1 BALDWIN STREET,
MONTPELIER, VT 05633-5701

PHONE: (802) 828-2295
FAX: (802) 828-2483

STATE OF VERMONT
JOINT FISCAL OFFICE

MEMORANDUM

To: James Reardon, Commissioner of Finance & Management

From: Nathan Lavery, Fiscal Analyst

Date: May 18, 2009

Subject: JFO #2378

No Joint Fiscal Committee member has requested that the following item be held for review:

JFO #2378 — $92,888.00 grant from the National Institute of Justice to Public Safety – Criminal Justice Services. These grant funds will support a limited service position for research and development in the area of controlled substance detection and analysis.
[*JFO received 4/16/09*]

In accordance with 32 V.S.A. §5, the requisite 30 days having elapsed since these items were submitted to the Joint Fiscal Committee, the Governor's approval may now be considered final. We ask that you inform the Secretary of Administration and your staff of this action.

cc: Thomas Tremblay, Commissioner

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INFORMATION NOTICE

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[*JFO received 4/16/09*]

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STATE OF VERMONT
JOINT FISCAL OFFICE

MEMORANDUM

To: Joint Fiscal Committee Members

From: Nathan Lavery, Fiscal Analyst

Date: April 17, 2009

Subject: Grant Request

Enclosed please find one (1) request that the Joint Fiscal Office has received from the administration:

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[*JFO received 4/16/09*]

The Joint Fiscal Office has reviewed this submission and determined that all appropriate forms bearing the necessary approvals are in order.

In accordance with the procedures for processing such requests, we ask you to review the enclosed and notify the Joint Fiscal Office (Nathan Lavery at (802) 828-1488; nlavery@leg.state.vt.us) if you have questions or would like an item held for Joint Fiscal Committee review. Unless we hear from you to the contrary by May 1 we will assume that you agree to consider as final the Governor's acceptance of this request.

cc: James Reardon, Commissioner
Thomas Tremblay, Commissioner

1 BALDWIN STREET,
MONTPELIER, VT 05633-5701

PHONE: (802) 828-2295
FAX: (802) 828-2483

STATE OF VERMONT
JOINT FISCAL OFFICE

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From: Nathan Lavery, Fiscal Analyst

Date: April 17, 2009

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cc: James Reardon, Commissioner
Thomas Tremblay, Commissioner

5 R0 2378

VERMONT

State of Vermont
Department of Finance & Management
109 State Street, Pavilion Building
Montpelier, VT 05620-0401

[phone] 802-828-2376
[fax] 802-828-2428

Agency of Administration

STATE OF VERMONT
FINANCE & MANAGEMENT GRANT REVIEW FORM

Grant Summary:	Supports position to perform research & development in the area of controlled substances.				
Date:	3/23/2009				
Department:	Public Safety - Criminal Justice Services - Forensic Laboratory				
Legal Title of Grant:	Research & Development in the Area of Controlled Substances				
Federal Catalog #:	16.560				
Grant/Donor Name and Address:	National Institute of Justice				
Grant Period: From:	1/1/2009	**To:**	12/31/2010		
Grant/Donation					
	SFY 1	**SFY 2**	**SFY 3**	**Total**	**Comments**
Grant Amount:	$73,704	$19,184	$	$92,888	

	# Positions	**Explanation/Comments**
Position Information:	1	Forensic chemist II

DB 3/23/09

Additional Comments:	Grant will support the Lab's primary work.

Department of Finance & Management	3/27/09	(Initial)
Secretary of Administration	KPM 4/8/09	(Initial)
Sent To Joint Fiscal Office	4/14/09	**Date**

RECEIVED
APR 16 2009
JOINT FISCAL OFFICE

Dept. of Public Safety
Administration Division
Accounting Unit

Memo

To: David Beatty, Budget & Management Analyst

From: Tracy O'Connell, Programs Administration Supervisor TO

Date: 12/22/08

CC: file

Re: Request for Grant Acceptance

Attached you will find an AA-1 form for the request to accept a grant from the National Institute of Justice.

If you have any questions, please contact me at 802-241-5574 or toconnel@dps.state.vt.us; or Richard Hallenbeck at 802-241-5339 or rhallenb@dps.state.vt.us.

Thank you.

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

BASIC GRANT INFORMATION				
1. Agency:				
2. Department:	Public Safety			
3. Program:	Criminal Justice Services Forensic Labratory			
4. Legal Title of Grant:	Research & Development in the Area of Controlled Substances			
5. Federal Catalog #:	16.560			
6. Grant/Donor Name and Address: National Institute of Justice; 810 Seventh St., NW; Washington, DC 20531				
7. Grant Period: **From:**	1/1/2009	**To:**	12/31/2010	
8. Purpose of Grant: The proposed research seeks to develop procedures and protocols for the analysis of drugs that currently yield limited information. This research will focus on the routine identification of commonly encountered drugs, designer drugs, and closely related drug isomers.				
9. Impact on existing program if grant is not Accepted: If successful, this project could introduce a new method of drug analysis that would be quicker, or could allow for simultaneous processing of casework with existing methods, therefore relieving backlogs in drug analysis.				

10. BUDGET INFORMATION

	SFY 1	SFY 2	SFY 3	Comments
Expenditures:	**FY** 2010	**FY** 2011	**FY**	
Personal Services	$68152	$13632	$	
Operating Expenses	$5552	$5552	$	
Grants	$	$	$	
Total	$73,704	$19,184	$	
Revenues:				
State Funds:	$	$	$	
Cash	$	$	$	
In-Kind	$	$	$	
Federal Funds:	$	$	$	
(Direct Costs)	$73704	$19184	$	
(Statewide Indirect)	$	$	$	
(Departmental Indirect)	$	$	$	
Other Funds:	$	$	$	
Grant (source)	$	$	$	
Total	$	$	$	

Appropriation No:	2140020000	**Amount:**	$92888
			$
			$
			$
			$
			$
			$

DEC 24 2008

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

		Total	$92,888

PERSONAL SERVICE INFORMATION

11. Will monies from this grant be used to fund one or more Personal Service Contracts? ☐ Yes ☒ No
If "Yes", appointing authority must initial here to indicate intent to follow current competitive bidding

Appointing Authority Name: Agreed by: _ _____ (initial)

12. Limited Service Position Information:	**# Positions**	**Title**
	1	Forensic Chemist II - will convert a Forensic Chemist IV position into a Forensic Chemist II position when the incumbent retires in Sept 09.
Total Positions	1	

12a. Equipment and space for these positions: ☒ Is presently available. ☐ Can be obtained with available funds.

13. AUTHORIZATION AGENCY/DEPARTMENT

I certify that no funds have been expended or committed in anticipation of Joint Fiscal Committee Approval of this grant:	Signature: Thomas R Tremblay	Date: 12/19/08
	Title: Commissioner	

14. ACTION BY GOVERNOR

☑	Check One Box: Accepted		4/13/09
☐	Rejected	(Governor's signature)	Date:

15. SECRETARY OF ADMINISTRATION

☐	Check One Box: Request to JFO	Linda P McClure	4/8/09
☐	Information to JFO	(Secretary's signature or designee)	Date:

16. DOCUMENTATION REQUIRED

Required GRANT Documentation	
☐ Request Memo	☐ Request Memo
☐ Dept. project approval (if applicable)	☐ Dept. project approval (if applicable)
☐ Notice of Award	☐ Notice of Donation (if any)
☐ Grant Agreement	☐ Grant (Project) Timeline (if applicable)
☐ Grant Budget	☐ Request for Extension (if applicable)

End Form AA-1

DEPARTMENT OF PUBLIC SAFETY

Memo

To: Commissioner Thomas Tremblay

From: Eric Buel, Ph.D. Laboratory Director *Eric Buel*

Date: December 19, 2008

Subject: R&D Controlled Substances Detection & Analysis Grant
Award #: 2008-DN-BX-K161

Commissioner,

As you know, we have been awarded a Research and Development grant in the area of controlled substances detection and analysis. The award provides funding for supplies for research and salary for one individual. Below is an outline of the application and award period for the grant.

10/19/07:
Received invitation for concept papers

11/9/07:
Submitted concept paper. Includes a "staffing plan" for 1 new FTE + OT for existing staff

1/29/08:
Received invitation to submit full proposal. Collaborated on scope and budget

2/14/08:
Approval of final budget which includes 1 FTE + OT for existing staff

2/15/08:
Submitted full proposal

7/14/08:
Responded to inquiries re classification of costs

9/18/08:
Assigned POC & Downloaded award

9/19/08:
Accepted Award

DEC 24 2008

We accepted the award in September; however we delayed submitting the award to the JFO for approval due to: the fiscal environment, FY09 position reductions and the fact that we don't have any vacant civilian limited-service positions at this time (as no new positions are being created).

We have received preliminary approval from NIJ for a one-year extension on the grant, thereby extending the grant end date to 12/31/2010. Instead of requesting a new limited service position be created, I am proposing the following:

I would like to seek state permission to proceed with our drug research under this award using funds available for supplies as soon as the state approves the grant. We would use funds for overtime to support existing personnel to slowly move forward to accomplish some of the goals of the award. One individual in our laboratory will be retiring in September 2009 and we would like to use that "position number" as the position we fill with this drug grant position. This would result in a delayed start to a portion of the drug research program. During the summer of 2009, we would advertise for a qualified individual to fill the "position number" we would have available in September 2009. I believe that we will be able to meet all the expectations of the grant but it will be slightly delayed.

Department of Justice
Office of Justice Programs
National Institute of Justice

Cooperative Agreement

1. RECIPIENT NAME AND ADDRESS (Including Zip Code)

Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

4. AWARD NUMBER: 2008-DN-BX-K161

5. PROJECT PERIOD: FROM 01/01/2009 TO 12/31/2009
BUDGET PERIOD: FROM 01/01/2009 TO 12/31/2009

6. AWARD DATE 09/17/2008

7. ACTION: Initial

1A. GRANTEE IRS/VENDOR NO.
036000274

8. SUPPLEMENT NUMBER
00

9. PREVIOUS AWARD AMOUNT: $0

3. PROJECT TITLE
VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

10. AMOUNT OF THIS AWARD: $ 92,888

11. TOTAL AWARD: $ 92,888

12. SPECIAL CONDITIONS

THE ABOVE GRANT PROJECT IS APPROVED SUBJECT TO SUCH CONDITIONS OR LIMITATIONS AS ARE SET FORTH ON THE ATTACHED PAGE(S).

13. STATUTORY AUTHORITY FOR GRANT

This project is supported under FY08(NIJ - COPS DNA/Forensics) Pub. L. No. 110-161, 121 Stat. 1897, 1910; 28 USC 530C

15. METHOD OF PAYMENT

PAPRS

[redacted] AGENCY APPROVAL [redacted]

16. TYPED NAME AND TITLE OF APPROVING OFFICIAL

Jeffrey L. Sedgwick
Acting Assistant Attorney General

17. SIGNATURE OF APPROVING OFFICIAL

[redacted] GRANTEE ACCEPTANCE [redacted]

18. TYPED NAME AND TITLE OF AUTHORIZED GRANTEE OFFICIAL

Thomas Tremblay
Commissioner

19. SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL

19A. DATE: 9/19/08

[redacted] AGENCY USE ONLY [redacted]

20. ACCOUNTING CLASSIFICATION CODES

FISCAL YEAR	FUND CODE	BUD. ACT.	OFC.	DIV. REG.	SUB.	POMS	AMOUNT
X	B	DN	60	00	00		92888

21. HDNSGT0088

OJP FORM 4000/2 (REV. 5-87) PREVIOUS EDITIONS ARE OBSOLETE.

