and classification. Given the laboratory directors’ customary focus on expeditious case processing, one unexpected finding was how few of them cited acceleration of analysis (6.3 %) and significance assessment (5.8 %).

Exhibit 7. Use of reference materials

Use of reference materials	Percentage	Number
Interpretation of test results	17.1	95
Training or instructional aids	16.1	89
Classification	15.2	84
Individualization	12.5	69
Baseline calibration	9.7	54
Research	8.7	48
Population statistics	7.4	41
Acceleration of analysis	6.3	35
Significance assessment	5.8	32
Comparisons	0.9	5
Standards and controls	0.4	2

The results of the laboratory director survey are presented by type of laboratory in appendix C.

Findings: Section Supervisor Survey

Since the 1999 *Survey of Reference Materials for Forensic Science* was designed to capture the opinions of frontline scientists in the Nation's crime laboratories, the responses of the section supervisors comprise the heart of this survey. A total of 431 section supervisors from the 121 crime laboratories completed the questionnaire. The response ranged from one to nine questionnaires per laboratory for an average of 3.7 questionnaires per laboratory.

The section supervisor questionnaire asked four key questions, three of them open-ended, to ascertain the following information:

- What reference materials the section supervisors needed in order to expand their investigative capabilities, to improve their efficiency, and to perform their jobs more effectively.
- What reference collections were currently available to bench scientists at the laboratory.
- What reference collections the supervisors would like to see in the future.

The fourth question, the only close-ended question in the section supervisor survey, asked respondents about the primary uses of a national repository for SRCs. Like the laboratory directors, section supervisors were given a list of possible uses of such a repository and asked to rank the top three. This was the only survey question put to *both* laboratory directors and section supervisors.

The first item on the questionnaire requested the name of the supervisor's section, division, or unit. The responses produced 42 different classifications. Twenty of the sections handled a single, primary discipline such as firearms, toxicology, trace, or subcategories of trace. The other 22, however, were combinations of two or more primary sections (e.g., prints and trace, firearms and toolmarks) and were therefore more difficult to classify. Strategies for classifying the combined sections ranged from grouping them by task or activity to organizing them according to the five major academic categories: chemistry (e.g., trace, controlled substances); biology (e.g., latent prints); physical sciences (e.g., firearms, toolmarks); physiology (e.g., blood alcohol, toxicology); and computer science (e.g., computer crime). Ultimately, the structure of the laboratories was accepted as is, because the issue was not directly relevant to the goals of the survey. The critical need was to determine which materials were needed by functional discipline regardless of the laboratory section title or internal structure. Furthermore, many of the same materials (e.g., trace evidence and DNA analysis) were needed by more than one section.

In keeping with the purpose of the survey—to determine the current status of, and need for, reference materials and standard reference collections in the Nation's crime laboratories—this report identifies the discrete, physical objects that can be assembled as reference materials or collections through Federal and State government sponsorship. To this end, the report has identified the materials that laboratory scientists requested over and over again. An assessment of which physical collections they wanted was conducted by examining the frequency with which discrete physical objects or related drugs or chemicals were cited, and then identifying key words and search strings. For further discussion of this analysis, refer to appendix D.

Reference Materials Needed

The section supervisors were asked to list the reference materials they needed to expand their investigative capabilities, to improve their efficiency, and to better perform their jobs. The survey provided the following definition of a reference material:

A reference material is a material or substance, having one or more properties which are sufficiently established so that the established property(ies) can be used to assign a value to material, calibrate an apparatus, assess a measurement method, identify a material or substance, or provide training and education. A material or substance may be a single item or part of a single item.

In addition to discrete physical objects, section supervisors listed books, journals, printed databases, and computer databases, many of which are readily available yet severely lacking in the laboratories. This critical need for basic information resources is a key finding of this survey. Given the inadequacy of funding in the Nation's crime laboratories, this finding was not surprising. Scientists in many laboratories, for example, do not have access to the Internet. Overwhelmingly, laboratory personnel requested basic resources that should be available in the laboratories. Because current accreditation standards do not regard literature and electronic information as essential items, management may assign lower priority to these resources. However, it is clear from the survey results that bench scientists consider books, journals, printed databases, and computer databases essential to proper job performance.

The following subject-specific reference books were requested most frequently:

Instrumental Data for Drug Analysis, Volumes I-V, by Mills and Robertson (18)

The Logo Index for Tablets and Capsules by DEA (12)

Isolation and Identification of Drugs by Clarke (12)

HAAS Typewriter Atlas (12)

General Rifling Characteristics File by FBI (10)

The Particle Atlas (9)

Forensic Science Handbook, Volumes I to III (8)

FT-IR Condensed Phase Library by Nicolet and Aldrich (7)

The most popular journals were the *Journal of Forensic Science* (10) and *AFTE Journal* (9), and DEA's *Microgram* (6). Also listed were databases such as the Drug Identification Database (DRUGBASE) (5), Shoe Outsole Data Base (5), and MicroMEDEX Identix Medical Pharmaceutical Database (4).

In the area of general reference guides, both *The Merck Index* (11) and the *Physicians' Desk Reference* (PDR) (11) were listed frequently. Both firearm schematics/diagrams (10) and ammunition (7) were listed for product literature.

Reference materials identified by the section supervisors were divided into physical objects and drugs. These materials are presented in rank order in exhibit 8. In reviewing the list of reference

materials, it is important to note that regardless of how often a material is cited, any material that facilitates the identification of crime scene evidence is critical.

The physical objects were categorized into 23 primary groups. Fiber, biological specimens, and DNA headed the list of materials needed as reference sources. Because the forensic scientists surveyed were asked to write in the reference materials they needed, rather than select the materials from a list, their responses varied widely, from very specific (e.g., asbestos grouped as a mineral fiber) to generic (e.g., fiber). The primary groups were further classified to organize the materials into useful and meaningful subcategories. Appendix E presents a detailed list of the materials, arranged in alphabetical order by primary group.

The largest primary group—fibers—was organized into 11 subgroups. These subgroups were created to capture generic, nonspecific categories, such as manufactured and natural fibers, as well as synthetics, vegetable, mineral, and animal fibers. Within the subgroups, the materials cited most often were fibers by end use, such as insulation, carpet fibers, and modacrylic fibers (as found in wigs); synthetic fibers; and nonspecified natural fibers.

The biological specimens group was organized into seven subgroups, the largest of which were blood toxicology and human sperm. Responses that were nonspecific or generic were included in more than one subcategory. For example, aged bloodstains were listed in both the human and animal blood categories, and semen samples with documented P30 concentrations were listed in both human and animal semen.

DNA requests were for qualitative and quantitative standards regardless of the different methods, e.g., Polymerase Chain Reaction (PCR), Restricted Fragment Length Polymorphism (RFLP), and Short Tandem Repeat (STR), used by the laboratory. The paint subgroups of (both foreign and domestic) automotive paint and nonspecific paint (both automotive and architectural) led the group. As exhibit 8 indicates, only four of the remaining primary groups—ammunition, explosives, accelerants, and glass—had more than 30 citations. Within each of these groups, no individual subgroup accounted for a majority of the materials cited.

Drugs, which were analyzed separately and grouped by noncontrolled and controlled substances, are listed alphabetically by individual drug. Although crime laboratories are primarily concerned with the analysis of illicit drugs, requests for samples of noncontrolled drugs outnumbered those for controlled substances. One possible explanation may be that when laboratories do encounter noncontrolled substances, they do not have or cannot obtain the needed reference samples.

Exhibit 8. Reference materials by primary groups

	Primary Group	Number
Physical Objects	Fiber	131
	Biological Specimens	94
	Paint	65
	DNA	59
	Ammunition	50
	Explosives	38
	Accelerants	36
	Glass	32
	Hair	22
	Firearms	19
	Polymer	18
	Tape	16
	Clay, Minerals, & Metals	16
	Shoe/Foot	16
	Botanical	12
	Tires	12
	Wood/Pollen	9
	Ink	8
	Paper	8
	Rope	7
Typewriter	6	
Toolmarks	5	
Dyes	3	
Drugs	Noncontrolled	313
	Controlled	280

Reference Collections

Section supervisors also were asked which reference collections were currently available to bench scientists in their laboratories and which collections they anticipated would be needed in the future. A reference collection was defined in the survey as follows:

A reference collection is an accumulation of actual samples (e.g., samples of drugs, automotive paint, natural fibers, or shoeprints) for use in the identification and comparison of evidence. A collection may be physical specimens or other characterization data including, but not limited to, spectra, manufacturing data, identification markings, and photomicrographs. The collection may be gathered

from a crime scene¹ (street samples), compiled by a colleague for internal laboratory use or part of his or her educational program, or commercially manufactured. The collection may not be 100 % complete but is a substantial portion of the materials or substance.

Reference collections and future collections were organized in the same way as reference materials. Once again, the focus was on physical objects, such as fiber, paint, hair, footwear, and ammunition, along with drugs.

Many of the reference collections cited already exist, but laboratory personnel were not aware of them. Some of the reference materials and collections identified are available through commercial firms and government agencies:

- Controlled drugs (can be purchased from Aldrich, USP).
- DNA, through the Combined DNA Index System (CODIS).
- Cigarette butts.
- Animal hair (companies in Alaska sell hair from various species).
- Paint (FBI maintains a national automobile paint file; paint data are also available through the Paint Data Query (PDQ)).
- Auto carpet fiber (FBI is assembling an auto carpet fiber file; Collaborative Testing Services, Inc., (CTS) data on fiber no longer exist).
- Tire prints (annual tire tread manual).

The data indicate that the laboratories have identified a need for these collections and are trying to meet that need by generating their own reference collections. It is important; therefore, to assess the usefulness of collections available to bench scientists at individual laboratories: What is the quality of these collections? Are they complete?

With the exception of the annual tire tread design guide, existing collections are not complete and they are not authenticated, that is, the collections are not from a known source that is documented with a letter or certificate stating one or more properties of the materials or substance. For instance, there is no standardized footwear collection; any footwear collection is a local one. U.S. Customs officials photograph the soles of all imported shoes, but the photos are discarded when the shoes get through Customs because hard-pressed public crime laboratories do not have the staff to process and archive the photos.

¹ A collection gathered from a crime scene acknowledges that a forensic examiner/scientist may assemble a limited personal collection of reference materials. Examples include sand gathered from different locations within a geographic area, illicit drugs confiscated during an arrest, or original automobile paint samples gathered from body shops. All of these materials are properly stored or mounted, and labeled with identifying information such as the geographic location where it was gathered, vehicle identification number, and date collected.

Digital cameras, which produce very high-quality pictures, could be used to help alleviate the difficulties of creating footwear and other reference collections. If Customs officials photographed the imported shoe soles with a digital camera, for example, the photos on the disc could be transmitted to any crime laboratory. This technology could be used to generate a variety of needed reference collections.

Another potential SRC—a fiber collection—could be created with minimal resources and a dedicated staff to track the source and maintain the collection. Worldwide production of fiber is more than 80 billion pounds, half of which is cotton. To assemble a collection, 80 to 100 samples would be needed. These samples could come from end rolls that are discarded, but manufacturers have been unwilling to cooperate in such an effort. Yet gathering 100 samples is not an unreasonable assignment. Producing 500 collections (while keeping one) is a doable task.

The reference collections identified by the section supervisors are presented by rank in exhibit 9. Seven of the 23 primary groups were cited at least 50 times as needed reference collections. Two of the top three reference materials cited—fiber and biological specimens—are also among the top three reference collections cited. The other primary groups cited in the top seven collections were hair, ammunition, paint, accelerants, and firearms. DNA, which ranked second among needed reference materials, ranked number 13 among reference collections.

In the fiber group, which ranked first in both materials and collections, the need for reference collections was highest in the areas of synthetic fibers, nonspecified natural fibers, and generic fibers of all types. The fiber group included generalized, nonspecific responses that were interpreted as being part of all seven fiber subcategories. Examples of these responses are the names of specific commercial fiber collections, such as CTS and McCrone Fiber Reference Collection, along with broader descriptions, such as fibers and reference fibers. In the biological specimens area, collections of human and nonhuman blood and semen had more citations than either blood or urine toxicology.