OJP FORM 4000/2 (REV. 4-88)

Department of Justice

Office of Justice Programs

Office of the Assistant Attorney General *Washington, D.C. 20531*

September 17, 2008

Commissioner Thomas Tremblay
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

Dear Commissioner Tremblay:

On behalf of Attorney General Michael B. Mukasey, it is my pleasure to inform you that the Office of Justice Programs has approved your application for funding under the Research and Development in the Area of Controlled Substances Detection and Analysis in the amount of $92,888 for Vermont Department of Public Safety. The title of this project is, "VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis."

Enclosed you will find the Grant Award and Special Conditions documents. This award is subject to all administrative and financial requirements, including the timely submission of all financial and programmatic reports, resolution of all interim audit findings, and the maintenance of a minimum level of cash-on-hand. Should you not adhere to these requirements, you will be in violation of the terms of this agreement and the award will be subject to termination for cause or other administrative action as appropriate.

If you have questions regarding this award, please contact:

- Program Questions, Frances Scott, Program Manager at (202) 305-9950; and
- Financial Questions, the Office of the Chief Financial Officer, Customer Service Center (CSC) at (800) 458-0786, or you may contact the CSC at ask.ocfo@usdoj.gov.

Congratulations, and we look forward to working with you.

Sincerely,

Jeffrey L. Sedgwick
Acting Assistant Attorney General

Enclosures

Forensic drug identification by Gas Chromatography- Infrared Spectroscopy

Eric Buel, P.I.

PROGRAM NARRATIVE

Abstract:

The primary goal of the forensic drug examiner is the unequivocal identification of any controlled substance present in a drug exhibit. Most forensic laboratories routinely employ GC-MS as the preferred method for this examination. The technique provides a rapid, semi-automated analysis of the sample and typically yields sufficient information to identify the compounds in question. However, the application of GC-MS for drug analysis does have its limitations.

Certain drugs yield minimal mass spectral fragmentation patterns using electron impact MS, while other compounds, such as some diastereomers and positional isomers, are not readily differentiated by mass spectroscopy. Forensic scientists have been concerned for many years with the differentiation of isomers as evidenced by the work in the 1970's to distinguish the diethyl amide and methylpropylamide isomers of LSD and more recently the diastereomers ephedrine/pseudoephedrine and the isomers of phenethylamines. Infrared spectroscopy provides an alternate technique to mass spectroscopy for the identification of organic compounds. Recent improvements in the hyphenated technique, GC-IR, may provide a simple alternative or supplemental approach to GC-MS for the identification of certain compounds. A newly introduced instrument collects GC effluent on a liquid nitrogen cooled, IR transparent window that allows the direct analysis of the deposited solid material. This technique is superior to the IR light pipe in sensitivity, IR spectral quality, and allows direct comparison of the collected spectra to existing IR

databases. The proposed research seeks to develop procedures and protocols for the analysis of drugs yielding limited MS information via GC-IR and report to the forensic community the benefits and limitations of this technology. This research will focus on the routine identification of commonly encountered drugs, designer drugs, closely related drug isomers, as well as the fundamentals of the gas chromatography and infrared systems. Our laboratory currently owns a GC-IR instrument, and this research intends to further the work started by our laboratory [illegible]velop this technology into a viable technique for the f[illegible]unity.

3. Main Body

A). Purpose

The purpose of this research is to determine the benefits and limitations of the newly introduced Spectra Analysis GC-IR instrument. From this work, we will develop and make available protocols and procedures to use this instrument for routine drug analysis. This is important to the forensic community because this technology could allow the simple identification of certain compounds not routinely amenable to analysis by GC-MS.

B) Research Goal and Objectives

The objectives of this research are to fulfill the above purpose by meeting the following: 1) assessment of the GC-IR instrument to allow forensic scientists to understand the appropriate use of GC-IR and to 2) develop protocols and procedures for the efficient use of this instrument by the forensic community.

Objective 1: Our first objective is to assess the GC-IR for forensic drug identification. In most laboratories, drug submissions compose the bulk of the casework and as a result, laboratories attempt to semi-automate the drug analysis process. According to the 2006 Collaborative Testing Services drug proficiency test review, most respondents used gas chromatography-mass spectrometry for identification of the proficiency drug exhibit. GC-MS is ideally suited for drug analysis since most drug samples are mixed with any number of possible substances and GC-MS provides both the separation and structural information of the mixture of compounds seen in many forensic exhibits. This technique is easily linked to an auto-sampler which provides a semi-automated approach to drug analysis. The simplicity of use, combined separation and analysis power of the

instrument, coupled to large searchable mass spectral databases, has made GC-MS the forensic instrument of choice for routine drug identification. Samples from drug submissions may be dissolved into a suitable solvent, loaded into the auto-sampler, and analyzed un-attended while the examiner processes additional cases or reviews data from previous GC-MS analyses. This process works well for the busy forensic laboratories with backlogs and rush requests that must be analyzed in a simple, efficient, but accurate process. As with most techniques, however, the application of GC-MS for drug analysis does have its limitations and a supplementary or alternative tool employing infrared spectroscopy, could give the forensic scientist additional information to allow a more thorough identification of certain drugs. A further discussion of mass spectroscopy and infrared spectroscopy is detailed in the *Review of Relevant Literature* section.

Infrared spectroscopy is a proven tool for the positive identification of organic compounds. The routine application of traditional IR spectroscopy can be time consuming since the technique is not typically amenable to automation and the instrument requires samples to be relatively free of adulterants, often requiring some sample purification prior to IR analysis. Once a sample is relatively "clean" and ready for analysis, the specimen could be analyzed via any number of commonly employed manual methods: KBr pellet, thin film on NaCl plates, an ATR or an IR microscope accessory to name a few. All of these analytical procedures are useful, proven manual technologies. However, an infrared instrument that is coupled to a separation based technology such as gas chromatography, could offer a degree of automation that would allow the combined instrumentation to become an alternative, simple approach, for the routine analysis of certain drugs of abuse.

A number of attempts have been made to link an IR instrument to a separation technique. None of these attempts to develop a "hyphenated" technique have truly taken hold in the forensic community for a number of reasons. Previously designed instruments were either very expensive, difficult to use, had inadequate compound sensitivity or yielded poorly resolved spectra.

We have recently purchased a newly introduced GC-IR instrument offered by Spectra Analysis, Inc., Marlborough, MA. Their approach builds upon previous attempts to collect GC effluents at low temperatures for IR analysis. In this direct deposit approach, the GC effluent is deposited upon a spiraling ZnSe disk cooled with liquid nitrogen. The ZnSe disk is transparent to IR energy and the spectrum of the deposited material is captured immediately after sample deposition. This linking of a gas chromatograph instrument to an infrared detector, allows the separation of complex mixtures of substances and the subsequent collection of a full IR spectrum (4000 cm to 650 cm^{-1}). The instrument can be coupled to an auto-sampler and linked to commercially available IR libraries to allow a semi-automated approach to the analysis of drug samples. With this combination of technologies, GC-IR analysis could become a viable technique for the identification of complex drug mixtures.

Objective 2: The second objective of this project is to develop protocols and procedures for the efficient use of the GC-IR and distribute those to the forensic community. Since this instrument is newly introduced, we will need to perform a number of studies to determine the optimum operating parameters for forensic drug analysis. We intend to determine appropriate GC and IR conditions and any procedures necessary to allow forensic scientists to purchase and use this equipment with confidence.

D) Research Design and Methods

Objective 1: We intend to assess the GC-IR instrument to determine the benefits and limitations of this technology. The company, Spectra Analysis, takes "off the shelf" GC and auto-sampler components and links them to their IR detector. This IR detector system is essentially an untested system for the field of forensics, and while it may be suitable for commercial applications, a number of concerns must be answered prior to the forensic community implementing the technology. One of the issues that must be evaluated is the possibility of cross contamination of samples collected upon the reusable ZeSe disk. Two issues must be addressed here; how to identify that the disk is clean and ready for use prior to sample collection and the potential for cross contamination between separate collection tracks on the disk. We will develop a procedure to quickly scan a "cleaned" disk to determine if it is contaminant free. We will also intentionally load samples into the GC at concentrations that exceed routine limits to determine if there is any track to track contamination.

The crystalline and amorphous states of the same compound will yield different IR spectra. Various factors may affect the state of the material deposited upon the cooled zinc selenide disk. We will start our investigation of this phenomenon by looking at a wide range of compounds with the disk at a number of different temperatures and attempt to determine the conditions applicable for most forensic drug samples to maximize crystallization of the compounds of interest.

We have conducted some initial work concerning instrument sensitivity for a limited number of drugs but we intend to study additional drugs suited for GC-IR to define the sensitivity limitations of the instrument. We will also consider the difference in

sensitivity of the instrument capturing "on-the-fly" IR spectra versus re-scanning the deposited sample after the GC run has been completed. Multiple GC injections of the same sample may be performed to redeposit the GC effluent on the same disk track to concentrate the sample in an attempt to detect low concentration sample components. This mode of operation will be evaluated. The GC conditions will also have a large effect on sensitivity and will be evaluated as noted below.

In order to understand the real benefits and limitations of the system, we will need to analyze typical forensic samples. We will eval[illegible] samples to determine how the system [illegible] a wide range of drug submissions. Of interest will be p[illegible]nylamines (methamphetamine, MDMA and related compounds), psilocyn, tryptamines, and other commonly encountered drugs of abuse which yield minimal mass spectral data. These samples will be diluted in an appropriate solvent and analyzed by both GC-IR and GC-MS. A comparison will be made between the two technologies to determine if the same components are detected via both methods and to assess the protocols developed. An evaluation will be made [illegible] informational content [illegible] via the two technologies.

We also plan to define the limitations inherent in IR analysis by investigating closely related isomers. We are planning to work in conjunction with another NIJ grant recipient, Dr. Randall Clark (see attached letter of intent), to determine if GC-IR can be used to identify the varied MDMA analogs he has synthesized. Many of these compounds are not adequately discriminated by mass spectroscopy alone. IR is a powerful tool that may offer laboratories the ability to unequivocally identify closely related compounds. A variety of compounds (isomers not amenable to MS analysis) will be subjected to GC-IR

analysis. The IR of the closely related compounds will be compared along with the retention times of the compounds on different GC columns.