An analysis of the other top primary groups in reference collections revealed a need for collections of both animal and human hair, but not domestic animal hair or textile fur hair. Within the paint group, the automotive subgroup accounted for more than half of the citations. This subgroup included both foreign and domestic paint collections for various model years. Within the accelerants group, ignitable liquids—nonspecified ignitable liquids, as well as gasoline, kerosene, and turpentine—accounted for the majority of citations. In both ammunition and firearms, the top subgroups were very general descriptions of ammunition and firearms collections. The remaining 16 primary groups included no outstanding subgroups.

Since drugs were evaluated individually, not as collections, there was less interest in collections of drugs than in collections of physical objects. A detailed list of the reference collections of physical objects and drugs cited most frequently by section supervisors is presented in appendix F.

Exhibit 9. Reference collections by primary groups

	Primary group	Number
Physical objects	Fiber	138
	Hair	104
	Biological Specimens	82
	Ammunition	72
	Paint	70
	Accelerants	65
	Firearms	61
	Explosives	43
	Glass	35
	Clay, Minerals, & Metals	30
	Typewriter	28
	Wood/Pollen	24
	Shoe/Foot	23
	DNA	21
	Polymer	16
	Tire	12
	Botanical	9
	Toolmarks	6
	Tape	6
	Paper	4
Ink	2	
Dyes	1	
Rope	0	
Drugs	Controlled	8
	Noncontrolled	1

Looking to the future, section supervisors cited collections that are needed for the next century. These collections may already exist or may no longer be available through a commercial source or from the manufacturer. The fiber and paint groups remain on top of the list, with more than 50 citations each. Among the fiber subgroups, the most frequently cited future collections were nonspecified natural fibers, fibers by end use, and synthetic fibers. The paint subgroups cited most often were foreign and domestic automotive paint, nonspecific paint (both automotive and architectural) and paint components (binders, pigments, extenders, solvents, and additives). The future collections are presented in rank order in exhibit 10 and further detailed in appendix G.

Exhibit 10. Future collections by primary groups

	Primary group	Number
Physical objects	Fiber	79
	Paint	70
	Ammunition	47
	Accelerants	46
	Biological Specimens	34
	Explosives	34
	Firearms	33
	Shoe/Foot	30
	Glass	25
	Tape	23
	Ink	22
	DNA	19
	Polymer	19
	Hair	18
	Tire	17
	Wood/Pollen	13
	Typewriter	11
	Paper	9
	Clay, Minerals, & Metals	8
	Toolmarks	8
Dyes	7	
Botanical	4	
Rope	4	
Drugs	Noncontrolled	6
	Controlled	2

National Repository

Like the laboratory directors, the section supervisors were asked what they considered the primary uses of a national repository and how they would rank the top three uses (see exhibit 5 for laboratory directors' responses). The differences in how the two groups ranked the uses of the repository were striking. Both agreed that the interpretation of test results was the primary use of a national repository. For second and third places in the ranking of uses, however, the section supervisors selected individualization and classification, while the laboratory directors chose baseline calibration and acceleration of analysis. It was not surprising that the laboratory directors ranked acceleration of analysis higher than the section supervisors did, because a primary goal of the director is to expedite the case through the laboratory.

Exhibit 11. Primary use of a national repository identified by section supervisors

Primary use of a national repository	Ranking	Primary use selection	
		Percentage	Number
Interpretation of test results	1.76	14.4	233
Classification	1.79	14.0	226
Individualization	1.79	11.7	189
Clearinghouse	2.00	5.3	86
Baseline calibration	2.02	5.0	81
Acceleration of analysis	2.11	7.7	124
Training or instructional aids	2.16	18.5	299
Research	2.20	11.8	191
Share cost and expense of materials and collections	2.37	9.5	153
Other	1.61	2.3	37

Appendix A: Survey Instruments

NIST's Office of Law Enforcement Standards Survey of Reference Materials for Forensic Science Laboratory Director Questionnaire

The National Institute of Justice (NIJ) has provided funding for this survey to address the needs and concerns of the forensic science community.

Public reporting burden for this collection of information is estimated to average 20 minutes per questionnaire, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to U.S. Department of Commerce Reports Clearance Officer, ATTN: Linda Englemier, Department Forms Clearance Officer, U. S. Department of Commerce, Room 5327, 14th and Constitution Avenue, NW, Washington, DC 20230.

INSTRUCTION: Please complete and return one copy of the Laboratory Director Questionnaire. In addition, please distribute one copy of the Supervisor Questionnaire to **EACH** of your sections, departments, or units to be completed and returned. Additional copies of the Supervisor Questionnaire may be duplicated as needed. For an electronic copy of the survey, send an E-mail request to survey@aspensys.com or call 1-800-441-7080.

DEFINITIONS

Reference Material: A material or substance, having one or more properties which are sufficiently established so that the established property(ies) can be used to assign a value to material, calibrate an apparatus, assess a measurement method, identify a material or substance, or provide training and education. A material or substance may be a single item or part of a single item.

Reference Collection: An accumulation of actual samples (e.g., samples of drugs, automotive paint, natural fibers, or shoeprints) for use in the identification and comparison of evidence. A collection may be physical specimens or other characterization data including but not limited to spectra, manufacturing data, identification markings, and photomicrographs. The collection may be gathered from a crime scene (street samples), compiled by a colleague for internal laboratory use or part of his/her educational program, or commercially manufactured. The collection may not be 100 % complete but is a substantial portion of the materials or substances.

LABORATORY CHARACTERISTICS

1. Which of the following best describes your lab? (CHECK ONLY ONE BOX)

<input type="checkbox"/>	Municipal	<input type="checkbox"/>	Regional	<input type="checkbox"/>	Federal/National	<input type="checkbox"/>	Private/Corporate
<input type="checkbox"/>	County	<input type="checkbox"/>	State	<input type="checkbox"/>	International		

2. Is your lab part of a system?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
--------------------------	-----	--------------------------	----

2a. **If yes**, does this report cover other labs?

Yes, how many? _____ No

3. Is your lab ASCLD/LAB accredited?

Yes No

3a. **If no**, will you be seeking accreditation in the future?

Yes No

4. We are interested in learning about the organizational structure of your laboratory. Please list the names of each of the sections, departments, or units within your laboratory. **DO NOT LIMIT YOUR LISTING TO TRACE EVIDENCE. ATTACH ADDITIONAL SHEETS AS NECESSARY, ALONG WITH A COPY OF YOUR ORGANIZATIONAL CHART.**

- | | |
|----------|-----------|
| 1. _____ | 7. _____ |
| 2. _____ | 8. _____ |
| 3. _____ | 9. _____ |
| 4. _____ | 10. _____ |
| 5. _____ | 11. _____ |
| 6. _____ | 12. _____ |

SCIENTIFIC TECHNICAL WORKING GROUPS (SWG) formerly Technical Working Groups (TWG)

5. Are you aware of the guidelines established by the SWGs/TWGs?

Yes (CONTINUE) No (SKIP TO Q6)

5a. **If yes**, does your laboratory voluntarily utilize SWG (formerly TWG) guidelines or do you plan to utilize the guidelines in the future? (CHECK ALL THAT APPLY)

	Yes, currently use some or all SWG guidelines	Yes, plan to in the future	No future plans	Not Applicable
DNA (SWG DAM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trace (SWG MAT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fingerprints (SWG FAST)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documents (SWG DOC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Imagery (SWG IT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digital Image (SWG DE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Firearms (SWG FT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drugs (SWG DRUG)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Explosives (SWG FX)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NATIONAL REPOSITORY

6. Do you see a need for a national repository or archive to serve as a source and custodian of reference collections for forensic science in the United States?

- Yes (CONTINUE)
- No (SKIP TO Q 9)

7. How important is the need for a national repository or archive of reference materials for forensic science?

- Very important
- Somewhat important
- Neither important nor unimportant
- Somewhat unimportant
- Very unimportant

7a. Please elaborate on your response in question 7 above. (PLEASE PRINT.)

8. What do you see as the primary use of a national repository?

- | | |
|--|-------------------------------------|
| 8a. Check all that apply. | 8b. Rank your top three selections. |
| <input type="checkbox"/> Classification | _____ |
| <input type="checkbox"/> Individualization | _____ |
| <input type="checkbox"/> Baseline calibration | _____ |
| <input type="checkbox"/> Interpretation of test results | _____ |
| <input type="checkbox"/> Research | _____ |
| <input type="checkbox"/> Training or instructional aids | _____ |
| <input type="checkbox"/> Clearinghouse | _____ |
| <input type="checkbox"/> Share cost expense of materials/collections | _____ |
| <input type="checkbox"/> Acceleration of analysis | _____ |
| <input type="checkbox"/> Other (SPECIFY): _____ | _____ |

9. If a national repository for forensic science were established, should it contain physical specimens, technical data, or both physical specimens and technical data? Data includes photomicrographs, spectra, characterization information, manufacturing sources/samples, and identification markings.

- Physical specimens/samples/materials only
- Technical data only
- Both physical specimens and technical data
- Other (SPECIFY): _____

10. If a national repository were established, would your laboratory be interested in contributing or being a resource for either physical specimens or data?

- Physical specimens/samples/materials (current or historical) only
- Technical data only
- Both physical specimens and technical data
- Other (SPECIFY): _____

11. How should a national repository of forensic science materials be funded?

- By annual subscription
- Pay-as-needed basis
- Government sponsorship
- Other (SPECIFY): _____

REFERENCE MATERIALS

12. In general, how does your laboratory use reference materials and/or collections?
(CHECK ALL THAT APPLY.)

- Classification
- Individualization
- Baseline calibration
- Population statistics
- Significance assessment
- Interpretation of test results
- Research
- Training or instructional aid
- Acceleration of analysis
- Other (SPECIFY): _____

**THANK YOU FOR COMPLETING THE
SURVEY OF REFERENCE MATERIALS FOR FORENSIC SCIENCE**

**Please return: Laboratory Director Questionnaire,
Section Supervisor Questionnaires, and
Laboratory Organizational Chart
by June 25, 1999**

**MAIL TO: Survey of Reference Materials for Forensic Science
2277 Research Boulevard, Rockville, MD 20850-3166**

or

**FAX TO: Survey of Reference Materials for Forensic Science
(301) 519-6300**

For an electronic copy of the survey, send an E-mail request to survey@aspensys.com or call 1-800-441-7080.

NIST's Office of Law Enforcement Standards Survey of Reference Materials for Forensic Science Section Supervisor Questionnaire

The National Institute of Justice (NIJ) has provided funding for this survey to address the needs and concerns of the forensic science community.

Public reporting burden for this collection of information is estimated to average 30 minutes per questionnaire, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to U.S. Department of Commerce Reports Clearance Officer, ATTN: Linda Englemier, Department Forms Clearance Officer, U.S. Department of Commerce, Room 5327, 14th and Constitution Avenue, NW, Washington, DC 20230.

NAME OF SECTION, DIVISION OR UNIT: _____

INSTRUCTION: NIJ and the Office of Law Enforcement Standards are interested in obtaining the opinions of technical bench supervisors and working analysts on the status and needs for reference materials and collections. **Please make additional copies of the questionnaire, as necessary.** For an electronic copy of the survey, send an E-mail request to survey@aspensys.com or call 1-800-441-7080.

DEFINITIONS

Reference Material: A material or substance, having one or more properties which are sufficiently established so that the established property(ies) can be used to assign a value to material, calibrate an apparatus, assess a measurement method, identify a material or substance, or provide training and education. A material or substance may be a single item or part of a single item.

Reference Collection: An accumulation of actual samples (e.g., samples of drugs, automotive paint, natural fibers, or shoeprints) for use in the identification and comparison of evidence. A collection may be physical specimens or other characterization data including but not limited to spectra manufacturing data, identification markings, and photomicrographs. The collection may be gathered from a crime scene (street samples), compiled by a colleague for internal laboratory use or part of his or her educational program, or commercially manufactured. The collection may not be 100 % complete but is a substantial portion of the materials or substance.

Manufactured – A collection that is commercially produced and distributed for analytical use such as Collaborative Testing Services (CTS).

Controlled – A collection for analytical use that is created from evidence found at crime scenes (street samples).

Authenticated – A collection of samples/specimens from a known source that is documented with a letter or certificate stating one or more properties of the materials or substance.

1. What **reference materials** do you need to expand your investigative capabilities, improve your efficiency, and thus better enable you to perform your job? Please list as many reference materials as you feel would be helpful regardless of how frequently you use the reference material (several times per week or once a year).

Not Applicable/No Need

Material (PLEASE PRINT ONE MATERIAL PER LINE)

Office Use Only

_____	_ _ _ _
_____	_ _ _ _
_____	_ _ _ _
_____	_ _ _ _
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_____	_ _ _ _

2. What **reference collections** (e.g., automotive paint, natural fibers, firearms, and shoeprints) does your lab/section have available to bench scientists. Since reference collections come from a variety of sources, please list collections that were gathered from crime scenes (street samples), compiled by a colleague for internal laboratory use or as part of his or her educational program, or commercially manufactured. For each collection listed, please indicate the source of the collection that is manufactured, controlled, or authenticated. (See definitions on page 1 of the Section Supervisor Questionnaire.)

Not Applicable/No Collections

2a. **COLLECTION** (PLEASE PRINT) **TYPE** (CHECK ALL THAT APPLY)

_____ Physical samples Technical data

2a.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)

Manufactured

Authenticated

Controlled

Other (SPECIFY): _____

2b. **COLLECTION** (PLEASE PRINT) **TYPE** (CHECK ALL THAT APPLY)

_____ Physical samples Technical data

2b.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)

Manufactured

Authenticated

Controlled

Other (SPECIFY): _____

2c. **COLLECTION** (PLEASE PRINT) **TYPE** (CHECK ALL THAT APPLY)

_____ Physical samples Technical data

2c.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)

Manufactured

Authenticated

Controlled

Other (SPECIFY): _____

2d. **COLLECTION** (PLEASE PRINT) **TYPE** (CHECK ALL THAT APPLY)

_____ Physical samples Technical data

2d.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)

Manufactured

Authenticated

Controlled

Other (SPECIFY): _____

2e. **COLLECTION (PLEASE PRINT)** _____ **TYPE (CHECK ALL THAT APPLY)**
 Physical samples Technical data

2e.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)
 Manufactured Authenticated
 Controlled Other (SPECIFY): _____

2f. **COLLECTION (PLEASE PRINT)** _____ **TYPE (CHECK ALL THAT APPLY)**
 Physical samples Technical data

2f.1 What is the source or composition of the collection? (CHECK ALL THAT APPLY)
 Manufactured Authenticated
 Controlled Other (SPECIFY): _____

3. What reference collections would you like to see in the future? Please list collections that are not available, are not adequate for your needs, or have not yet been developed.(CHECK ALL THAT APPLY.)

Not Applicable/No Collections

COLLECTION (PLEASE PRINT)	TYPE	
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
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_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data
_____	<input type="checkbox"/> Physical samples	<input type="checkbox"/> Technical data

NATIONAL REPOSITORY

4. If a national repository or archive was developed to serve as a source and custodian of reference collections for forensic science in the United States, what would you see as its primary use, as it pertains to your section?

4a. Check all that apply.

- Classification
- Individualization
- Baseline calibration
- Interpretation of test results
- Research
- Training or instructional aids
- Clearinghouse
- Share cost expense of materials/collections
- Acceleration of analysis
- Other (SPECIFY): _____

4b. Rank your top three selections.

Completed By: _____ Telephone: (____) _____

**THANK YOU FOR COMPLETING THE
SURVEY OF REFERENCE MATERIALS FOR FORENSIC SCIENCE**
Please return Section Supervisor Questionnaire to your Laboratory Director, or
his/her representative for inclusion with other sections of this survey.

**ALL SURVEY RESPONSES ARE DUE
BY NO LATER THAN JUNE 25, 1999**

**MAIL TO: Survey of Reference Materials for Forensic Science
2277 Research Boulevard, Rockville, MD 20850-3166**

or

**FAX TO: Survey of Reference Materials for Forensic Science
(301) 519-6300**

For an electronic copy of the survey, send an E-mail request to survey@aspensys.com or call 1-800-441-7080.

*Appendix B: Laboratory Directors’
Comments*

APPENDIX B

LABORATORY DIRECTORS' COMMENTS

- 7a. Please elaborate on the need for a national repository or archive of reference materials for forensic science.

Improve Standards and Uniformity

A central location for reference collections would provide each laboratory with uniform samples. This would aid in the exchange of data between laboratories.

It would be an area where all laboratories can access the same information.

I think it could benefit the forensic science field tremendously by providing training and education. It would also be used in the identification and comparison of evidence.

In forensic work, due to the paucity of traceable standards and reference materials, it is extremely difficult to estimate how good most of the methods used are. The only alternative that is available to the forensic area is to participate actively in external proficiencies once a year. But then again, we are not aware of how good the proficiencies are.

In the area of proficiency testing, a better quality of source materials would be available. This would allow for a closer comparison of laboratory capabilities and competencies.

It would meet the increased need for accurate, NIST-traceable standards in all

fields demanded by court and ASCLD/LAB.

It is important for labs to have accessible standards for comparison/identification of case samples, as well as for QC purposes.

It would help standardize results, not methodology.

One major difficulty is to find authenticated samples. The recent proficiency test involving natural fibers is a good case in point.

Reference materials are absolutely necessary for identification and/or comparison at every level of forensic science.

Standardization and accessibility.

The availability of appropriate reference materials is critical for appropriate validation, standardization, and verification of methods.

Consistent standards are important to the forensic community. Analysis should be consistent using standardized methods; reference materials and collections should be consistent everywhere tests are performed.

It would be helpful for references and possibly for consistency of information distributed and accessed.

I think most agencies will continue to maintain their own collections. The sharing of the physical specimens may be a logistical problem; the data should be easy enough. I do not think anybody will stop production if one does not exist. It may be a step towards national standardization.

It is important that all forensic science work in law enforcement is scientifically acceptable work.

Standards that are verified by a national repository assists in appropriate QA & QC.

Due to continual changes in technology, it is important to have continual up-to-date reference materials for review. Even with sending analysts to school and workshops, there are numerous topics that cannot be covered thoroughly in this fashion alone.

Improve Forensic Science

A source of reference materials and data is essential to the practice of forensic science due to the varied samples and databases required in characterizing materials and assigning weight to their value in assisting the court systems of our country in determining guilt and innocence.

Attempts should be made to consolidate reference materials currently held by several Federal agencies.

Economically it makes sense. A national reference collection would assist both large and small labs/systems.

The FBI has been providing reference collections in the past. However, forensic science needs a better method to distribute their samples. The automotive paint collection is a good example of a program that failed.

If a reference file that was available in a particular location was available throughout the entire United States, it would be of great value.

It does not exist and would be very useful to have!

It is very important to allow us to have access to a national repository of fingerprints through our AFIS system. It's a good idea that should be implemented and available to forensic labs.

The reference materials are very important for forensic scientists to improve the forensic analysis in terms of weight and impact in the system.

A national repository for known criminal fingerprints, firearm marking and identification (especially for those made outside the United States), and other technical data specific to forensic science would be helpful.

Databases such as DNA, fingerprints, and automated bullet comparison systems are very important to the continued advancement of our field and cannot be handled fully at the State or local level!

It would be useful to have a centralized source for reference materials for identification of unknown substances.

Most labs have their own (limited) reference materials. But, it would be helpful to have one large, complete archive available to supplement local and State materials because it's often not practical for each and every lab to maintain a complete inventory.

Some collections, like the national automobile paint collections, are very important for identification; others, like a collection of cigarettes, are merely useful to have.

Such a repository supports the goals of SWG guidelines. Forensic science will elevate itself on a national basis through such an endeavor.

Assist Individual Laboratories Lacking Resources

A national repository would provide a known and easily accessible source for reference materials that individual labs might not have in their own collections.

At the present time, there is no national repository or Federal labs. For the most part, they do not have a staff or funds to maintain reference materials in all the different areas of forensic science.

Having a national repository would enhance the resources of all laboratories nationwide. It would probably be more beneficial for labs in isolated rural areas.

Smaller laboratories with stretched resources need this type of repository, an archive to continue with the latest, most efficient use of reference materials.

Smaller laboratories, which probably cannot afford expensive performance

collections, should still have access to those collections.

It would provide reference materials for agencies otherwise unable to collect and maintain reference collections. It's too expensive to maintain individual collections.

Individual labs do not have the resources to create repositories.

Individual labs do not have resources to maintain an exhaustive/validated database on most material. The ability to have a large expensive repository would be of great assistance.

In some areas, it would be nearly impossible to maintain an adequate repository locally, e.g., automotive paints.

It's needed in some areas, not in others. It would be great if reference collections could be obtained by all "legal" forensic labs at no cost to labs.

Save Time and Resources

A standardized national repository of both physical specimens and technical data would save a laboratory both time and money. It should be connected electronically with the latest search capabilities, as well as be updated frequently as new information and technology become available.

All labs require reference materials, but few can afford to keep and update them.

It would appear to be the one source for reference material without the time or expense of searching. I imagine it would

be accessible to all labs and maintain consistency between labs.

It would save us time and resources if a central repository were set up.

Many control and/or comparison samples are difficult to locate in a cost-effective and timely manner.

The relatively low volume of casework performed in State and local labs pertaining to many types of evidence (e.g., glass, fibers, paints) preclude the cost-effective maintenance of reference materials.

Too much time is wasted on a major case attempting to collect samples. Need to go to only one source to get materials.

A single source for all reference materials would greatly diminish time spent searching for sources of such materials. It also helps in presentation of testimony if such a source is officially recognized.

It is too time-consuming to try and maintain a current reference collection in every area.

It would save a considerable amount of time and resources if a national repository of reference materials were maintained.

Better Access to Rare Collections

It is impossible for every lab to compile and maintain collections, especially for those items that are not used frequently.

It is very difficult to find many of the items necessary to perform an analysis. Many of the drug standards are not

available, such as L-Propoxyphene or lysergic acid methyl propylamide (LAMP). Cost is also a prohibitive factor.

It would benefit all of forensic science if we had a resource to go to and obtain reference materials for the more exotic or rarely encountered exhibits, instead of each lab having to invent the wheel each time such submissions are encountered.

The availability of unusual reference samples to even the smallest forensic lab would be of great assistance.

It's needed for unusual casework requiring standards not usually found in C.L., like wood, minerals, cigarette butts, insects, etc.

It would be beneficial if all forensic labs had access to the most inclusive reference materials and collections possible instead of individually attempting to keep up current collections.

Many standards and references must be available quickly and on hand at the laboratory. Rare items could be archived at a national level.

There are so few reference sources in some disciplines, and in others it is hard to verify the source.

Improve Knowledge of What Is Available

A national repository would enhance the quantity and quality of materials available by increasing the base of contribution from the standpoint of reference materials and financial resources.

Knowledge of what is available is critical. Oftentimes labs are not aware of what is available. A national repository online would answer this concern.

Many analyses are comparative if QST/STD are available. If no local STD, then a national database would be required to identify possible sources of est [sic]-local labs not equipped to create these databases. Often, we are asked how common/rare a material is or what other sources of it there are.

There are few reference collections readily available for firearms, fibers, hairs, and footwear.

Without such collections, we will never be able to assign uniqueness to evidence in casework.

Not Practical and Too Expensive

It is nice in theory, but we do not know if it would be practical (what, how much, and who decides on what to save as reference). How available will it be at a reasonable cost?

The data collections are very important and the access by users is imperative, but the cost of application must be considered.

The need for a national archive of law enforcement reference standards is probably “somewhat” real and “somewhat” important. However, it is contradictory by definition in that the needs are usually “local” (and immediate) and a national archive will likely be “distant” (and delayed) for most all of the Nation’s crime laboratories. A national repository

concept could work only if it will provide the needed materials/data on an immediate time-frame basis. Numerous other complex issues must be considered and adequately addressed before a concept such as this is moved forward. Some examples include the huge number and wide variety of materials encountered as evidence; ever-changing and newly developed materials; issues of security, safety, confidentiality, restricted access, and authorization to use “law enforcement” forensic science reference standards; the issue of manufacturer’s proprietary information; legal issues on validation of materials/standards/data/collections in the repository; and most importantly “Who pays?” The concept sounds good, but realistically it is far too complex, cumbersome, and costly to be an effective, comprehensive resource for the public forensic laboratories in the United States.