Objective 2: As we assess the instrument, we will learn what works well for drug analysis and develop protocols and procedures appropriate for the analysis of forensic drug samples. The GC-IR is less sensitive than a GC-MS and hence appropriate sample concentrations will need to be evaluated along with GC split ratios. To obtain the optimum separation and sensitivity we will need to evaluate GC column length, diameter, stationary phases, and carrier gas flow rates. The IR collection system will be evaluated to assess collection disk speed and IR resolution settings. In developing the protocols we will review what we learned during the assessment phase and implement those factors into a general protocol. Much of what we do will be an iterative process, where we develop a protocol and modify it by evaluating a variable and reassess the system. If time and in-house funding permits, we would also like to consider linking the IR detector to an existing GC-MS, yielding a GC-MS-IR system. This linking has been done by Spectra Analysis, but not in a forensic setting. This combined instrument would reduce the cost burden to forensic labs wishing to obtain both MS and IR information simultaneously from a sample.

E. Implications for Criminal Justice Policy and Practice

Many forensic disciplines have been challenged in the courts, and as this occurs it should prompt us to evaluate those technologies we perform to see if other strategies could add depth to our current analytical methods. The analysis of controlled substances is becoming more demanding as higher analytical standards are expected, and as the number of abused substances and designer drugs rise across the country. As we are

presented with analytical options to those methods and technologies we have been familiar with for years, it is incumbent upon us to review those technologies to determine if it makes sense to use these emerging tools to improve the analyses we offer to the criminal justice community.

GC-MS is often used for the forensic analysis of controlled substances and it is an excellent tool for routine drug analysis. However, a number of published reports have discussed the limitations of MS for certain compounds. Some of these limitations can be overcome by evaluating sample GC retention time (as compared to a retention time from a known drug) or by sample derivatization. GC retention time in combination with MS is a standard method for drug identification, but one may want to reflect upon relying on this combination of techniques for the differentiation of drugs where the compound yields a minimal MS pattern. Additionally, some regioisomers have been shown to co-elute, requiring the selection of additional GC columns and appropriate temperature programs to provide adequate compound resolution. Some "designer drugs" are nothing more than isomeric cousins to established drugs, and hence these substances could co-elute with the target compound, compromising an analysis if the mass spectra are indistinguishable.

Derivatization increases the molecular weight of the target compound, which can improve the mass spectral informational content, while altering the chromatography of the molecule. In the case of amphetamines, derivatization improves the overall shape of the GC peak (1), and produces additional ions for identification purposes. Sample derivatization can improve the MS of a compound, but it adds steps to the analysis, decreases overall productivity, requires the handling of hazardous chemicals and derivatization can not be universally performed on all drugs.

Busy forensic laboratories need simple alternatives to assist the examiner in the unequivocal identification of controlled substances. The above methods are tried and true, but other techniques may provide information that is equal to, if not more compelling, through a semi-automated manner. We believe that increased sample information may be obtained simply, efficiently and in a semi-automated manner with GC-IR. Through our work we hope to show that GC-IR will be a supplementary or alternative tool to routine GC-MS, and will allow the forensic examiner to quickly and unequivocally identify compounds that have minimal or indistinguishable MS patterns. Our assessment of the instrument, and generation of protocols and procedures, would allow the forensic community to quickly evaluate the instrument for their use. We believe the emerging GC-IR technology will assist the examiner in the identification of routine drugs of abuse and those unusual substances seen today, in addition to those developed in the future.

F. Management plan and organization

A scientist with an appropriate background in chemistry will be hired and will work full-time on this project. The scientist will be assisted by Robert Shipman (see attached CV) who has been working on the GC-IR since the Vermont Forensic Laboratory (VFL) received the instrument. Mr. Shipman is a drug analyst with extensive hands-on experience with GC-MS, IR and GC-IR techniques. Dr. Eric Buel will oversee the project and his background includes forensic drug analysis. Both individuals will request funding for ~ 2 hours per week but will devote additional, un-funded time, as necessary to achieve the goals of the project.

After the project is complete, it is hoped that the state of Vermont will continue to fund the new hire, or there may be position openings due to retirement.

To date the VFL has performed some limited experiments with the instrument. The manufacturer (Spectra Analysis, Inc.) designed an instrument which, when it was received by the VFL, was suitable for research applications. The software and protocols for operation were not suited for routine forensic applications, but for use by a research institution or for solving a particular problem in an industrial/pharmaceutical application. After simple experiments were performed to conceptually show that the instrument should be of value to the forensic community, we began working with Spectra Analysis, Inc. to design and implement software and routine procedures to allow the introduction of the instrument into the forensic community. For example, suitable software needs to be finalized and tested to allow easy and routine instrument control (of both the GC and IR) with subsequent collection and appropriate reporting of the data. We believe this initial work will be done prior to receiving the grant so that the work described above can be accomplished in the allotted time.

Time Line:

Item	**Time**
Hire Scientist	Month 1
Drugs for project • Contact collaborators-specify drug samples needed • Purchase commercially available drugs	Month 1
Purchase necessary supplies- columns, solvents etc.	Month 1
Disk contamination issue • Evaluate cross contamination • Develop disk assessment protocol	Months 2-3
Crystalline and Amorphous states	Month 4

• Evaluate a wide range of drugs • Assess disk conditions to minimize amorphous state	
Sensitivity Study • On-the-fly versus re-scanning • Multiple deposition • Variations in GC conditions and disk speed	Month 5-6
Analysis of selected drugs (commercially available and from collaborators) • Routinely encountered drugs • Isomers and related compounds • Drugs with minimal MS patterns	Months 6-9
Forensic casework • Routine cases • Designer drug cases	Months 7-11
Develop and modify protocols	Months 7-12
Disseminate results to forensic community	Month 12

G. Dissemination Strategy

A major goal of our work is to distribute our findings and any derived methods to the forensic community to improve criminal justice. The cost of the Spectra Analysis instrument ($130,000, not including the GC- as per company representative), and costs relative to the operation of the instrument will be also be presented.

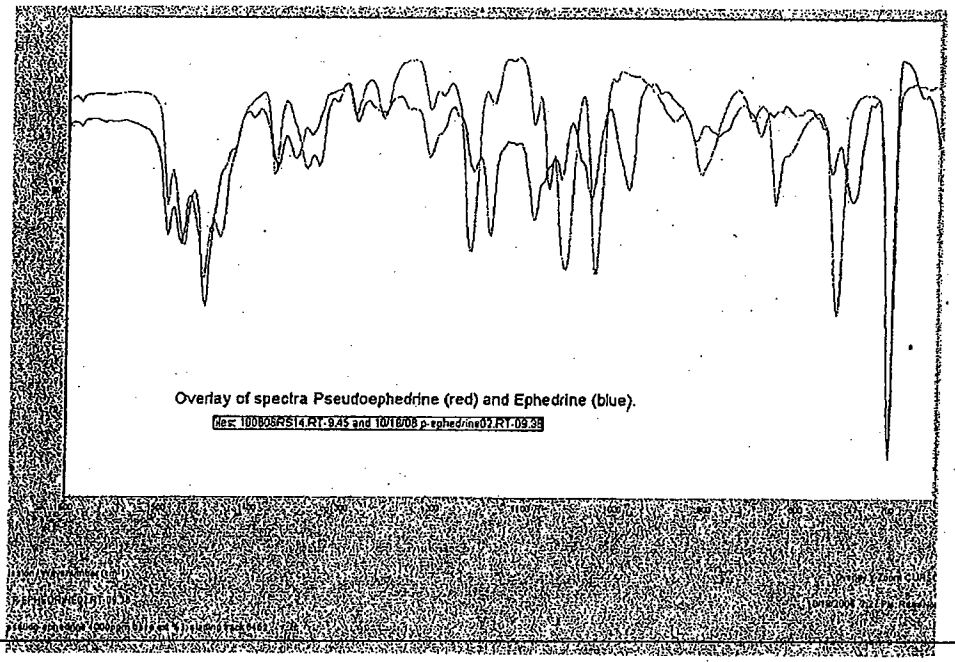
To this end, we will publish our results for peer review in the Journal of Forensic Sciences or other suitable journal and create basic protocols for others to use. We plan to present our findings at regional forensic meetings, and the American Academy of Forensic Sciences. This may take the form of poster sessions or as oral presentations. We also plan to be available by phone/e-mail to anyone interested in receiving information. We will also work with the National Forensic Science Training Center to hold a hands-on

work shop if they feel it is appropriate. I believe if one were to review our history, we have been proactive in providing peer reviewed publications, presentations, and "one-on one" information concerning any of our NIJ funded research projects.

H. Preliminary Data:

Figure 4 (below) shows the IR fingerprint region for the compounds pseudoephedrine and ephedrine. Both compounds were run separately on the GC-IR and the IR data collected. The spectra were overlaid to demonstrate the differences between these two diastereomers and to show the quality of the IR spectra typically obtained with this instrument. The mass spectra for these two compounds are essentially the same.

Figure 4



Grant Application Identifier: 2008 Controlled Substances Detection & Analysis R&D

Grant Period: 1/1/2009 12/31/2009

Adapted for VT DPS from

Budget Detail Worksheet

A. Personnel - List each position by title and name of employee, if available. Show the annual salary rate and the percentage of time to be devoted to the project. Compensation paid for employees engaged in grant activities must be consistent with that paid for similar work within the applicant organization.

Name, Position / Title		Computation: Hourly Rate	X Number of Hr's in Pay Period	X Number of Pay Periods	=	Cost for the Project Period		Total Personnel for Employee
1. Forensic Chemist II, t.b.a.	Step 2: 1/1/09-6/30/09	22.96	80	13		23,878.40		
PayGr 25, hired 'in range'	Step 2: with 2% COLA: 7/1/09-12/31/09	23.42	80	13		24,355.97	>	48,234.37
				26				
2. Robert Shipman, Forensic Chemist III	Step 6: 1/1/09-6/30/09	26.26	4	13		1,365.52		
OT only, PayGr 25	Step 6 :plus 2% COLA: 7/1/09-8/10/09	26.79	4	3		321.42		
	Step 7: with 2% COLA: 8/11/09-12/31/09	27.69	4	10		1,107.72	>	2,794.66
				26				
3. Eric Buel, Forensics Lab Director	Step 13: 1/1/09-4/9/09	41.78	4	8		1,336.96		
OT only, PayGr 29	Step 14: 4/10/09-6/30/09	42.95	4	5		859.00		
	Step 14: with 2% COLA: 7/1/09-12/31/09	43.81	4	[redacted]		2,278.07	>	4,474.03
				26				

Sub-Total $ 55,503

B. Fringe Benefits - Fringe benefits should be based on actual known costs or an established formula. Fringe benefits are for the personnel listed in budget category (A) and only for the percentage of time devoted to the proejct. Fringe benefits on overtime hours are limited to FICA, Workman's Compensation, and Unemployment Compensation.