It would be nice to have the help; but not essential.

Useful Depending Upon Need

It could be useful depending on needs.

The importance of the repository would be based on its scope, accessibility, cost, and relevance.

The need for external reference material is infrequent. We have access to material from laboratory contacts and library and electronic sources.

Miscellaneous

A library of mass spectra of drugs, especially these recently approved by the FDA, would be useful.

If access is simple, inexpensive, and quick – this is a good source.

We use reference collections in typewriters, automotive paints, shoe prints, and tire prints.

*Appendix C: Laboratory Directors’
Results by Type of
Laboratory*

**Appendix C: Laboratory Directors’ Results
by Type of Laboratory**

Table 1. Labs that are part of a system by type of lab

Type of lab	(Number) Percentage	
	Part of a system	Not part of a system
Municipal	(N=0) 0.00%	(N=21) 17.36%
Regional	(N=5) 4.13%	(N=5) 4.13%
Federal/National	(N=5) 4.13%	(N=3) 2.48%
County	(N=2) 1.65%	(N=18) 14.88%
State	(N=47) 38.84%	(N=15) 12.40%
Total	(N=59) 48.76%	(N=62) 51.24%

Table 2. System labs that include other labs by type of lab

Type of lab	(Number) Percentage	
	Other labs included	Other labs not included
Municipal	(N=0) 0.00%	(N=0) 0.0%
Regional	(N=1) 1.69%	(N=4) 6.78%
Federal/National	(N=0) 0.00%	(N=5) 8.47%
County	(N=1) 1.69%	(N=1) 1.69%
State	(N=15) 25.42%	(N=32) 54.24%
Total	(N=17) 28.81%	(N=42) 71.19%

Table 3. ASCLD accreditation by type of lab

Type of lab	(Number) percentage	
	Accredited	Not accredited
Municipal	(N=6) 4.96%	(N=15) 12.40%
Regional	(N=5) 4.13%	(N=5) 4.13%
Federal/National	(N=6) 4.96%	(N=2) 1.65%
County	(N=10) 8.26%	(N=10) 8.26%
State	(N=37) 30.58%	(N=25) 20.66%
Total	(N=64) 52.89%	(N=57) 47.11%

Table 4. Labs seeking accreditation in the future by type of lab

Type of lab	(Number) percentage	
	Seeking accreditation	Not seeking accreditation
Municipal	(N=12) 21.43%	(N=2) 3.57%
Regional	(N=5) 8.93%	(N=0) 0.00%
Federal/National	(N=2) 3.57%	(N=0) 0.00%
County	(N=10) 17.86%	(N=0) 0.00%
State	(N=21) 37.50%	(N=4) 7.14%
Total	(N=50) 89.29%	(N=6) 10.71%

Table 5. Organizational structure of laboratory by type of lab

Type of lab	(Number) Percentage													
	Alcohol	Field services	Miscellaneous	Chemical analysis/ controlled substances/ drugs	DNA/CODIS/ biochemistry/ serology	Fire and explosive debris	Firearms	AFIS/ latent fingerprint examination	Questioned documents	Shoeprint/ tiretrack/ footprint/ firearm/ toolmark	Toxicology	Trace/ microscopy: biochemistry	Special services	Support services
Municipal	(N=1) 0.24%	(N=3) 0.71%	(N=6) 1.42%	(N=12) 2.84%	(N=15) 3.55%	(N=1) 0.24%	(N=7) 1.65%	(N=8) 1.89%	(N=3) 0.71%	(N=6) 1.42%	(N=3) 0.71%	(N=13) 3.07%	(N=1) 0.24%	(N=1) 0.24%
Regional	(N=2) 0.47%	(N=1) 0.24%	(N=2) 0.47%	(N=9) 2.13%	(N=5) 1.18%	(N=1) 0.24%	(N=1) 0.24%	(N=2) 0.47%	(N=2) 0.47%	(N=2) 0.47%	(N=2) 0.47%	(N=4) 0.95%	(N=0) 0.00%	(N=0) 0.00%
Federal/ National	(N=0) 0.00%	(N=1) 0.24%	(N=2) 0.47%	(N=6) 1.42%	(N=0) 0.00%	(N=1) 0.24%	(N=1) 0.24%	(N=2) 0.47%	(N=2) 0.47%	(N=0) 0.00%	(N=1) 0.24%	(N=2) 0.47%	(N=1) 0.24%	(N=0) 0.00%
County	(N=2) 0.47%	(N=1) 0.24%	(N=5) 1.18%	(N=13) 3.07%	(N=14) 3.31%	(N=4) 0.95%	(N=8) 1.89%	(N=4) 0.95%	(N=4) 0.95%	(N=4) 0.95%	(N=4) 0.95%	(N=12) 2.84%	(N=0) 0.00%	(N=1) 0.24%
State	(N=6) 1.42%	(N=1) 0.24%	(N=6) 1.42%	(N=43) 10.17%	(N=34) 8.04%	(N=3) 0.71%	(N=12) 2.84%	(N=20) 4.73%	(N=16) 3.78%	(N=18) 4.26%	(N=19) 4.49%	(N=34) 8.04%	(N=2) 0.47%	(N=1) 0.24%
Total	(N=11) 2.60%	(N=7) 1.65%	(N=21) 4.96%	(N=83) 19.62%	(N=68) 16.08%	(N=10) 2.36%	(N=29) 6.86%	(N=36) 8.51%	(N=27) 6.38%	(N=30) 7.09%	(N=29) 6.86%	(N=65) 15.37%	(N=4) 0.95%	(N=3) 0.71%

Table 6. Aware of SWG/TWG guidelines by type of lab

Type of Lab	(Number) percentage	
	Aware	Not aware
Municipal	(N=20) 16.53%	(N=1) 0.83%
Regional	(N=9) 7.44%	(N=1) 0.83%
Federal/National	(N=8) 6.61%	(N=0) 0.00%
County	(N=19) 15.70%	(N=1) 0.83%
State	(N=54) 44.63%	(N=8) 6.61%
Total	(N=110) 90.91%	(N=11) 9.09%

Table 7A. Municipal laboratory usage of SWG guidelines by type of guidelines

Utilization of guidelines	DNA (SWG DAM)	Trace (SWG MAT)	Fingerprints (SWG FAST)	Documents (SWG DOC)	Image technology (SWG IT)	Digital evidence (SWG DE)	Firearms (SWG GUN)	Drugs (SWG DRUG)	Explosives (SWG FEX)	Total
Currently use some/all guidelines	(N=12) 33.33%	(N=6) 16.67%	(N=5) 13.89%	(N=1) 2.78%	(N=1) 2.78%	(N=0) 0.00%	(N=3) 8.33%	(N=7) 19.44%	(N=1) 2.78%	36
Plan to use in the future	(N=2) 4.65%	(N=7) 16.28%	(N=5) 11.63%	(N=6) 13.95%	(N=1) 2.33%	(N=3) 6.98%	(N=7) 16.28%	(N=6) 13.95%	(N=6) 13.95%	43
No future plans to use	(N=0) 0.00%	(N=2) 16.67%	(N=1) 8.33%	(N=1) 8.33%	(N=2) 16.67%	(N=2) 16.67%	(N=1) 8.33%	(N=2) 16.67%	(N=1) 8.33%	12
Total	14	15	11	8	4	5	11	15	8	91

Table 7B. Regional laboratory usage of SWG guidelines by type of guidelines

Utilization of guidelines	DNA (SWG DAM)	Trace (SWG MAT)	Fingerprints (SWG FAST)	Documents (SWG DOC)	Image technology (SWG IT)	Digital evidence (SWG DE)	Firearms (SWG GUN)	Drugs (SWG DRUG)	Explosives (SWG FEX)	Total
Currently use some/all guidelines	(N=7) 41.18%	(N=1) 5.88%	(N=1) 5.88%	(N=1) 5.88%	(N=0) 0.00%	(N=0) 0.00%	(N=3) 17.65%	(N=3) 17.65%	(N=1) 5.88%	17
Plan to use in the future	(N=0) 0.00%	(N=6) 20.00%	(N=4) 13.33%	(N=1) 3.33%	(N=4) 13.33%	(N=4) 13.33%	(N=4) 13.33%	(N=5) 16.67%	(N=2) 6.67%	30
No future plans to use	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=2) 50.00%	(N=1) 25.00%	(N=1) 25.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	4
Total	7	7	5	4	5	5	7	8	3	51

Table 7C. Federal/national laboratory usage of SWG guidelines by type of guidelines

Utilization of guidelines	DNA (SWG DAM)	Trace (SWG MAT)	Fingerprints (SWG FAST)	Documents (SWG DOC)	Image technology (SWG IT)	Digital evidence (SWG DE)	Firearms (SWG GUN)	Drugs (SWG DRUG)	Explosives (SWG FEX)	Total
Currently use some/all guidelines	(N=1) 8.33%	(N=1) 8.33%	(N=3) 25.00%	(N=1) 8.33%	(N=1) 8.33%	(N=1) 8.33%	(N=1) 8.33%	(N=2) 16.67%	(N=1) 8.33%	12
Plan to use in the future	(N=0) 0.00%	(N=1) 9.09%	(N=2) 18.18%	(N=2) 18.18%	(N=1) 9.09%	(N=2) 18.18%	(N=0) 0.00%	(N=3) 27.27%	(N=0) 0.00%	11
No future plans to use	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	0
Total	1	2	5	3	2	3	1	5	1	23

Table 7D. County laboratory usage of SWG guidelines by type of guidelines

Utilization of guidelines	DNA (SWG DAM)	Trace (SWG MAT)	Fingerprints (SWG FAST)	Documents (SWG DOC)	Image technology (SWG IT)	Digital evidence (SWG DE)	Firearms (SWG GUN)	Drugs (SWG DRUG)	Explosives (SWG FEX)	Total
Currently use some/all guidelines	(N=17) 48.57%	(N=6) 17.14%	(N=2) 5.71%	(N=1) 2.86%	(N=0) 0.00%	(N=0) 0.00%	(N=3) 8.57%	(N=4) 11.43%	(N=2) 5.71%	35
Plan to use in the future	(N=0) 0.00%	(N=9) 14.52%	(N=3) 4.84%	(N=7) 11.29%	(N=7) 11.29%	(N=9) 14.52%	(N=9) 14.52%	(N=12) 19.35%	(N=6) 9.68%	62
No future plans to use	(N=0) 0.00%	(N=2) 11.76%	(N=2) 11.76%	(N=3) 17.65%	(N=3) 17.65%	(N=2) 11.76%	(N=2) 11.76%	(N=1) 5.88%	(N=2) 11.76%	17
Total	17	17	7	11	10	11	14	17	10	114

Table 7E. State laboratory usage of SWG guidelines by type of guidelines

Utilization of guidelines	DNA (SWG DAM)	Trace (SWG MAT)	Fingerprints (SWG FAST)	Documents (SWG DOC)	Image technology (SWG IT)	Digital evidence (SWG DE)	Firearms (SWG GUN)	Drugs (SWG DRUG)	Explosives (SWG FEX)	Total
Currently use some/all guidelines	(N=38) 30.65%	(N=18) 14.52%	(N=12) 9.68%	(N=10) 8.06%	(N=3) 2.42%	(N=4) 3.23%	(N=14) 11.29%	(N=20) 16.13%	(N=5) 4.03%	124
Plan to use in the future	(N=3) 2.27%	(N=21) 15.91%	(N=16) 12.12%	(N=12) 9.09%	(N=12) 9.09%	(N=13) 9.85%	(N=20) 15.15%	(N=19) 14.39%	(N=16) 12.12%	132
No future plans to use	(N=0) 0.00%	(N=4) 8.89%	(N=8) 17.78%	(N=5) 11.11%	(N=7) 15.56%	(N=7) 15.56%	(N=6) 13.33%	(N=5) 11.11%	(N=3) 6.67%	45
Total	41	43	36	27	22	24	40	44	24	301

Table 8. Need for a national repository by type of lab

Type of lab	(Number) percentage	
	Needed	Not needed
Municipal	(N=20) 16.53%	(N=1) 0.83%
Regional	(N=10) 8.26%	(N=0) 0.00%
Federal/National	(N=3) 2.48%	(N=5) 4.13%
County	(N=19) 15.70	(N=1) 0.83%
State	(N=57) 47.11%	(N=5) 4.13%
Total	(N=109) 90.08%	(N=12) 9.92%

Table 9. Importance of a national repository by type of lab

Type of lab	(Number) percentage			
	Very important	Somewhat important	Neither important nor unimportant	Very unimportant
Municipal	(N=8) 7.55%	(N=11) 10.38%	(N=0) 0.00%	(N=0) 0.00%
Regional	(N=4) 3.77%	(N=6) 5.66%	(N=0) 0.00%	(N=0) 0.00%
Federal/National	(N=2) 1.89%	(N=1) 0.94%	(N=0) 0.00%	(N=0) 0.00%
State	(N=37) 34.91%	(N=15) 14.15%	(N=2) 1.89%	(N=1) 0.94%
Total	(N=62) 58.49%	(N=41) 38.68%	(N=2) 1.89%	(N=1) 0.94%

Table 10. Primary use of a national repository by type of lab

Type of lab	(Number) Percentage								
	Assist individual labs lacking resources	Save time and resources	Better access to rare collections	Improve standards and uniformity	Improve forensic science	Not practical and too expensive	Improve knowledge of what is available	Useful depending upon need	Miscellaneous
Municipal	(N=3) 3.90%	(N=5) 6.49%	(N=3) 3.90%	(N=1) 1.30%	(N=2) 2.60%	(N=0) 0.00%	(N=0) 0.00%	(N=3) 3.90%	(N=0) 0.00%
Regional	(N=01) 1.30	(N=0) 0.00%	(N=0) 0.00%	(N=2) 2.60%	(N=1) 1.30%	(N=0) 0.00%	(N=1) 1.30%	(N=0) 0.00%	(N=2) 2.60%
Federal/National	(N=1) 1.30%	(N=0) 0.00%	(N=1) 1.30%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%
County	(N=1) 1.30%	(N=1) 1.30%	(N=1) 1.30%	(N=4) 5.19%	(N=3) 3.90%	(N=1) 1.30%	(N=1) 1.30%	N=0 0.00%	N=0 0.00%
State	(N=5) 6.49%	(N=4) 5.19%	(N=3) 3.90%	(N=9) 14.29%	(N=9) 11.69%	(N=3) 3.90%	(N=3) 3.90%	(N=0) 0.00%	(N=1) 1.30%
Total	(N=11) 14.29%	(N=10) 12.99%	(N=8) 10.39	(N=15) 23.38%	(N=14) 19.48%	(N=4) 5.19	(N=5) 6.49%	(N=3) 3.90%	(N=3) 1.30%

Table 11. Primary use of a national repository by type of lab

Type of lab	(Number) percentage				
	Training or instructional aids	Classification	Interpretation of test results	Individualization	Share cost and expense of materials/collections
State	(N=42) 7.13%	(N=35) 5.94%	(N=42) 7.13%	(N=32) 5.43%	(N=30) 5.09%
County	(N=13) 2.21%	(N=16) 2.72%	(N=15) 2.55%	(N=15) 2.55%	(N=14) 2.38%
Municipal	(N=16) 2.72%	(N=17) 2.89%	(N=12) 2.04%	(N=14) 2.38%	(N=15) 2.55%
Regional	(N=9) 1.53%	(N=8) 1.36%	(N=7) 1.19%	(N=6) 1.02%	(N=8) 1.36%
Federal/National	(N=2) 0.34%	(N=3) 0.51%	(N=3) 0.51%	(N=2) 0.34%	(N=2) 0.34%
Total	(N=82) 13.92%	(N=79) 13.41%	(N=79) 13.41%	(N=69) 11.71%	(N=69) 11.71%

Table 12. Primary use of a national repository by rank and type of lab

Type of lab	Ranking									
	Classification	Individualization	Baseline calibration	Interpretation of test results	Research	Training or instructional aids	Clearinghouse	Share cost and expense of materials/collections	Acceleration of analysis	Other
Municipal	2.18	2.20	1.00	2.13	3.00	2.13	2.00	1.86	1.75	1.00
Regional	1.75	2.00	1.00	2.00	2.80	1.50		1.00	2.25	2.00
Federal/National	2.50			1.00		2.00				3.00
County	2.38	2.18	2.00	1.36	1.00	2.40	2.60	2.00	2.00	
State	1.88	1.91	1.88	1.72	2.09	2.06	2.00	2.54	2.00	3.00
Total	2.04	2.02	1.71	1.70	2.19	2.09	2.21	2.15	2.00	2.40

Table 13. Contents of a national repository by type of lab

Type of lab	(Number) percentage			
	Physical specimens/samples materials only	Technical data only	Both physical specimens and technical data	Other
Municipal	(N=1) 0.83%	(N=1) 0.83%	(N=19) 15.83%	(N=0) 0.00%
Regional	(N=0) 0.00%	(N=2) 1.67%	(N=8) 6.67%	(N=0) 0.00%
Federal/National	(N=1) 0.83%	(N=2) 1.67%	(N=5) 4.17%	(N=0) 0.00%
County	(N=0) 0.00%	(N=0) 0.00%	(N=20) 16.67%	(N=0) 0.00%
State	(N=1) 0.83%	(N=5) 4.17%	(N=54) 45.00%	(N=1) 0.83%
Total	(N=3) 2.50%	(N=10) 8.33%	(N=106) 88.33%	(N=1) 0.83%

Table 14. Contribution to national repository by type of lab

Type of lab	(Number) percentage						
	Both physical specimens and technical data	Technical data only	Physical specimens/ samples/ materials only	Other	Need more information	No contribution	Uncertain at this time
State	(N=33) 30.00	(N=10) 9.09%	(N=5) 4.55%	(N=4) 5.64%	(N=2) 1.82%	(N=2) 1.82%	(N=1) 0.91%
Municipal	(N=10) 9.09%	(N=2) 1.82%	(N=4) 3.64%	(N=1) 0.91%	(N=2) 1.82%	(N=0) 0.00%	(N=0) 0.00%
County	(N=10) 9.09%	(N=4) 3.64%	(N=0) 0.00%	(N=0) 0.00%	(N=2) 1.82%	(N=0) 0.00%	(N=1) 0.91%
Regional	(N=5) 4.55%	(N=2) 1.82%	(N=1) 0.91	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=1) 0.91%
Federal/National	(N=3) 2.73%	(N=2) 1.82%	(N=0) 0.00%	(N=2) 1.82%	(N=0) 0.00%	(N=1) 0.91%	(N=0) 0.00%
Total	(N=61) 55.45%	(N=20) 18.18%	(N=10) 9.09%	(N=7) 6.36%	(N=6) 5.45%	(N=3) 2.73%	(N=3) 2.73%

Table 15. National repository funding by type of lab

Type of lab	(Number) percentage							
	Government sponsorship	By annual subscription	Annual subscription and government sponsorship	Pay on as-needed basis	Government sponsorship with minimal pay by need access	Other	Subscription (annual) pay-as-needed basis and government sponsorship	Not sure
State	(N=40) 31.75%	(N=8) 6.35%	(N=6) 4.76%	(N=4) 3.17%	(N=2) 1.59%	(N=2) 1.59%	(N=3) 2.38%	(N=0) 0.00%
County	(N=12) 9.52%	(N=3) 2.38%	(N=3) 2.38%	(N=2) 1.59%	(N=1) 0.79%	(N=1) 0.79%	(N=0) 0.00%	(N=0) 0.00%
Municipal	(N=13) 10.32%	(N=1) 0.79%	(N=0) 0.00%	(N=2) 1.59%	(N=3) 2.38%	(N=1) 0.79%	(N=0) 0.00%	(N=1) 0.79%
Regional	(N=4) 3.17%	(N=3) 2.38%	(N=3) 2.38%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%
Federal/National	(N=4) 3.17%	(N=2) 1.59%	(N=0) 0.00%	(N=0) 0.00%	(N=0) 0.00%	(N=1) 0.79%	(N=0) 0.00%	(N=1) 0.79%
Total	(N=73) 57.94%	(N=17) 13.49%	(N=12) 9.52%	(N=8) 6.35%	(N=6) 4.76%	(N=5) 3.97%	(N=3) 2.38%	(N=2) 1.59%

Table 16. Use of reference materials by type of lab

Type of lab	(Number) percentage										
	Interpretation of test results	Training or instructional aid	Classification	Individualization	Baseline calibration	Research	Population statistics	Acceleration of analysis	Significance assessment	Comparisons	Standards and controls
State	(N=50) 9.03%	(N=46) 8.30%	(N=42) 7.58%	(N=32) 5.78%	(N=32) 5.78%	(N=24) 4.33%	(N=21) 3.79%	(N=21) 3.79%	(N=18) 3.25%	(N=3) 0.54%	(N=1) 0.18%
County	(N=17) 3.07%	(N=15) 2.71%	(N=16) 2.89%	(N=14) 2.53%	(N=10) 1.81%	(N=10) 1.81%	(N=9) 1.62%	(N=5) 0.90%	(N=8) 1.44%	(N=0) 0.00%	(N=0) 0.00%
Municipal	(N=15) 2.71%	(N=18) 3.25%	(N=15) 2.71%	(N=15) 2.71%	(N=10) 1.81%	(N=8) 1.44%	(N=7) 1.26%	(N=5) 0.90%	(N=4) 0.72%	(N=1) 0.18%	(N=1) 0.18%
Regional	(N=8) 1.44%	(N=6) 1.08%	(N=7) 1.26%	(N=5) 0.90%	(N=2) 0.36%	(N=2) 0.36%	(N=4) 0.72%	(N=3) 0.54%	(N=2) 0.36%	(N=0) 0.00%	(N=0) 0.00%
Federal/National	(N=5) 0.90%	(N=4) 0.72%	(N=4) 0.72%	(N=3) 0.54%	(N=0) 0.00%	(N=4) 0.72%	(N=0) 0.00%	(N=1) 0.18%	(N=0) 0.00%	(N=1) 0.18%	(N=0) 0.00%
Total	95	89	84	69	54	48	41	35	32	5	2

*Appendix D: Study
Methodology*

APPENDIX D

STUDY METHODOLOGY

The 1999 *Survey of Reference Materials for Forensic Science*, sponsored by the National Institute of Standards and Technology's Office of Law Enforcement Standards (OLES), was funded by the National Institute of Justice (NIJ). The survey is a systematic, scientific, and comprehensive study designed to determine which certified reference materials and collections the Nation's crime laboratories need in order to expand their investigative capabilities and improve their efficiency.

Technical Advisory Panel

To assist in this effort, a Technical Advisory Panel (TAP) was formed to provide input from the forensic science community. The TAP consisted of nine individuals who were representative of the study population. The panel included members of the American Society of Crime Laboratory Directors (crime laboratory directors and/or section supervisors), Scientific Working Group chairs or committee members (working scientists), and representatives from four of the Federal crime laboratories (Federal Bureau of Investigation; Drug Enforcement Administration; Bureau of Alcohol, Tobacco, and Firearms; and the U.S. Postal Service).

Site Visits and Pretest

During the survey design phase, six site visits to laboratories in Connecticut, New York, Florida, Illinois, Virginia, and FBI Headquarters were conducted to provide insight into the diversity of the organizations, the services provided, the terminology used, and the data elements that would be recorded.