Name, Position / Title	Computation					Cost
1. Forensic Chemist II, t.b.a.	Social Security at		6.20%		of salary	$ 2,991
	Medicare at		1.45%		of salary	$ 699
	Retirement at		9.70%		of salary	$ 4,679
	Worker's Comp at		6.00%		of salary	$ 2,894
	Health Ins at	$ 463.00	X	26.0	80-hour pay periods	$ 12,038
	Life Ins at		0.35%		of salary	$ 169
	Dental Ins at	$ 41.74	X	26.0	80-hour pay periods	$ 1,085
	EAP at	$ 1.08	X	26.0	80-hour pay periods	$ 28
						$ 24,583
2. Robert Shipman, Forensic Chemist III	Social Security at		6.20%		of salary	$ 173
	Medicare at		1.45%		of salary	$ 41
	Retirement at		9.70%		of salary	$ 271
	Worker's Comp at		6.00%		of salary	$ 168
						$ 653
3. Eric Buel, Forensics Lab Director	Social Security at		6.20%		of OT salary	$ 277
	Medicare at		1.45%		of OT salary	$ 65
	Retirement at		9.70%		of OT salary	$ 434
	Worker's Comp at		6.00%		of OT salary	$ 268
						$ 1,045

Sub-Total $ 26,280

TOTAL PERSONNEL AND FRINGE BENEFITS: $ 81,783

Travel - Itemize travel expenses of project personnel by purpose (e.g., staff to training, field interviews, advisory group meeting, etc.). Show the basis of computation (e.g., six people to 3-day training at $X airfair, $X lodging, $X substinance). In training projects, travel and meals for trainees should be listed separately. Show the number of trianees and the unit costs involved. Identify the location of travle, if known. Indicate source of Travel Policies applied, Applicant or Federal Travel Regulations.

Purpose	Location	Computation				T. Cost Per Line	
		# of people	# of days	Cost Ea	Description		
AAFS Meeting	TBA	1	-	$ 558.00	Airfare	$ 558	
		1	4	$ 130.00	Lodging	$ 520	
		1	4	$ 40.00	Subsistence	$ 160	$ 1,238

TOTAL TRAVEL $ 1,238

D. Equipment - List non-expendable items that are to be purchased. Non-expendable equipment is tangible property having a useful life of more than two years and an acquisition cost of $5,000 or more per unit. (Note: Organization's own capitalization policy may be used for items costing less than $5,000). Expendable items should be included either in the "supplies" category or in the "Other" category. Applicants should analyze the cost benefits or purchasing versus leasing equipment, especially high cost items and those subject to rapid technical advances. Rented or leased equipment costs sh ould be listed in the "Contractual" category. Explain how the equipment is necessary for the success of the project. Attach a narrative describing the procurement method to be used.

Equipment Items	Computation			Cost
	Quantity		Cost Each	
None.	0	at	$ -	$ -

TOTAL EQUIPMENT: $ -

E. Supplies - List items by type (office supplies, postage, training materials, copying paper, and expandable equipment items costing less than $5,000, such as books, hand held tape recorders) and show the basis for computation. (Note: Organization's own capitalization policy may be used for items costingless than $5,000). Generally, supplies include any materials that are expendable or consumed during the course of the project.

Supply Items	Computation					T. Cost Per Line
	Quantity	Unit		Price Per Unit		
Custom designed and systhezied drugs	14	each	at	$ 500.00		$ 7,000.00
Commercially available drugs	27	each	at	$ 50.00		$ 1,350.00
GC Columns	3	each	at	$ 500.00		$ 1,500.00

TOTAL SUPPLIES: $ 9,850

F. Construction - As a rule, construction costs are not allowable. In some cases, minor repairs or renovations may be allowable. Check with the program office before budgeting funds in this category.

Purpose	Description of Work	Cost
None		$ -

TOTAL CONSTRUCTION: $ -

G. Consultants/Contracts - Indicate whether applicant's formal, written Procurement Policy or the Federal Acquisition Regulations are followed.

Consultant Fees: For each consultant enter the name, if known, service to be provided, hourly or daily fee (8-hour day), and the estimated time on the project. Consultant fees in excess of $450 per day require additional justification and prior approval from OJP.

Name of Consultant	Service Provided	Computation	Cost
None.			$ -
			Sub-Total: $ -

Consultant Expenses: List all expenses to be paid from the grant to the individual consultants in addition to their fees (i.e., travel, meals, lodging, etc.)

Item	Location	Computation	Cost
None			$ -
			Sub-Total: $ -

Contracts: Provide a description of the product or service to be procured by contract and an estimate of the cost. Applicants are encouraged to promote free and open competition in awarding contracts. A separate justification must be provided for sole source contracts in excess of $100,000.

Item			Cost
	at	$ -	$ -
			Sub-Total: $ -

TOTAL CONTRACTS / CONSULTANTS: $ -

.i. Other Costs - List items (e.g., rent, reproduction, telephone, janitorial or security services, and investigative or confidential funds) by major type and the basis of the computation. For example, provide the square footage and the cost per square foot for rent, or provide a monthly rental cost and how many months to rent.

Description	Computation	Cost
Program Costs:		
None	at $ -	$ -
Administrative Costs:		
Fidelity Bond Premium on State of Vermont Personal services	0.02% of Total P/S budget	$ 16.36

TOTAL OTHER: $ 16

I. Indirect Costs - Indirect costs are allowed only if the applicant has a Federally approved indirect cost rate. A copy of the rate approval (a fully executed, negotiated agreement), must be attached. If the applicant does not have an approved rate, one can be requested by contacting the applicant's cognizant Federal agency, which will review all documentation and approve a rate for the applicant organization, or if the applicant's accounting system permits, costs may be allocated in direct costs categories.

Description	Computation	Cost
None		$ -

TOTAL INDIRECT: $ -

TOTAL PROJECT COST: $ 92,888

Budget Summary

Budget Category	Amount
A. Personnel	$ 55,503
B. Fringe Benefits	$ 26,280
C. Travel	$ 1,238
D. Equipment	$ -
E. Supplies	$ 9,850
F. Construction	$ -
G. Consultants/Contracts	$ -
H. Other	$ 16
Total Direct Costs	$ 92,888
I. Indirect Costs	$ -
TOTAL PROJECT COSTS	$ 92,888
Federal Request	$92,888
Non-Federal Amount	$0

$0

[redacted]

Budget Narrative

The budget narrative should be a plain-language explanation of the proposed expenditures that are listed in the Budget Detail Worksheet above.

A. Personnel

The salary and benefits will support the hiring of a full time forensic chemist who has appropriate chemistry training for the proposed research. Robert Shipman and Eric Buel will request 2 hours of funding per week for their work on the project.

C. Travel

Travel will include a trip to the AAFS meeting to present the results of the research.

D. Equipment

None.

E. Supplies

Custom synthesized drugs will be made by Dr. Clark (see letter of support). Commercially available drugs will be purchased from standard drug supply companies. Two GC columns will be purchased to allow the development of GC separation protcols.

F. Construction

None.

G. Consultants / Contracts

None.

H. Other Costs

Program Costs:

Administrative Costs:

Costs to the Department of Public Safety for administering federal funds.

I. Indirect Costs

None.

SFO 2378

VERMONT

State of Vermont
Department of Finance & Management
109 State Street, Pavilion Building
Montpelier, VT 05620-0401

[phone] 802-828-2376
[fax] 802-828-2428

Agency of Administration

STATE OF VERMONT
FINANCE & MANAGEMENT GRANT REVIEW FORM

Grant Summary:	Supports position to perform research & development in the area of controlled substances.					
Date:	3/23/2009					
Department:	Public Safety - Criminal Justice Services - Forensic Laboratory					
Legal Title of Grant:	Research & Development in the Area of Controlled Substances					
Federal Catalog #:	16.560					
Grant/Donor Name and Address:	National Institute of Justice					
Grant Period: **From:**	1/1/2009	**To:**	12/31/2010			
Grant/Donation						
	SFY 1	**SFY 2**	**SFY 3**	**Total**	**Comments**	
Grant Amount:	$73,704	$19,184	$	$92,888		

	# Positions	**Explanation/Comments**
Position Information:	1	Forensic chemist II DB 3/23/09

Additional Comments:	Grant will support the Lab's primary work.

Department of Finance & Management	3/27/09	(Initial)
Secretary of Administration	RPM 4/8/09	(Initial)
Sent To Joint Fiscal Office	4/14/09	**Date**

RECEIVED
APR 16 2009
JOINT FISCAL OFFICE

Dept. of Public Safety
Administration Division
Accounting Unit

Memo

To: David Beatty, Budget & Management Analyst

From: Tracy O'Connell, Programs Administration Supervisor

Date: 12/22/08

CC: file

Re: Request for Grant Acceptance

Attached you will find an AA-1 form for the request to accept a grant from the National Institute of Justice.

If you have any questions, please contact me at 802-241-5574 or toconnel@dps.state.vt.us; or Richard Hallenbeck at 802-241-5339 or rhallenb@dps.state.vt.us.

Thank you.

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

BASIC GRANT INFORMATION				
1. Agency:				
2. Department:	Public Safety			
3. Program:	Criminal Justice Services Forensic Labratory			
4. Legal Title of Grant:	Research & Development in the Area of Controlled Substances			
5. Federal Catalog #:	16.560			
6. Grant/Donor Name and Address: National Institute of Justice; 810 Seventh St., NW; Washington, DC 20531				
7. Grant Period: **From:**	1/1/2009	**To:**	12/31/2010	
8. Purpose of Grant: The proposed research seeks to develop procedures and protocols for the analysis of drugs that currently yield limited information. This research will focus on the routine identification of commonly encountered drugs, designer drugs, and closely related drug isomers.				
9. Impact on existing program if grant is not Accepted: If successful, this project could introduce a new method of drug analysis that would be quicker, or could allow for simultaneous processing of casework with existing methods, therefore relieving backlogs in drug analysis.				

10. BUDGET INFORMATION

	SFY 1	SFY 2	SFY 3	Comments
Expenditures:	**FY** 2010	**FY** 2011	**FY**	
Personal Services	$68152	$13632	$	
Operating Expenses	$5552	$5552	$	
Grants	$	$	$	
Total	$73,704	$19,184	$	
Revenues:				
State Funds:	$	$	$	
Cash	$	$	$	
In-Kind	$	$	$	
Federal Funds:	$	$	$	
(Direct Costs)	$73704	$19184	$	
(Statewide Indirect)	$	$	$	
(Departmental Indirect)	$	$	$	
Other Funds:	$	$	$	
Grant (source)	$	$	$	
Total	$	$	$	

Appropriation No:	2140020000	**Amount:**	$92888
			$
			$
			$
			$
			$
			$

DEC 2 4 2008

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

		Total	$92,888

PERSONAL SERVICE INFORMATION

11. Will monies from this grant be used to fund one or more Personal Service Contracts? ☐ Yes ☒ No
If "Yes", appointing authority must initial here to indicate intent to follow current competitive bidding

Appointing Authority Name: Agreed by: _ _____ (initial)

12. Limited Service Position Information:	**# Positions**	**Title**
	1	Forensic Chemist II - will convert a Forensic Chemist IV position into a Forensic Chemist II position when the incumbent retires in Sept 09.
Total Positions	1	

12a. Equipment and space for these positions: ☒ Is presently available. ☐ Can be obtained with available funds.

13. AUTHORIZATION AGENCY/DEPARTMENT

I certify that no funds have been expended or committed in anticipation of Joint Fiscal Committee Approval of this grant:	Signature: Thomas R Tremblay	Date: 12/19/08
	Title: Commissioner	

14. ACTION BY GOVERNOR

☑	Check One Box: Accepted		4/13/09
☐	Rejected	(Governor's signature)	Date:

15. SECRETARY OF ADMINISTRATION

☐	Check One Box: Request to JFO	Linda P McClintock	4/8/09
☐	Information to JFO	(Secretary's signature or designee)	Date:

16. DOCUMENTATION REQUIRED

Required GRANT Documentation	
☐ Request Memo	☐ Request Memo
☐ Dept. project approval (if applicable)	☐ Dept. project approval (if applicable)
☐ Notice of Award	☐ Notice of Donation (if any)
☐ Grant Agreement	☐ Grant (Project) Timeline (if applicable)
☐ Grant Budget	☐ Request for Extension (if applicable)

End Form AA-1

DEPARTMENT OF PUBLIC SAFETY

Memo

To: Commissioner Thomas Tremblay

From: Eric Buel, Ph.D. Laboratory Director *Eric Buel*

Date: December 19, 2008

Subject: R&D Controlled Substances Detection & Analysis Grant
Award #: 2008-DN-BX-K161

Commissioner,

As you know, we have been awarded a Research and Development grant in the area of controlled substances detection and analysis. The award provides funding for supplies for research and salary for one individual. Below is an outline of the application and award period for the grant.

10/19/07:
Received invitation for concept papers

11/9/07:
Submitted concept paper. Includes a "staffing plan" for 1 new FTE + OT for existing staff

1/29/08:
Received invitation to submit full proposal. Collaborated on scope and budget

2/14/08:
Approval of final budget which includes 1 FTE + OT for existing staff

2/15/08:
Submitted full proposal

7/14/08:
Responded to inquiries re classification of costs

9/18/08:
Assigned POC & Downloaded award

9/19/08:
Accepted Award

We accepted the award in September; however we delayed submitting the award to the JFO for approval due to: the fiscal environment, FY09 position reductions and the fact that we don't have any vacant civilian limited-service positions at this time (as no new positions are being created).

We have received preliminary approval from NIJ for a one-year extension on the grant, thereby extending the grant end date to 12/31/2010. Instead of requesting a new limited service position be created, I am proposing the following:

I would like to seek state permission to proceed with our drug research under this award using funds available for supplies as soon as the state approves the grant. We would use funds for overtime to support existing personnel to slowly move forward to accomplish some of the goals of the award. One individual in our laboratory will be retiring in September 2009 and we would like to use that "position number" as the position we fill with this drug grant position. This would result in a delayed start to a portion of the drug research program. During the summer of 2009, we would advertise for a qualified individual to fill the "position number" we would have available in September 2009. I believe that we will be able to meet all the expectations of the grant but it will be slightly delayed.

Department of Justice
Office of Justice Programs
National Institute of Justice

Cooperative Agreement

1. RECIPIENT NAME AND ADDRESS (Including Zip Code)
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

4. AWARD NUMBER: 2008-DN-BX-K161

5. PROJECT PERIOD: FROM 01/01/2009 TO 12/31/2009
BUDGET PERIOD: FROM 01/01/2009 TO 12/31/2009

6. AWARD DATE 09/17/2008

7. ACTION
Initial

1A. GRANTEE IRS/VENDOR NO.
036000274

8. SUPPLEMENT NUMBER
00

9. PREVIOUS AWARD AMOUNT $0

3. PROJECT TITLE
VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

10. AMOUNT OF THIS AWARD $ 92,888

11. TOTAL AWARD $ 92,888

12. SPECIAL CONDITIONS
THE ABOVE GRANT PROJECT IS APPROVED SUBJECT TO SUCH CONDITIONS OR LIMITATIONS AS ARE SET FORTH ON THE ATTACHED PAGE(S).

13. STATUTORY AUTHORITY FOR GRANT
This project is supported under FY08(NIJ - COPS DNA/Forensics) Pub. L. No. 110-161, 121 Stat. 1897, 1910; 28 USC 530C

15. METHOD OF PAYMENT
PAPRS

[redacted] AGENCY APPROVAL [redacted]

16. TYPED NAME AND TITLE OF APPROVING OFFICIAL
Jeffrey L. Sedgwick
Acting Assistant Attorney General

17. SIGNATURE OF APPROVING OFFICIAL
Jeffrey L. Sedgwick

[redacted] GRANTEE ACCEPTANCE [redacted]

18. TYPED NAME AND TITLE OF AUTHORIZED GRANTEE OFFICIAL
Thomas Tremblay
Commissioner

19. SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL
Thomas R. Tremblay

19A. DATE
9/19/08

[redacted] AGENCY USE ONLY [redacted]

20. ACCOUNTING CLASSIFICATION CODES

FISCAL YEAR	FUND CODE	BUD. ACT.	OFC.	DIV. REG.	SUB.	POMS	AMOUNT
X	B	DN	60	00	00		92888

21. HDNSGT0088

Department of Justice

Office of Justice Programs

Office of the Assistant Attorney General *Washington, D.C. 20531*

September 17, 2008

Commissioner Thomas Tremblay
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

Dear Commissioner Tremblay:

On behalf of Attorney General Michael B. Mukasey, it is my pleasure to inform you that the Office of Justice Programs has approved your application for funding under the Research and Development in the Area of Controlled Substances Detection and Analysis in the amount of $92,888 for Vermont Department of Public Safety. The title of this project is, "VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis."

Enclosed you will find the Grant Award and Special Conditions documents. This award is subject to all administrative and financial requirements, including the timely submission of all financial and programmatic reports, resolution of all interim audit findings, and the maintenance of a minimum level of cash-on-hand. Should you not adhere to these requirements, you will be in violation of the terms of this agreement and the award will be subject to termination for cause or other administrative action as appropriate.

If you have questions regarding this award, please contact:

- Program Questions, Frances Scott, Program Manager at (202) 305-9950; and
- Financial Questions, the Office of the Chief Financial Officer, Customer Service Center (CSC) at (800) 458-0786, or you may contact the CSC at ask.ocfo@usdoj.gov.

Congratulations, and we look forward to working with you.

Sincerely,

Jeffrey L. Sedgwick
Acting Assistant Attorney General

Enclosures

Forensic drug identification by Gas Chromatography- Infrared Spectroscopy

Eric Buel, P.I.

PROGRAM NARRATIVE

Abstract:

The primary goal of the forensic drug examiner is the unequivocal identification of any controlled substance present in a drug exhibit. Most forensic laboratories routinely employ GC-MS as the preferred method for this examination. The technique provides a rapid, semi-automated analysis of the sample and typically yields sufficient information to identify the compounds in question. However, the application of GC-MS for drug analysis does have its limitations.

Certain drugs yield minimal mass spectral fragmentation patterns using electron impact MS, while other compounds, such as some diastereomers and positional isomers, are not readily differentiated by mass spectroscopy. Forensic scientists have been concerned for many years with the differentiation of isomers as evidenced by the work in the 1970's to distinguish the diethyl amide and methylpropylamide isomers of LSD and more recently the diastereomers ephedrine/pseudoephedrine and the isomers of phenethylamines. Infrared spectroscopy provides an alternate technique to mass spectroscopy for the identification of organic compounds. Recent improvements in the hyphenated technique, GC-IR, may provide a simple alternative or supplemental approach to GC-MS for the identification of certain compounds. A newly introduced instrument collects GC effluent on a liquid nitrogen cooled, IR transparent window that allows the direct analysis of the deposited solid material. This technique is superior to the IR light pipe in sensitivity, IR spectral quality, and allows direct comparison of the collected spectra to existing IR

databases. The proposed research seeks to develop procedures and protocols for the analysis of drugs yielding limited MS information via GC-IR and report to the forensic community the benefits and limitations of this technology. This research will focus on the routine identification of commonly encountered drugs, designer drugs, closely related drug isomers, as well as the fundamentals of the gas chromatography and infrared systems. Our laboratory currently owns a GC-IR instrument, and this research intends to further the work started by our laboratory [illegible]velop this technology into a viable technique for the f[illegible]unity.

3. Main Body

A). Purpose

The purpose of this research is to determine the benefits and limitations of the newly introduced Spectra Analysis GC-IR instrument. From this work, we will develop and make available protocols and procedures to use this instrument for routine drug analysis. This is important to the forensic community because this technology could allow the simple identification of certain compounds not routinely amenable to analysis by GC-MS.

B) Research Goal and Objectives

The objectives of this research are to fulfill the above purpose by meeting the following: 1) assessment of the GC-IR instrument to allow forensic scientists to understand the appropriate use of GC-IR and to 2) develop protocols and procedures for the efficient use of this instrument by the forensic community.

Objective 1: Our first objective is to assess the GC-IR for forensic drug identification. In most laboratories, drug submissions compose the bulk of the casework and as a result, laboratories attempt to semi-automate the drug analysis process. According to the 2006 Collaborative Testing Services drug proficiency test review, most respondents used gas chromatography-mass spectrometry for identification of the proficiency drug exhibit. GC-MS is ideally suited for drug analysis since most drug samples are mixed with any number of possible substances and GC-MS provides both the separation and structural information of the mixture of compounds seen in many forensic exhibits. This technique is easily linked to an auto-sampler which provides a semi-automated approach to drug analysis. The simplicity of use, combined separation and analysis power of the

instrument, coupled to large searchable mass spectral databases, has made GC-MS the forensic instrument of choice for routine drug identification. Samples from drug submissions may be dissolved into a suitable solvent, loaded into the auto-sampler, and analyzed un-attended while the examiner processes additional cases or reviews data from previous GC-MS analyses. This process works well for the busy forensic laboratories with backlogs and rush requests that must be analyzed in a simple, efficient, but accurate process. As with most techniques, however, the application of GC-MS for drug analysis does have its limitations and a supplementary or alternative tool employing infrared spectroscopy, could give the forensic scientist additional information to allow a more thorough identification of certain drugs. A further discussion of mass spectroscopy and infrared spectroscopy is detailed in the *Review of Relevant Literature* section.

Infrared spectroscopy is a proven tool for the positive identification of organic compounds. The routine application of traditional IR spectroscopy can be time consuming since the technique is not typically amenable to automation and the instrument requires samples to be relatively free of adulterants, often requiring some sample purification prior to IR analysis. Once a sample is relatively "clean" and ready for analysis, the specimen could be analyzed via any number of commonly employed manual methods: KBr pellet, thin film on NaCl plates, an ATR or an IR microscope accessory to name a few. All of these analytical procedures are useful, proven manual technologies. However, an infrared instrument that is coupled to a separation based technology such as gas chromatography, could offer a degree of automation that would allow the combined instrumentation to become an alternative, simple approach, for the routine analysis of certain drugs of abuse.

A number of attempts have been made to link an IR instrument to a separation technique. None of these attempts to develop a "hyphenated" technique have truly taken hold in the forensic community for a number of reasons. Previously designed instruments were either very expensive, difficult to use, had inadequate compound sensitivity or yielded poorly resolved spectra.