In addition, the questionnaire was pretested in a number of crime laboratories to assess the clarity of the instructions, language, and definitions, as well as the time required to complete the laboratory director questionnaire and the section supervisor questionnaire. The following laboratories participated in the pretest:

- Orange County (CA) Sheriff's Department - Forensic Science Services
- Georgia Bureau of Investigation - Forensic Science Division
- Florida Department of Law Enforcement Regional Laboratory
- Miami-Dade Police Department
- Forensic Science Center at Chicago
- Virginia Division of Forensic Science
- Hamilton County (OH) Coroner's Lab
- Huntington Beach (CA) Police Department
- Albuquerque Police Department

Survey Sample

Because the *Survey of Reference Materials for Forensic Science* was intentionally designed to capture the opinions of frontline scientists, Aspen's Survey Research Center expanded the universe of laboratories surveyed to include field laboratories as well as headquarters. A universe of 352 public crime laboratories was created using mailing lists obtained from the FBI and ASCLD. The FBI's Combined DNA Index System (CODIS) list, updated through November 1998, included headquarters and field laboratories, as well as mobile units. The CODIS list was combined with the ASCLD membership list, which had been updated through September 1998. To ensure that the list of public crime labs was as comprehensive as possible, Aspen updated the ASCLD list based on knowledge of individual labs and information from the ASCLD Workload Survey Aspen conducted in January 1999. University labs, private and foreign labs, the mobile units, and scientists who had retired from the laboratories were removed from the newly combined universe. Each lab was assigned a unique identification number that would be used to link the ID printed on the surveys to the name and address of the lab.

Data Collection

On May 21, 1999, the survey was mailed to 352 crime laboratories across the Nation. The survey data were collected from May 21 to June 25, 1999. Laboratory directors who had not responded by the initial due date of June 25, 1999, were contacted by telephone between July 1 and July 7, and encouraged to complete and return the survey. If the survey had been lost or misplaced, another copy was mailed. Aspen processed all surveys received through August 21, 1999.

Response Rate

The overall response rate for the laboratory director survey was 34 %. This figure is based solely on the number of surveys that were mailed to crime laboratories (352) and the number of laboratory director questionnaires that were returned (121). Seventeen of the 121 responding laboratories reported that they were part of a system of laboratories and that their survey responses covered the other laboratories as well as their own. Each of these 17 laboratories included data for between one and seven additional labs in their surveys, for a total of 60 additional labs. The adjusted response rate was 51 % (181 labs). The response rate by type of laboratory, excluding the additional system laboratories, was as follows:

Response rate by type of laboratory

Laboratory type	Sample	Number of respondents	Percentage of sample
State	138	62	44.9
Municipal	73	21	28.7
County	52	20	38.4
Regional	56	10	17.8
Federal/National	33	8	24.2
Total	352	121	34.3

In response to the section supervisor survey, a total of 431 questionnaires were returned. The response ranged from one to nine questionnaires per laboratory and averaged 3.7 per laboratory.

Analysis

The survey data were keyed into two separate systems. The close-ended responses to the laboratory director questionnaire were keyed with 100 % verification into an ASCII file and imported into the Statistical Analysis System (SAS) analysis.

The section supervisor questionnaire began with a request for the name of the supervisor's section, division, or unit. The request produced 42 different section classifications, each reflecting the operations of the laboratory in a real-world environment. To facilitate the analysis, the following 14 broad classifications were created:

- AFIS/Latent Fingerprint Examination.
- Alcohol.
- Chemical Analysis/Controlled Substances/Drugs.
- DNA/CODIS/Biochemistry/Biology/Serology.
- Field Services.
- Fire and Explosive Debris.
- Firearms.
- Miscellaneous.
- Questioned Documents.
- Shoeprint/Tiretrack/Footprints/Firearms/Toolmarks.
- Special Services.
- Support Services.
- Toxicology.
- Trace/Microscopy/Biochemistry.

The responses to the three open-ended questions on the section supervisor survey were keyed into separate Excel spreadsheets for each of the questions and classified into one of six categories as follows:

1. Computer databases.
2. Books and printed databases.
3. Physical objects.
4. Chemicals.
5. Certified reference or calibration standards.
6. Training aids or materials.

Once the data were entered, classified, and verified, they were imported into the SAS to perform a series of keyword searches. Many of the needs the supervisors reported were readily available resources such as books, journals, and computer databases. These categories—1, 2, and 6—were reviewed independently from the word search and classified into books, journals, computer databases, manuals, reference guides, and product literature. For data in Category 4, chemicals, the *Physicians' Desk Reference* and the *Code of Federal Regulations: Food and Drugs* were used to identify the drugs and classify them by type of controlled substance schedule (I, II, III, IV, or V); prescription drugs; or over-the-counter medications.

An initial list of keyword searches was identified, and the remaining ungrouped words were reviewed for possible inclusion in the search strings or the creation of additional primary categories. The primary group search included the primary text string plus the various secondary names listed in the search string. The listing was used *only once* within a primary group but could be used in several different primary groups. Any listings that were not in a primary group were assigned to the category “Not Classified Elsewhere.” Those listings were printed out and reviewed for possible creation of a new group or for other adjustments (e.g., combined groups). The primary categories and their search strings are listed below:

Primary group	Search string
Fiber	Animal hair; textile; natural; synthetic; fibers; carpet; man-made; upholstery; wigs; insulation; linen; flax; microfibers; modacrylic; polyester; rayon; silk; sisal; textile; asbestos; dacron; cloth.
Paint	Automotive; architectural; craft; artistic media; primer; structural; house; pigments, binders; PDQ.
Hair	Hair; fur; dog; cow; deer; horse; llama; mouse; opossum; raccoon; rat.
Shoe/Foot	Foot; footwear; shoe; shoeprints.

Primary group	Search string
Ammunition	Bullet; shotshells; pellets; cartridge case; casing; gun powder; gunshot; percussion caps; BBs; ammo; cartridges.
Firearms	Barrels; reloading; pistol; rifle; serial; weapons.
Accelerants	Ignitable liquid; kerosene; explosives; gasoline; SAM; flammable; turpentine; accelerants; arson.
Tire	
Glass	Auto; lamps; bulb; sheet; optical.
Typewriter	Font; Bouffard; HAAS; type; print; check writer; fax.
Wood/Pollen	Gymnosperm; hardwoods; pollen.
Explosives	Black; black powder; smokeless; Pyrodex; powder; blasting caps.
Paper	Watermarks; documents.
Polymer	Plastic; rubber.
Ink	Toner; documents; photocopy.
Tape	Adhesive; duct; package; masking; vinyl; glue.
Dyes	
Drugs, Controlled Substances	Refer to <i>Code of Federal Regulations: Food and Drugs</i> .
Drugs, Pharmaceuticals	Refer to <i>Physicians' Desk Reference</i> .
Drugs, Over-the-Counter	Brand names.
Botanicals	Leaves; needles; coca; marijuana; mushrooms; soil; plants.
Toolmarks	Hand tools; knife; tool; locks; keys.
Computer	Hard drive; printers; photocopiers; toners.
Biological	Blood; sperm; semen; body fluid; urine; saliva; serology.
DNA	CODIS
Clay, Minerals, & Metals	Safe insulation; soil.
Rope	Cord; cordage; twine; jute; sisal.
NCE (Not Classified Elsewhere)	

Appendix E: Reference Materials

PHYSICAL OBJECTS

GROUP=Accelerants

Material	Count
TOTAL FOR GROUP	36
Explosives Standards (Low & High, Including Pyrotechnics) U.S. and Foreign	15
Ignitable Liquids-Neat and Weathered with Analytical Data	21

GROUP=Ammunition

Material	Count
TOTAL FOR GROUP	50
General Ammunition	15
Gunpowders/Propellants	11
Bullets	7
Gunshot Residue Standards	7
Metal Alloys Standards	3
Cartridge Cases	2
Primers	2
Ammunition Test Results	1
Percussion Caps, BBs, Pellets	1
Wound Ballistic Profiles	1

GROUP=Biological Specimens

Material	Count
TOTAL FOR GROUP	94
Toxicology, Blood	25
Semen, Human	18
Toxicology, Urine	13
Blood, Human	12
Semen, Nonhuman	12
Blood, Nonhuman	8
Body Fluids	6

GROUP=Botanical

Material	Count
TOTAL FOR GROUP	12
Marijuana	5
Botanical Material Standards (Leaves/Needles, Type and Shape)	3
Soil Material - Sand, Silica, etc.	3
Psilocybin Mushrooms (Dried)	1

PHYSICAL OBJECTS (Continued)

GROUP=Clay, Minerals, & Metals

Material	Count
TOTAL FOR GROUP	16
Metals	4
Soil Samples (for Size Gradation, Color Assay, and Clay Typing)	3
Building Materials/SAFE Insulation	1
Clays	1
Environmental Minerals	1
Heavy Metals ICP-MS Standards for Toxicology Screens	1
Metal End Caps (Manufacturer's)	1
Minerals	1
RI/Trace Metals in Glass	1
Samples of Metals and Alloys Used in FIA and Ammo Manufacture	1
Segmental Hair Standards (Heavy Metals)	1

GROUP=DNA

Material	Count
TOTAL FOR GROUP	59
Human Origin Specimens – Extracts of Known Quality (Type of Loci) and Quantity	28
Method Specific Quantization Standards and Molecular Weight Standards	11
Human Origin Specimens – Fluid/Tissue/Organ Standards (Including Saliva, Semen, Blood, Muscle, Bone and Teeth)	10
Other Method, Training and/or Validation Standards (Molecular Ladders, Mixtures of Known Proportion, CODIS Profiles, Lineage Reference Set, Mock Case Samples)	5
Human Origin Specimens – Gender Standards (Male/Female)	4
Nonhuman Origin Specimens	1

GROUP=Dyes

Material	Count
TOTAL FOR GROUP	3
Bank Dyes	1
Dyes Associated with Tear Gas(es)	1
Dyes of Fibers (Yearly)	1

PHYSICAL OBJECTS (Continued)

GROUP=Explosives

Material	Count
TOTAL FOR GROUP	38
General Explosives	12
General Gunpowder/Propellants	12
Smokeless Powders	4
Black Powder/Substitutes	2
Chemistry of Powder and Explosives	2
Low Explosives	2
Black Pepper Spray	1
Blasting Caps	1
Explosives Residues	1
High Explosives	1

GROUP=Fiber

Material	Count
TOTAL FOR GROUP	131
Fibers by End Use	21
Synthetic Fibers	17
Natural Fibers	16
Mineral Fibers	14
Animal Fibers	13
Manufactured Fibers	13
Fabric	12
Vegetable Fibers	12
Analytical Data	10
Polymers	2
Textile Dyes	1

GROUP=Firearms

Material	Count
TOTAL FOR GROUP	19
General Firearms	14
Consecutively Manufactured Barrels	1
Firearms Photographs	1
Proficiency Test Materials	1
Reloading Equipment	1
Serial Numbers, Marks, and Patterns	1

PHYSICAL OBJECTS (Continued)

GROUP=Glass

Material	Count
TOTAL FOR GROUP	32
Glass	17
NIST Glass Standards	6
CTS Glass	1
Miscellaneous Refractive Index Standards	2
Calibration Standards for GRIM and GRIM2	2
Miscellaneous Composition Standards	2
Automobile Headlamps	2

GROUP=Hair

Material	Count
TOTAL FOR GROUP	22
Animal Hairs	10
Domestic Animal Hairs	6
Human Hairs	4
Textile Fur Hairs	2

GROUP=Ink

Material	Count
TOTAL FOR GROUP	8
General Inks	4
Toners	2
Light Source for Examination of Documents	1
TLC Library of Inks	1

GROUP=Paint

Material	Count
TOTAL FOR GROUP	65
Automotive Paint – Physical Specimens (Both Foreign and Domestic)	20
Paint Samples – Physical Specimens, Nonspecific (Both Automotive and Architectural)	18
Samples of Paint Components – Binders, Pigments, Extenders, Solvents, and Additives	10
Architectural Paint – Physical Specimens	9

PHYSICAL OBJECTS (Continued)**GROUP=Paint (Continued)**

Material	Count
Paint and Paint Component Data Bases – Composition, Year, Make	4
Collection of Spectra (IR, Pyrolysis, Chromatograms) from Paint and Paint Components	3
Proficiency Paint Test Samples	1

GROUP=Paper

Material	Count
TOTAL FOR GROUP	8
Paper	3
Watermarks	3
Light for Examination of Documents	1
Paper Tapes	1

GROUP=Polymer

Material	Count
TOTAL FOR GROUP	18
Plastics	8
Polymers	6
Plasticizers-Reference Collection	1
Plastic-to-Spectra Couple Kinds (Useful for FTIR Calibration)	1
Rubber	1
Thin Film for IR or Pyrolysis GC of Polymers Used in Manufacture of Synthetic Fibers and Paints	1