We have recently purchased a newly introduced GC-IR instrument offered by Spectra Analysis, Inc., Marlborough, MA. Their approach builds upon previous attempts to collect GC effluents at low temperatures for IR analysis. In this direct deposit approach, the GC effluent is deposited upon a spiraling ZnSe disk cooled with liquid nitrogen. The ZnSe disk is transparent to IR energy and the spectrum of the deposited material is captured immediately after sample deposition. This linking of a gas chromatograph instrument to an infrared detector, allows the separation of complex mixtures of substances and the subsequent collection of a full IR spectrum (4000 cm to 650 cm^{-1}). The instrument can be coupled to an auto-sampler and linked to commercially available IR libraries to allow a semi-automated approach to the analysis of drug samples. With this combination of technologies, GC-IR analysis could become a viable technique for the identification of complex drug mixtures.

Objective 2: The second objective of this project is to develop protocols and procedures for the efficient use of the GC-IR and distribute those to the forensic community. Since this instrument is newly introduced, we will need to perform a number of studies to determine the optimum operating parameters for forensic drug analysis. We intend to determine appropriate GC and IR conditions and any procedures necessary to allow forensic scientists to purchase and use this equipment with confidence.

D) Research Design and Methods

Objective 1: We intend to assess the GC-IR instrument to determine the benefits and limitations of this technology. The company, Spectra Analysis, takes "off the shelf" GC and auto-sampler components and links them to their IR detector. This IR detector system is essentially an untested system for the field of forensics, and while it may be suitable for commercial applications, a number of concerns must be answered prior to the forensic community implementing the technology. One of the issues that must be evaluated is the possibility of cross contamination of samples collected upon the reusable ZeSe disk. Two issues must be addressed here; how to identify that the disk is clean and ready for use prior to sample collection and the potential for cross contamination between separate collection tracks on the disk. We will develop a procedure to quickly scan a "cleaned" disk to determine if it is contaminant free. We will also intentionally load samples into the GC at concentrations that exceed routine limits to determine if there is any track to track contamination.

The crystalline and amorphous states of the same compound will yield different IR spectra. Various factors may affect the state of the material deposited upon the cooled zinc selenide disk. We will start our investigation of this phenomenon by looking at a wide range of compounds with the disk at a number of different temperatures and attempt to determine the conditions applicable for most forensic drug samples to maximize crystallization of the compounds of interest.

We have conducted some initial work concerning instrument sensitivity for a limited number of drugs but we intend to study additional drugs suited for GC-IR to define the sensitivity limitations of the instrument. We will also consider the difference in

sensitivity of the instrument capturing "on-the-fly" IR spectra versus re-scanning the deposited sample after the GC run has been completed. Multiple GC injections of the same sample may be performed to redeposit the GC effluent on the same disk track to concentrate the sample in an attempt to detect low concentration sample components. This mode of operation will be evaluated. The GC conditions will also have a large effect on sensitivity and will be evaluated as noted below.

In order to understand the real benefits and limitations of the system, we will need to analyze typical forensic samples. We will eval[illegible] samples to determine how the system [illegible] a wide range of drug submissions. Of interest will be p[illegible]nylamines (methamphetamine, MDMA and related compounds), psilocyn, tryptamines, and other commonly encountered drugs of abuse which yield minimal mass spectral data. These samples will be diluted in an appropriate solvent and analyzed by both GC-IR and GC-MS. A comparison will be made between the two technologies to determine if the same components are detected via both methods and to assess the protocols developed. An evaluation will be made [illegible]e informational content [illegible]d via the two technologies.

We also plan to define the limitations inherent in IR analysis by investigating closely related isomers. We are planning to work in conjunction with another NIJ grant recipient, Dr. Randall Clark (see attached letter of intent), to determine if GC-IR can be used to identify the varied MDMA analogs he has synthesized. Many of these compounds are not adequately discriminated by mass spectroscopy alone. IR is a powerful tool that may offer laboratories the ability to unequivocally identify closely related compounds. A variety of compounds (isomers not amenable to MS analysis) will be subjected to GC-IR

analysis. The IR of the closely related compounds will be compared along with the retention times of the compounds on different GC columns.

Objective 2: As we assess the instrument, we will learn what works well for drug analysis and develop protocols and procedures appropriate for the analysis of forensic drug samples. The GC-IR is less sensitive than a GC-MS and hence appropriate sample concentrations will need to be evaluated along with GC split ratios. To obtain the optimum separation and sensitivity we will need to evaluate GC column length, diameter, stationary phases, and carrier gas flow rates. The IR collection system will be evaluated to assess collection disk speed and IR resolution settings. In developing the protocols we will review what we learned during the assessment phase and implement those factors into a general protocol. Much of what we do will be an iterative process, where we develop a protocol and modify it by evaluating a variable and reassess the system. If time and in-house funding permits, we would also like to consider linking the IR detector to an existing GC-MS, yielding a GC-MS-IR system. This linking has been done by Spectra Analysis, but not in a forensic setting. This combined instrument would reduce the cost burden to forensic labs wishing to obtain both MS and IR information simultaneously from a sample.

E. Implications for Criminal Justice Policy and Practice

Many forensic disciplines have been challenged in the courts, and as this occurs it should prompt us to evaluate those technologies we perform to see if other strategies could add depth to our current analytical methods. The analysis of controlled substances is becoming more demanding as higher analytical standards are expected, and as the number of abused substances and designer drugs rise across the country. As we are

presented with analytical options to those methods and technologies we have been familiar with for years, it is incumbent upon us to review those technologies to determine if it makes sense to use these emerging tools to improve the analyses we offer to the criminal justice community.

GC-MS is often used for the forensic analysis of controlled substances and it is an excellent tool for routine drug analysis. However, a number of published reports have discussed the limitations of MS for certain compounds. Some of these limitations can be overcome by evaluating sample GC retention time (as compared to a retention time from a known drug) or by sample derivatization. GC retention time in combination with MS is a standard method for drug identification, but one may want to reflect upon relying on this combination of techniques for the differentiation of drugs where the compound yields a minimal MS pattern. Additionally, some regioisomers have been shown to co-elute, requiring the selection of additional GC columns and appropriate temperature programs to provide adequate compound resolution. Some "designer drugs" are nothing more than isomeric cousins to established drugs, and hence these substances could co-elute with the target compound, compromising an analysis if the mass spectra are indistinguishable.

Derivatization increases the molecular weight of the target compound, which can improve the mass spectral informational content, while altering the chromatography of the molecule. In the case of amphetamines, derivatization improves the overall shape of the GC peak (1), and produces additional ions for identification purposes. Sample derivatization can improve the MS of a compound, but it adds steps to the analysis, decreases overall productivity, requires the handling of hazardous chemicals and derivatization can not be universally performed on all drugs.

Busy forensic laboratories need simple alternatives to assist the examiner in the unequivocal identification of controlled substances. The above methods are tried and true, but other techniques may provide information that is equal to, if not more compelling, through a semi-automated manner. We believe that increased sample information may be obtained simply, efficiently and in a semi-automated manner with GC-IR. Through our work we hope to show that GC-IR will be a supplementary or alternative tool to routine GC-MS, and will allow the forensic examiner to quickly and unequivocally identify compounds that have minimal or indistinguishable MS patterns. Our assessment of the instrument, and generation of protocols and procedures, would allow the forensic community to quickly evaluate the instrument for their use. We believe the emerging GC-IR technology will assist the examiner in the identification of routine drugs of abuse and those unusual substances seen today, in addition to those developed in the future.

F. Management plan and organization

A scientist with an appropriate background in chemistry will be hired and will work full-time on this project. The scientist will be assisted by Robert Shipman (see attached CV) who has been working on the GC-IR since the Vermont Forensic Laboratory (VFL) received the instrument. Mr. Shipman is a drug analyst with extensive hands-on experience with GC-MS, IR and GC-IR techniques. Dr. Eric Buel will oversee the project and his background includes forensic drug analysis. Both individuals will request funding for ~ 2 hours per week but will devote additional, un-funded time, as necessary to achieve the goals of the project.

After the project is complete, it is hoped that the state of Vermont will continue to fund the new hire, or there may be position openings due to retirement.

To date the VFL has performed some limited experiments with the instrument. The manufacturer (Spectra Analysis, Inc.) designed an instrument which, when it was received by the VFL, was suitable for research applications. The software and protocols for operation were not suited for routine forensic applications, but for use by a research institution or for solving a particular problem in an industrial/pharmaceutical application. After simple experiments were performed to conceptually show that the instrument should be of value to the forensic community, we began working with Spectra Analysis, Inc. to design and implement software and routine procedures to allow the introduction of the instrument into the forensic community. For example, suitable software needs to be finalized and tested to allow easy and routine instrument control (of both the GC and IR) with subsequent collection and appropriate reporting of the data. We believe this initial work will be done prior to receiving the grant so that the work described above can be accomplished in the allotted time.

Time Line:

Item	**Time**
Hire Scientist	Month 1
Drugs for project • Contact collaborators-specify drug samples needed • Purchase commercially available drugs	Month 1
Purchase necessary supplies- columns, solvents etc.	Month 1
Disk contamination issue • Evaluate cross contamination • Develop disk assessment protocol	Months 2-3
Crystalline and Amorphous states	Month 4

• Evaluate a wide range of drugs • Assess disk conditions to minimize amorphous state	
Sensitivity Study • On-the-fly versus re-scanning • Multiple deposition • Variations in GC conditions and disk speed	Month 5-6
Analysis of selected drugs (commercially available and from collaborators) • Routinely encountered drugs • Isomers and related compounds • Drugs with minimal MS patterns	Months 6-9
Forensic casework • Routine cases • Designer drug cases	Months 7-11
Develop and modify protocols	Months 7-12
Disseminate results to forensic community	Month 12

G. Dissemination Strategy

A major goal of our work is to distribute our findings and any derived methods to the forensic community to improve criminal justice. The cost of the Spectra Analysis instrument ($130,000, not including the GC- as per company representative), and costs relative to the operation of the instrument will be also be presented.

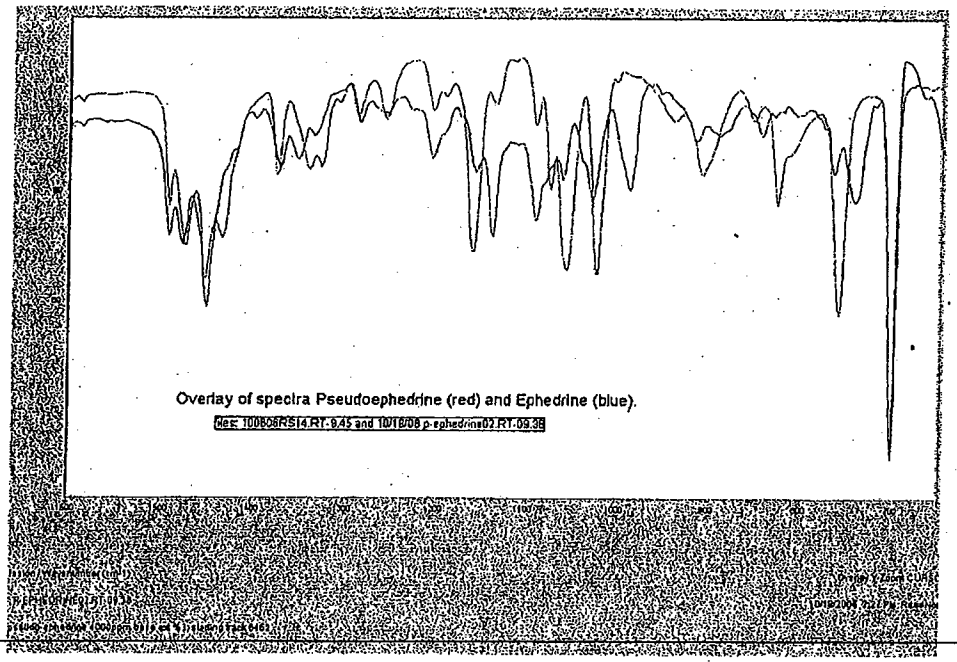
To this end, we will publish our results for peer review in the Journal of Forensic Sciences or other suitable journal and create basic protocols for others to use. We plan to present our findings at regional forensic meetings, and the American Academy of Forensic Sciences. This may take the form of poster sessions or as oral presentations. We also plan to be available by phone/e-mail to anyone interested in receiving information. We will also work with the National Forensic Science Training Center to hold a hands-on

work shop if they feel it is appropriate. I believe if one were to review our history, we have been proactive in providing peer reviewed publications, presentations, and "one-on one" information concerning any of our NIJ funded research projects.