GROUP=Rope

Material	Count
TOTAL FOR GROUP	7
Rope, All Types	7

GROUP=Shoe/Foot

Material	Count
TOTAL FOR GROUP	16
Shoe–Tread Design by Manufacturer	16

PHYSICAL OBJECTS (Continued)

GROUP=Tape

Material	Count
TOTAL FOR GROUP	16
Tapes	7
Duct Tape	5
Adhesives	4

GROUP=Tires

Material	Count
TOTAL FOR GROUP	12
Tires by Manufacturer	12

GROUP=Toolmarks

Material	Count
TOTAL FOR GROUP	5
Knife Reference Collection	2
Tool Reference Collection	2
Examples of Sharp Force Trauma in Soft Tissue and Bone from Common "Tools" with Known Force Applied	1

GROUP=Typewriter

Material	Count
TOTAL FOR GROUP	6
Typewriter Collection	5
Checkwriter	1

GROUP=Wood/Pollen

Material	Count
TOTAL FOR GROUP	9
Wood	5
Pollens	4

DRUGS**GROUP=Noncontrolled**

Material	Count
TOTAL FOR GROUP	313
Fluoxetine	3
Ibuprofen	3
Lidocaine	3
Quinine	3
Tramadol	3
Acetaminophen	2
Amitriptyline	2
Atropine	2
Benzocaine	2
Brompheniramine	2
Bupivacaine	2
Caffeine	2
Carbamazepine	2
Carbinoxamine	2
Carisoprodol	2
Chlorpromazine	2
Chlorzoxazone	2
Clozapine	2
Cyclobenzaprine	2
Desipramine	2
Diltiazem	2
Diphenhydramine	2
Doxepin	2
Doxylamine	2
Ephedrine	2
Guaifenesin	2
Hydroxyzine	2
Imipramine	2
Isoflurane	2
Maprotiline	2
Meclizine	2
Mesoridazine	2
Metoclopramide	2
Metoprolol	2
Naproxen, Naprosyn	2
Nefazodone	2
Nicotine	2
Nortriptyline	2

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Orphenadrine	2
Papaverine	2
Paroxetine	2
Phenylpropanolamine	2
Primidone	2
Procaine	2
Promethazine	2
Propafenone	2
Propoxyphene	2
Propranolol	2
Pseudoephedrine	2
Quinidine	2
Salicylamide	2
Salicylate	2
Sertraline	2
Theophylline	2
Thioridazine	2
Trazadone	2
Trimethoprim	2
Trimipramine	2
Valproic Acid	2
Venlafaxine	2
Verapamil	2
Warfarin	2
Acebutolol	1
Acetazolamide	1
Acetohexamide	1
Acetylsalicylic acid	1
Albuterol	1
Amantadine	1
Amiodarone	1
Amoxapine	1
Analgesics (NSAIDs)	1
Aniline	1
Anticonvulsants	1
Antihistamines	1
Antipyrine	1
Aspirin	1
Atenolol	1

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Atracurium	1
Azatadine	1
Baclofen	1
Benzonatate	1
Benztropine	1
Biperiden	1
Bisoprolol	1
Bumetanide	1
Bupropion	1
Buspirone	1
Camphor	1
Captopril	1
Chloroprocaine	1
Chloroquine	1
Chlorothiazide	1
Chlorpropamide	1
Chlorprothixene	1
Chlorthalidone	1
Cimetidine	1
Clomipramine	1
Clonidine	1
Colchicine	1
Cyproheptadine	1
Dantrolene	1
Dicyclomine	1
Diffunisal	1
Digitoxin	1
Digoxin	1
Dilantin	1
Dimethylsulfoxide	1
Disopyramide	1
Disulfiram	1
Doxapram	1
Dyphylline	1
Enflurane	1
Ethosuximide	1
Ethotoin	1
Ethyl chloride	1
Etidocaine	1

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Etodolac	1
Felodipine	1
Fenoprofen	1
Flecainide	1
Fluconazole	1
Flumazenil	1
Fluorouracil, 5-	1
Fluphenazine	1
Fructose	1
Furosemide	1
Glucose	1
Haldol	1
Haloperidol	1
Halothane	1
Hexachlorophene	1
Hydrochlorothiazide	1
Hydroxychloroquine	1
Indapamide	1
Indomethacin	1
Insulin	1
Ipecac	1
Isometheptene	1
Isoniazid	1
Isopropanol	1
Isoproterenol	1
Isosorbide dinitrate	1
Ketoprofen	1
Ketorolac	1
Labetalol	1
Lindane	1
Lithium	1
Loxapine	1
Ludiomil	1
Mefenamic acid	1
Mephentyoin	1
Mepivacaine	1
Metaproterenol	1
Metaxalone	1
Metformin	1

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Methocarbamol	1
Methotrimeprazine	1
Methsuximide	1
Methyl salicylate	1
Methyldopa	1
Metronidazole	1
Minoxidil	1
Molindone	1
Moricizine	1
Nadolol	1
Nalbuphine	1
Naloxone	1
Naltrexone	1
Nicardipine	1
Nifedipine	1
Nimodipine	1
Nitrate	1
Nitrites for Greiss Test	1
Nitrofurantoin	1
Nitroglycerin	1
Nitrous oxide	1
Nizatidine	1
Oxaprozin	1
Oxtriphylline	1
Oxyphenbutazone	1
Pancuronium bromide	1
Paxil	1
Pentoxifylline	1
Perphenazine	1
Phenacetin	1
Phenazone	1
Phenelzine	1
Phenformin	1
Pheniramine	1

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Phenmetrazine	1
Phenol	1
Phensuximide	1
Phenylbutazone	1
Phenylephrine	1
Phenyltoloxamine	1
Phenytoin	1
Pindolol	1
Piroxicam	1
Potassium	1
Prazosin	1
Prilocaine	1
Primaquine	1
Probenecid	1
Procainamide	1
Procaineamide	1
Prochlorperazine	1
Procyclidine	1
Propofol	1
Propylene glycol	1
Propylhexedrine	1
Protriptyline	1
Pyrilamine	1
Ranitidine	1
Salicylic Acid	1
Scopolamine	1
Selegiline	1
SKF-525A	1
Sotalol	1
Spermicides	1
Steroids (not anabolic)	1
Succinylcholine	1
Sucrose	1
Sulfanilamide	1
Sulfathiazole	1
Sulindac	1

DRUGS (Continued)**GROUP=Noncontrolled (Continued)**

Material	Count
Sympathomimetics, alpha	1
Talcum powders	1
Terbutaline	1
Terfenadine	1
Tetrahydroethylene	1
Thiothixene	1
Timolol	1
Tocainide	1
Tolazamide	1
Tolmetin	1
Toradol	1
Tranlycypromine	1
Triamterene	1
Tricyclic antidepressants	1
Trifluoperazine	1
Trihexyphenidyl	1
Tripelennamine	1
Tubocurarine	1
Yohimbine	1
Zidovudine	1
Zolof	1

DRUGS (Continued)**GROUP=Controlled**

Material	Count
TOTAL FOR GROUP	280
Codeine	5
Flunitrazepam	4
Oxycodone	4
Amphetamine	3
Diazepam	3
Dihydrocodeine	3
Fentanyl	3
Hydromorphone	3
Levorphanol	3
Methaqualone	3
Phentermine	3
Psilocin	3
Psilocybin	3
Alfentanil	2
Alphaprodine	2
Alprazolam	2
Anabolic Steroids	2
Anileridine	2
Barbital	2
Butalbital	2
Chlordiazepoxide	2
Chlorpheniramine	2
Clonazepam	2
Diphenoxylate	2
Etorphine	2
Hydrocodone	2
Meperidine	2
Meprobamate	2
Mescaline	2
Methadone	2
Midazolam	2
Morphine	2
Nordiazepam	2
Oxymorphone	2
Pentazocine	2
Pentobarbital	2
Phencyclidine	2
Phenobarbital	2

DRUGS (Continued)**GROUP=Controlled (Continued)**

Material	Count
Secobarbital	2
Temazepam	2
Tetrahydrocannabinol	2
Thiopental	2
Triprolidine	2
Zolpidem	2
2, 5-Dimethoxyamphetamine	1
3, 4, 5-Trimethoxy amphetamine	1
3, 4-Methylenedioxy N-ethylamphetamine	1
3, 4-Methylenedioxyamphetamine	1
3-Methylfentanyl	1
3-Methylthiofentanyl	1
4-Bromo-2, 5-dimethoxyamphetamine	1
4-Methoxyamphetamine	1
4-Methyl-2, 5-dimethoxyamphetamine	1
5-Methoxy-3, 4-Methylenedioxyamphetamine	1
Acetorphine	1
Acetyl-alpha-methylfentanyl	1
Acetyldihydrocodeine	1
Acetylmethadol	1
Allylprodine	1
Alpha-methylfentanyl	1
Alpha-methylthiofentanyl	1
Amobarbital	1
Aprobarbital	1
Barbiturates	1
Benzethidine	1
Benzodiazepines	1
Benzphetamine	1
Benzylmorphine	1
Beta-hydroxy-3-methylfentanyl	1
Beta-hydroxyfentanyl	1
Betaprodine	1
Bezitramide	1
Bromazepam	1
Bufotenine	1
Buprenorphine	1
Butobarbital	1
Butorphanol	1

DRUGS (Continued)**GROUP=Controlled (Continued)**

Material	Count
Carfentanil	1
Chloral hydrate (Trichloroethanol)	1
Chlorphentermine	1
Cinnamoyl cocaine	1
Clobazam	1
Clonitazene	1
Clorazepate (Nordiazepam)	1
Cocaine (Benzoyl ecgonine) (Ecgonine methyl ester) (Cocaethylene)	1
Codeine methylbromide	1
Codeine-N-Oxide	1
Concentrate of Poppy Straw	1
Cyprenorphine	1
Delta-1 cis tetrahydrocannabinol	1
Delta-1 trans tetrahydrocannabinol	1
Delta-3, 4 cis tetrahydrocannabinol	1
Delta-3, 4 trans tetrahydrocannabinol	1
Delta-6 cis tetrahydrocannabinol	1
Delta-6 trans tetrahydrocannabinol	1
Desalkylflurazepam	1
Desomorphine	1
Dextromethorphan	1
Diampromide	1
Diethylpropion	1
Diethylthiambutene	1
Diethyltryptamine	1
Difenoxin	1
Dihydromorphine	1
Dimenoxadol	1
Dimethylthiambutene	1
Dioxaphetylbutyrate	1
Dipipanone	1
Dronabinol	1
Drotebanol	1
Estazolam	1
Ethchlorvynol	1
Ethinamate	1
Ethylamine analog of Phencyclidine	1

DRUGS (Continued)**GROUP=Controlled (Continued)**

Material	Count
Ethylmethythiambutene	1
Ethylmorphine	1
Etonitazene	1
Etorphine hydrochloride	1
Etoxidine	1
Fenfluramine	1
Flurazepam	1
Flurazepam (Desalkyl-)	1
Furethidine	1
Glutethimide	1
Granulated Opium	1
Halazepam	1
Heroin	1
Hydromorphenol	1
Hydroxypethidine	1
Ibogaine	1
Isomethadone	1
Ketamine	1
Ketobemidone	1
Levomethorphan	1
Levophenacymorphan	1
L-methorphan (levo-methorphan)	1
Lorazepam	1
LSD	1
Mazindol	1
Mecloqualone	1
Medazepam	1
Mephobarbital	1
Metazocine	1
Methadone-intermediate, 4-cyano-2-dimethylamino-4, 4-diphenylbutane	1
Methamphetamine	1
Methamphetamine, d-	1
Methamphetamine, l-	1
Metharbital	1
Methcathinone	1
Methotrexate	1
Methyl Phenidate	1