H. Preliminary Data:

Figure 4 (below) shows the IR fingerprint region for the compounds pseudoephedrine and ephedrine. Both compounds were run separately on the GC-IR and the IR data collected. The spectra were overlaid to demonstrate the differences between these two diastereomers and to show the quality of the IR spectra typically obtained with this instrument. The mass spectra for these two compounds are essentially the same.

Figure 4



Grant Application Identifier: 2008 Controlled Substances Detection & Analysis R&D

Grant Period: 1/1/2009 12/31/2009

Adapted for VT DPS

Budget Detail Worksheet

A. Personnel - List each position by title and name of employee, if available. Show the annual salary rate and the percentage of time to be devoted to the project. Compensation paid for employees engaged in grant activities must be consistent with that paid for similar work within the applicant organization.

Name, Position / Title		Computation: Hourly Rate	X Number of Hr's in Pay Period	X Number of Pay Periods	=	Cost for the Project Period		Total Personnel for Employee
1. Forensic Chemist II, t.b.a.	Step 2: 1/1/09-6/30/09	22.96	80	13		23,878.40		
PayGr 25, hired 'in range'	Step 2: with 2% COLA: 7/1/09-12/31/09	23.42	80	13		24,355.97	>	48,234.37
				26				
2. Robert Shipman, Forensic Chemist III	Step 6: 1/1/09-6/30/09	26.26	4	13		1,365.52		
OT only, PayGr 25	Step 6 :plus 2% COLA: 7/1/09-8/10/09	26.79	4	3		321.42		
	Step 7: with 2% COLA: 8/11/09-12/31/09	27.69	4	10		1,107.72	>	2,794.66
				26				
3. Eric Buel, Forensics Lab Director	Step 13: 1/1/09-4/9/09	41.78	4	8		1,336.96		
OT only, PayGr 29	Step 14: 4/10/09-6/30/09	42.95	4	5		859.00		
	Step 14: with 2% COLA: 7/1/09-12/31/09	43.81	4	13		2,278.07	>	4,474.03
				26				
						Sub-Total	$	55,503

B. Fringe Benefits - Fringe benefits should be based on actual known costs or an established formula. Fringe benefits are for the personnel listed in budget category (A) and only for the percentage of time devoted to the proejct. Fringe benefits on overtime hours are limited to FICA, Workman's Compensation, and Unemployment Compensation.

Name, Position / Title	Computation					Cost	
1. Forensic Chemist II, t.b.a.	Social Security at		6.20%		of salary	$	2,991
	Medicare at		1.45%		of salary	$	699
	Retirement at		9.70%		of salary	$	4,679
	Worker's Comp at		6.00%		of salary	$	2,894
	Health Ins at	$ 463.00	X	26.0	80-hour pay periods	$	12,038
	Life Ins at		0.35%		of salary	$	169
	Dental Ins at	$ 41.74	X	26.0	80-hour pay periods	$	1,085
	EAP at	$ 1.08	X	26.0	80-hour pay periods	$	28
						$	24,583
2. Robert Shipman, Forensic Chemist III	Social Security at		6.20%		of salary	$	173
	Medicare at		1.45%		of salary	$	41
	Retirement at		9.70%		of salary	$	271
	Worker's Comp at		6.00%		of salary	$	168
						$	653
3. Eric Buel, Forensics Lab Director	Social Security at		6.20%		of OT salary	$	277
	Medicare at		1.45%		of OT salary	$	65
	Retirement at		9.70%		of OT salary	$	434
	Worker's Comp at		6.00%		of OT salary	$	268
						$	1,045
					Sub-Total	$	26,280

TOTAL PERSONNEL AND FRINGE BENEFITS: $ 81,783

C. Travel - Itemize travel expenses of project personnel by purpose (e.g., staff to training, field interviews, advisory group meeting, etc.). Show the basis of computation (e.g., six people to 3-day training at $X air, $X lodging, $X substinance). In training projects, travel and meals for trainees should be listed separately. Show the number of trianees and the unit costs involved. Identify the location of travle, if known. Indicate source of Travel Policies applied, Applicant or Federal Travel Regulations.

Purpose	Location	Computation					T. Cost Per Line	
		# of people	# of days	Cost Ea		Description		
AAFS Meeting	TBA	1	-	$ 558.00		Airfare	$ 558	
		1	4	$ 130.00		Lodging	$ 520	
		1	4	$ 40.00		Subsistence	$ 160	$ 1,238

TOTAL TRAVEL $ 1,238

D. Equipment - List non-expendable items that are to be purchased. Non-expendable equipment is tangible property having a useful life of more than two years and an acquisition cost of $5,000 or more per unit. (Note: Organization's own capitalization policy may be used for items costing less than $5,000). Expendable items should be included either in the "supplies" category or in the "Other" category. Applicants should analyze the cost benefits or purchasing versus leasing equipment, especially high cost items and those subject to rapid technical advances. Rented or leased equipment costs sh ould be listed in the "Contractual" category. Explain how the equipment is necessary for the success of the project. Attach a narrative describing the procurement method to be used.

Equipment Items	Computation			Cost
	Quantity		Cost Each	
None.	0	at	$ -	$ -

TOTAL EQUIPMENT: $ -

E. Supplies - List items by type (office supplies, postage, training materials, copying paper, and expandable equipment items costing less than $5,000, such as books, hand held tape recorders) and show the basis for computation. (Note: Organization's own capitalization policy may be used for items costingless than $5,000). Generally, supplies include any materials that are expendable or consumed during the course of the project.

Supply Items	Computation					T. Cost Per Line
	Quantity	Unit		Price Per Unit		
Custom designed and systhezied drugs	14	each	at	$ 500.00		$ 7,000.00
Commercially available drugs		each	at	$ 50.00		$ 1,350.00
GC Columns		each	at	$ 500.00		$ 1,500.00

TOTAL SUPPLIES: $ 9,850

F. Construction - As a rule, construction costs are not allowable. In some cases, minor repairs or renovations may be allowable. Check with the program office before budgeting funds in this category.

Purpose	Description of Work	Cost
None		$ -

TOTAL CONSTRUCTION: $ -

G. Consultants/Contracts - Indicate whether applicant's formal, written Procurement Policy or the Federal Acquisition Regulations are followed.

Consultant Fees: For each consultant enter the name, if known, service to be provided, hourly or daily fee (8-hour day), and the estimated time on the project. Consultant fees in excess of $450 per day require additional justification and prior approval from OJP.

Name of Consultant	Service Provided	Computation	Cost
None.			$ -
		Sub-Total:	$ -

Consultant Expenses: List all expenses to be paid from the grant to the individual consultants in addition to their fees (i.e., travel, meals, lodging, etc.)

Item	Location	Computation	Cost
None			$ -
		Sub-Total:	$ -

Contracts: Provide a description of the product or service to be procured by contract and an estimate of the cost. Applicants are encouraged to promote free and open competition in awarding contracts. A separate justification must be provided for sole source contracts in excess of $100,000.

Item			Cost
	at	$ -	$ -
		Sub-Total:	$ -

TOTAL CONTRACTS / CONSULTANTS: $ -

Other Costs - List items (e.g., rent, reproduction, telephone, janitorial or security services, and investigative or confidential funds) by major type and the basis of the computation. For example, provide the square footage and the cost per square foot for rent, or provide a monthly rental cost and how many months to rent.

Description		Computation		Cost
Program Costs:				
None		at $ -		$ -
Administrative Costs:				
Fidelity Bond Premium	on State of Vermont Personal services	0.02%	of Total P/S budget	$ 16.36

TOTAL OTHER: $ 16

I. Indirect Costs - Indirect costs are allowed only if the applicant has a Federally approved indirect cost rate. A copy of the rate approval (a fully executed, negotiated agreement), must be attached. If the applicant does not have an approved rate, one can be requested by contacting the applicant's cognizant Federal agency, which will review all documentation and approve a rate for the applicant organization, or if the applicant's accounting system permits, costs may be allocated in direct costs categories.

Description	Computation	Cost
None		$ -

TOTAL INDIRECT: $ -

TOTAL PROJECT COST: $ 92,888

Budget Summary

Budget Category	Amount
A. Personnel	$ 55,503
B. Fringe Benefits	$ 26,280
C. Travel	$ 1,238
D. Equipment	$ -
E. Supplies	$ 9,850
F. Construction	$ -
G. Consultants/Contracts	$ -
H. Other	$ 16
Total Direct Costs	$ 92,888
I. Indirect Costs	$ -
TOTAL PROJECT COSTS	$ 92,888
Federal Request	$92,888
Non-Federal Amount	$0

$0

[redacted]

Budget Narrative

The budget narrative should be a plain-language explanation of the proposed expenditures that are listed in the Budget Detail Worksheet above.

A. Personnel

The salary and benefits will support the hiring of a full time forensic chemist who has appropriate chemistry training for the proposed research. Robert Shipman and Eric Buel will request 2 hours of funding per week for their work on the project.

C. Travel

Travel will include a trip to the AAFS meeting to present the results of the research.

D. Equipment

None.

E. Supplies

Custom synthesized drugs will be made by Dr. Clark (see letter of support). Commercially available drugs will be purchased from standard drug supply companies. Two GC columns will be purchased to allow the development of GC separation protcols.

F. Construction

None.

G. Consultants / Contracts

None.

H. Other Costs

Program Costs:

Administrative Costs:

Costs to the Department of Public Safety for administering federal funds.

I. Indirect Costs

None.

JFO 2378

VERMONT

State of Vermont
Department of Finance & Management
109 State Street, Pavilion Building
Montpelier, VT 05620-0401

[phone] 802-828-2376
[fax] 802-828-2428

Agency of Administration

STATE OF VERMONT
FINANCE & MANAGEMENT GRANT REVIEW FORM

Grant Summary:	Supports position to perform research & development in the area of controlled substances.				
Date:	3/23/2009				
Department:	Public Safety - Criminal Justice Services - Forensic Laboratory				
Legal Title of Grant:	Research & Development in the Area of Controlled Substances				
Federal Catalog #:	16.560				
Grant/Donor Name and Address:	National Institute of Justice				
Grant Period: From:	1/1/2009	**To:**	12/31/2010		
Grant/Donation					
	SFY 1	**SFY 2**	**SFY 3**	**Total**	**Comments**
Grant Amount:	$73,704	$19,184	$	$92,888	

	# Positions	**Explanation/Comments**
Position Information:	1	Forensic chemist II

DB 3/23/09

Additional Comments:	Grant will support the Lab's primary work.