DRUGS (Continued)**GROUP=Controlled (Continued)**

Material	Count
Methyldihydromorphine	1
Methylfentanyl	1
Methyprylon	1
Metopon	1
Monoacetylmorphine	1
Morpheridine	1
Morphine methylbromide	1
Morphine methylsulfonate	1
Morphine N-Oxide	1
Myrophine	1
N,N-dimethylamphetamine	1
Nabilone	1
Nalorphine	1
N-ethyl-3-piperidyl benzilate	1
N-ethylamphetamine	1
Nicocodeine	1
Nicomorphine	1
Nitrazepam	1
N-methyl-3-piperidyl benzilate	1
Noracymethadol	1
Normethadone	1
Normorphine	1
Opiates	1
Opium Extracts	1
Opium Fluid Extracts	1
Opium Poppy & Poppy Straw	1
Opium, Powdered	1
Opium, Raw	1
Opium, Tincture	1
Oxazepam	1
Para-fluorofentanyl	1
Paraldehyde	1
Paralexyl	1
Pemoline	1
PEPAP (1-(2-phenetyl)-4phenyl-4-acetoxypipcridine	1
Pethidine (Meperidine)	1
Pethidine-intermediate-A, 4-cyano-1-methyl-4-phenylpiperdine	1

DRUGS (Continued)**GROUP=Controlled (Continued)**

Material	Count
Pethidine-intermediate-B, ethyl-4-phenylpiperidine-4-carboxylate	1
Pethidine-intermediate-C, 1-methyl-4-phenylpiperidine-4-carboxylic acid	1
Peyote-Botanical Standard	1
Phenadoxone	1
Phenampromide	1
Phenazocine	1
Phendimetrazine	1
Phenomorphin	1
Phenoperidine	1
Phenylacetone	1
Phenylacetone & methylamine	1
Pholcodine	1
Piminodine	1
Piritramide	1
Prazepam (Nordiazepam)	1
Proheptazine	1
Properidine	1
Propiram	1
Pyrrolidine analog of Phencyclidine	1
Quazepam	1
Racemethorphan	1
Racemorphan	1
Sufentanil	1
Tetrahydrocannabinol carboxy metabolite	1
Thebacon	1
Thebaine	1
Thiophene analog of Phencyclidine	1
Tilidine	1
Triazolam	1
Trimeperidine	1
Zolpidem (Ambien)	1

Appendix F: Reference Collections

PHYSICAL OBJECTS

GROUP=Accelerants

Material	Count
TOTAL FOR GROUP	65
Ignitable Liquids	49
Explosives Standards	16

GROUP=Ammunition

Material	Count
TOTAL FOR GROUP	72
General Ammunition	49
Bullets	10
Cartridge Cases	7
Gun Powder	5
Gunshot Residues	1

GROUP= Biological Specimens

Material	Count
TOTAL FOR GROUP	82
Blood, Human	20
Semen, Nonhuman	15
Blood, Nonhuman	13
Semen, Human	12
Body Fluids	11
Toxicology, Blood	9
Toxicology, Urine	2

GROUP=Botanical

Material	Count
TOTAL FOR GROUP	9
Plants/Seeds	4
Soils	4
Botanical/Spice Collection	1

PHYSICAL OBJECTS (Continued)

GROUP=Clay, Minerals, & Metals

Material	Count
TOTAL FOR GROUP	30
Minerals	22
Safe Insulation	4
Soils	4

GROUP=DNA

Material	Count
TOTAL FOR GROUP	22
Known DNA Standards (Including Casework Samples, Validation Sample, Proficiency Test Samples)	13
Population and/or Profile Databases (Including Local Area Racial Samples, CODIS)	6
NIST Profiling Standards	3

GROUP=Dyes

Material	Count
TOTAL FOR GROUP	1
Textile Fiber Dyes	1

GROUP=Explosives

Material	Count
TOTAL FOR GROUP	43
General Explosives	16
Gunpowder	13
Smokeless Powder	6
Black Powder	3
Low Explosives	3
Explosive Residues	1
High Explosives	1

PHYSICAL OBJECTS (Continued)

GROUP=Fiber

Material	Count
TOTAL FOR GROUP	138
Synthetic Fibers	46
Natural Fibers, Not Specified	31
Fibers, All Types	29
Fibers by End Use	14
Manufactured Fibers, Not Specified	7
Mineral Fibers	6
Animal Fibers	3
Vegetable Fibers	1
Fabric	1

GROUP=Firearms

Material	Count
TOTAL FOR GROUP	61
General Firearms	56
Serial Number, Marks, and Patterns	3
Firearms Literature	2

GROUP=Glass

Material	Count
TOTAL FOR GROUP	35
Glass	26
NIST Glass Standards	4
Automobile Headlamps	3
Glass Refractive Index Standards	2

PHYSICAL OBJECTS (Continued)

GROUP=Hair

Material	Count
TOTAL FOR GROUP	104
Animal Hair	53
Human Hair	39
Domestic Animal Hairs	8
Textile Fur Hairs	4

GROUP=Ink

Material	Count
TOTAL FOR GROUP	2
Ink, General	2

GROUP=Paint

Material	Count
TOTAL FOR GROUP	70
Automotive Paints – Physical Specimens, Both Foreign and Domestic	44
Paint Samples – Physical Specimens, Nonspecific (Both Automotive and Architectural)	22
Samples of Paint Components – Binders, Pigments, Extenders, Solvents, and Additives	4

GROUP=Paper

Material	Count
TOTAL FOR GROUP	4
Paper	4

GROUP=Polymer

Material	Count
TOTAL FOR GROUP	16
Polymer	7
Plastics	6
Chemicals	1
Foam Rubber	1
Plasticizers	1

PHYSICAL OBJECTS (Continued)

GROUP=Shoe/Foot

Material	Count
TOTAL FOR GROUP	23
Shoe – Tread Design by Manufacturer	23

GROUP=Tape

Material	Count
TOTAL FOR GROUP	6
Duct Tape	4
Adhesives	2

GROUP=Tire

Material	Count
TOTAL FOR GROUP	12
Tires by Manufacturer	12

GROUP=Toolmarks

Material	Count
TOTAL FOR GROUP	6
Toolmarks	4
Knife Collection	1
Locks, Keys	1

GROUP=Typewriter

Material	Count
TOTAL FOR GROUP	28
Typewriter Collection	22
Checkwriters	3
Fax Collection	3

GROUP=Wood/Pollen

Material	Count
TOTAL FOR GROUP	24
Wood	19
Pollen	4
Soils, Wood, Plants	1

DRUGS

GROUP=Controlled

Material	Count
TOTAL FOR GROUP	8
Amphetamine	1
Cocaine	1
Cocaine Hydrochloride	1
Heroin	1
LSD	1
LSD Blotter Papers	1
Marijuana and Other Vegetation	1
Methamphetamine	1

GROUP=Non-Controlled

Material	Count
TOTAL FOR GROUP	1
Steroid Drugs (not anabolic)	1

*Appendix G: Future Reference
Collections*

PHYSICAL OBJECTS

GROUP=Accelerants

Material	Count
TOTAL FOR GROUP	46
Complete Collection of Components of Ignitable Liquids	46

GROUP=Ammunition

Material	Count
TOTAL FOR GROUP	47
General Ammunition	26
Bullet	7
Gun Powder	5
Cartridge Cases	3
Primers	3
Gunshot Residue	2
Pellets	1

GROUP=Biological Specimens

Material	Count
TOTAL FOR GROUP	34
Blood, Nonhuman	7
Blood, Human	6
Toxicology, Blood	6
Semen, Human	5
Semen, Nonhuman	5
Body Fluids	4
Toxicology, Urine	1

GROUP=Botanical

Material	Count
TOTAL FOR GROUP	4
Soil	3
Plant Leaves	1

PHYSICAL OBJECTS (Continued)

GROUP=Clay, Minerals, & Metals

Material	Count
TOTAL FOR GROUP	8
Metal and Alloy Samples	3
Soil	3
Safe Insulations (to I.D. Type as Well as Manufacturer)	2

GROUP=DNA

Material	Count
TOTAL FOR GROUP	19
Human Origin Specimens Extracts of Known Quality, Quantity, and/or Sequence Data	7
Nonhuman Specimens (Including Requests for Animals, Bacteria, Plants, and Fungus)	4
Human Origin Specimens – Rare Type and Variants	3
Human Origin Specimens Reference Standards – Fluid/Tissue/Organ Standards (Including Saliva, Semen, Blood, Muscle, Bone, and Teeth)	2
Other Request – e.g., Teaching Aids, Data Collections	2
Human Origin Specimens Reference Standards – Gender Standard (Male/Female)	1

GROUP=Dyes

Material	Count
TOTAL FOR GROUP	7
Dyes, All Types	3
Fiber Dyes	3
Microspectrophotometry of Fiber Dyes	1

PHYSICAL OBJECTS (Continued)

GROUP=Explosives

Material	Count
TOTAL FOR GROUP	34
General Explosives	14
General Gunpowder/Propellants	12
Low Explosives	4
High Explosives	3
Smokeless Gunpowder	1

GROUP=Fiber

Material	Count
TOTAL FOR GROUP	79
Natural Fibers	15
Fibers by End Use	14
Synthetic Fibers	11
Vegetable Fibers	7
Fiber, All Types	7
Fabric	6
Manufactured Fibers	5
Mineral Fibers	5
Analytic Data	4
Textile Dyes	4
Animal Fibers	1

GROUP=Firearms

Material	Count
TOTAL FOR GROUP	33
General Firearms	24
Firearm Photos	3
Serial Number, Marks, and Patterns	3
Consecutively Manufactured Barrels	1
Firearms Proficiency Test Material	1
Reloading Equipment	1

PHYSICAL OBJECTS (Continued)**GROUP=Glass**

Material	Count
TOTAL FOR GROUP	25
Glass	18
Automobile Headlamps	4
Calibration Standards for GRIM and GRIM2	1
CTS Glass	1
Miscellaneous Refractive Standards	1

GROUP=Hair

Material	Count
TOTAL FOR GROUP	18
Animal Hair	10
Human Hair	7
Domestic Animal Hairs	1

GROUP=Ink

Material	Count
TOTAL FOR GROUP	22
Inks – General	13
Toners	8
Palm Print Routine/4 Taken Via Livescan/Ink for Entry in Computer	1

GROUP=Paint

Material	Count
TOTAL FOR GROUP	70
Automotive Paint – Physical Specimens, Both Foreign and Domestic	22
Paint Samples – Physical Specimens, Nonspecific (Both Automotive and Architectural)	18
Samples of Paint Components – Binders, Pigments, Extenders, Solvents, Additives	16
Architectural Paint – Physical Specimens	9
Collection of Spectra (IR, Pyrolysis, Chromatograms) from Paint and Paint Components	3
Paint and Paint Component Databases – Composition, Year, Make	1
Proficiency Paint Test Samples	1

PHYSICAL OBJECTS (Continued)

GROUP=Paper

Material	Count
TOTAL FOR GROUP	9
Paper	8
Watermarks	1

GROUP=Polymer

Material	Count
TOTAL FOR GROUP	19
Plastic	9
Polymers	5
Rubbers, All Types	3
Adhesives: Plumbers Putty, Rubber Cement, Epoxy, etc.	1
Automotive Plastics	1

GROUP=Rope

Material	Count
TOTAL FOR GROUP	4
Rope	4

GROUP=Shoe/Foot

Material	Count
TOTAL FOR GROUP	30
Shoe-Tread Design by Manufacturer	30

GROUP=Tape

Material	Count
TOTAL FOR GROUP	23
Duct tape	10
Tapes	7
Adhesives	6

GROUP=Tire

Material	Count
TOTAL FOR GROUP	17
Tires by Manufacturer	17

PHYSICAL OBJECTS (Continued)

GROUP=Toolmarks

Material	Count
TOTAL FOR GROUP	8
Tools	5
Batteries, Clocks, and Wires	1
Examples of Sharp Force Trauma in Soft Tissue and Bone from Common “Tools” with Known Amount of Force Applied	1
Knife	1

GROUP=Typewriter

Material	Count
TOTAL FOR GROUP	11
Fonts, General	5
Collection of Fax standards	2
Typewriter Collection	2
Type Font Standards	1
Typewriter Fonts	1

GROUP=Wood/Pollen

Material	Count
TOTAL FOR GROUP	13
Pollen	8
Wood	5

DRUGS**GROUP=Noncontrolled**

Material	Count
TOTAL FOR GROUP	6
Steroids (Not Anabolic)	3
Albuterol	1
Oxaprozin	1
Sertraline	1

GROUP=Controlled

Material	Count
TOTAL FOR GROUP	2
Anabolic Steroids	1
LSD Blotter Paper	1