Department of Finance & Management	3/27/09	(Initial)
Secretary of Administration	RPM 4/8/09	(Initial)
Sent To Joint Fiscal Office	4/14/09	**Date**

RECEIVED
APR 16 2009
JOINT FISCAL OFFICE

Dept. of Public Safety
Administration Division
Accounting Unit

Memo

To: David Beatty, Budget & Management Analyst

From: Tracy O'Connell, Programs Administration Supervisor

Date: 12/22/08

CC: file

Re: Request for Grant Acceptance

Attached you will find an AA-1 form for the request to accept a grant from the National Institute of Justice.

If you have any questions, please contact me at 802-241-5574 or toconnel@dps.state.vt.us; or Richard Hallenbeck at 802-241-5339 or rhallenb@dps.state.vt.us.

Thank you.

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

BASIC GRANT INFORMATION				
1. Agency:				
2. Department:	Public Safety			
3. Program:	Criminal Justice Services Forensic Labratory			
4. Legal Title of Grant:	Research & Development in the Area of Controlled Substances			
5. Federal Catalog #:	16.560			
6. Grant/Donor Name and Address: National Institute of Justice; 810 Seventh St., NW; Washington, DC 20531				
7. Grant Period: **From:**	1/1/2009	**To:**	12/31/2010	
8. Purpose of Grant: The proposed research seeks to develop procedures and protocols for the analysis of drugs that currently yield limited information. This research will focus on the routine identification of commonly encountered drugs, designer drugs, and closely related drug isomers.				
9. Impact on existing program if grant is not Accepted: If successful, this project could introduce a new method of drug analysis that would be quicker, or could allow for simultaneous processing of casework with existing methods, therefore relieving backlogs in drug analysis.				

10. BUDGET INFORMATION

	SFY 1	SFY 2	SFY 3	Comments
Expenditures:	**FY** 2010	**FY** 2011	**FY**	
Personal Services	$68152	$13632	$	
Operating Expenses	$5552	$5552	$	
Grants	$	$	$	
Total	$73,704	$19,184	$	
Revenues:				
State Funds:	$	$	$	
Cash	$	$	$	
In-Kind	$	$	$	
Federal Funds:	$	$	$	
(Direct Costs)	$73704	$19184	$	
(Statewide Indirect)	$	$	$	
(Departmental Indirect)	$	$	$	
Other Funds:	$	$	$	
Grant (source)	$	$	$	
Total	$	$	$	

Appropriation No:	2140020000	**Amount:**	$92888
			$
			$
			$
			$
			$
			$

DEC 2 4 2008

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

		Total	$92,888

PERSONAL SERVICE INFORMATION

11. Will monies from this grant be used to fund one or more Personal Service Contracts? ☐ Yes ☒ No
If "Yes", appointing authority must initial here to indicate intent to follow current competitive bidding

Appointing Authority Name: Agreed by: _ _____ (initial)

12. Limited Service Position Information:	**# Positions**	**Title**
	1	Forensic Chemist II - will convert a Forensic Chemist IV position into a Forensic Chemist II position when the incumbent retires in Sept 09.
Total Positions	1	

12a. Equipment and space for these positions: ☒ Is presently available. ☐ Can be obtained with available funds.

13. AUTHORIZATION AGENCY/DEPARTMENT

I certify that no funds have been expended or committed in anticipation of Joint Fiscal Committee Approval of this grant:	Signature: Thomas R Tremblay	Date: 12/19/08
	Title: Commissioner	

14. ACTION BY GOVERNOR

☑	Check One Box: Accepted		4/13/09
☐	Rejected	(Governor's signature)	Date:

15. SECRETARY OF ADMINISTRATION

☐	Check One Box: Request to JFO	Linda P McNeil	4/8/09
☐	Information to JFO	(Secretary's signature or designee)	Date:

16. DOCUMENTATION REQUIRED

Required GRANT Documentation	
☐ Request Memo	☐ Request Memo
☐ Dept. project approval (if applicable)	☐ Dept. project approval (if applicable)
☐ Notice of Award	☐ Notice of Donation (if any)
☐ Grant Agreement	☐ Grant (Project) Timeline (if applicable)
☐ Grant Budget	☐ Request for Extension (if applicable)

End Form AA-1

DEPARTMENT OF PUBLIC SAFETY

Memo

To: Commissioner Thomas Tremblay

From: Eric Buel, Ph.D. Laboratory Director *Eric Buel*

Date: December 19, 2008

Subject: R&D Controlled Substances Detection & Analysis Grant
Award #: 2008-DN-BX-K161

Commissioner,

As you know, we have been awarded a Research and Development grant in the area of controlled substances detection and analysis. The award provides funding for supplies for research and salary for one individual. Below is an outline of the application and award period for the grant.

10/19/07:
Received invitation for concept papers

11/9/07:
Submitted concept paper. Includes a "staffing plan" for 1 new FTE + OT for existing staff

1/29/08:
Received invitation to submit full proposal. Collaborated on scope and budget

2/14/08:
Approval of final budget which includes 1 FTE + OT for existing staff

2/15/08:
Submitted full proposal

7/14/08:
Responded to inquiries re classification of costs

9/18/08:
Assigned POC & Downloaded award

9/19/08:
Accepted Award

DEC 24 2008

We accepted the award in September; however we delayed submitting the award to the JFO for approval due to: the fiscal environment, FY09 position reductions and the fact that we don't have any vacant civilian limited-service positions at this time (as no new positions are being created).

We have received preliminary approval from NIJ for a one-year extension on the grant, thereby extending the grant end date to 12/31/2010. Instead of requesting a new limited service position be created, I am proposing the following:

I would like to seek state permission to proceed with our drug research under this award using funds available for supplies as soon as the state approves the grant. We would use funds for overtime to support existing personnel to slowly move forward to accomplish some of the goals of the award. One individual in our laboratory will be retiring in September 2009 and we would like to use that "position number" as the position we fill with this drug grant position. This would result in a delayed start to a portion of the drug research program. During the summer of 2009, we would advertise for a qualified individual to fill the "position number" we would have available in September 2009. I believe that we will be able to meet all the expectations of the grant but it will be slightly delayed.

Department of Justice
Office of Justice Programs
National Institute of Justice

Cooperative Agreement

1. RECIPIENT NAME AND ADDRESS (Including Zip Code)

Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

4. AWARD NUMBER: 2008-DN-BX-K161

5. PROJECT PERIOD: FROM 01/01/2009 TO 12/31/2009

BUDGET PERIOD: FROM 01/01/2009 TO 12/31/2009

6. AWARD DATE 09/17/2008

7. ACTION: Initial

1A. GRANTEE IRS/VENDOR NO.
036000274

8. SUPPLEMENT NUMBER
00

9. PREVIOUS AWARD AMOUNT $0

3. PROJECT TITLE
VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

10. AMOUNT OF THIS AWARD $ 92,888

11. TOTAL AWARD $ 92,888

12. SPECIAL CONDITIONS

THE ABOVE GRANT PROJECT IS APPROVED SUBJECT TO SUCH CONDITIONS OR LIMITATIONS AS ARE SET FORTH ON THE ATTACHED PAGE(S).

13. STATUTORY AUTHORITY FOR GRANT

This project is supported under FY08(NIJ - COPS DNA/Forensics) Pub. L. No. 110-161, 121 Stat. 1897, 1910; 28 USC 530C

15. METHOD OF PAYMENT

PAPRS

[redacted] AGENCY APPROVAL [redacted]

16. TYPED NAME AND TITLE OF APPROVING OFFICIAL

Jeffrey L. Sedgwick
Acting Assistant Attorney General

17. SIGNATURE OF APPROVING OFFICIAL

Jeffrey L. Sedgwick

[redacted] GRANTEE ACCEPTANCE [redacted]

18. TYPED NAME AND TITLE OF AUTHORIZED GRANTEE OFFICIAL

Thomas Tremblay
Commissioner

19. SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL

Thomas R. Tremblay

19A. DATE

9/19/08

[redacted] AGENCY USE ONLY [redacted]

20. ACCOUNTING CLASSIFICATION CODES

FISCAL YEAR	FUND CODE	BUD. ACT.	OFC.	DIV. REG.	SUB.	POMS	AMOUNT
X	B	DN	60	00	00		92888

21. HDNSGT0088

OJP FORM 4000/2 (REV. 5-87) PREVIOUS EDITIONS ARE OBSOLETE.

OJP FORM 4000/2 (REV. 4-88)

Department of Justice

Office of Justice Programs

Office of the Assistant Attorney General *Washington, D.C. 20531*

September 17, 2008

Commissioner Thomas Tremblay
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

Dear Commissioner Tremblay:

On behalf of Attorney General Michael B. Mukasey, it is my pleasure to inform you that the Office of Justice Programs has approved your application for funding under the Research and Development in the Area of Controlled Substances Detection and Analysis in the amount of $92,888 for Vermont Department of Public Safety. The title of this project is, "VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis."

Enclosed you will find the Grant Award and Special Conditions documents. This award is subject to all administrative and financial requirements, including the timely submission of all financial and programmatic reports, resolution of all interim audit findings, and the maintenance of a minimum level of cash-on-hand. Should you not adhere to these requirements, you will be in violation of the terms of this agreement and the award will be subject to termination for cause or other administrative action as appropriate.

If you have questions regarding this award, please contact:

- Program Questions, Frances Scott, Program Manager at (202) 305-9950; and
- Financial Questions, the Office of the Chief Financial Officer, Customer Service Center (CSC) at (800) 458-0786, or you may contact the CSC at ask.ocfo@usdoj.gov.

Congratulations, and we look forward to working with you.

Sincerely,

Jeffrey L. Sedgwick
Acting Assistant Attorney General

Enclosures

Forensic drug identification by Gas Chromatography- Infrared Spectroscopy

Eric Buel, P.I.

PROGRAM NARRATIVE

Abstract:

The primary goal of the forensic drug examiner is the unequivocal identification of any controlled substance present in a drug exhibit. Most forensic laboratories routinely employ GC-MS as the preferred method for this examination. The technique provides a rapid, semi-automated analysis of the sample and typically yields sufficient information to identify the compounds in question. However, the application of GC-MS for drug analysis does have its limitations.

Certain drugs yield minimal mass spectral fragmentation patterns using electron impact MS, while other compounds, such as some diastereomers and positional isomers, are not readily differentiated by mass spectroscopy. Forensic scientists have been concerned for many years with the differentiation of isomers as evidenced by the work in the 1970's to distinguish the diethyl amide and methylpropylamide isomers of LSD and more recently the diastereomers ephedrine/pseudoephedrine and the isomers of phenethylamines. Infrared spectroscopy provides an alternate technique to mass spectroscopy for the identification of organic compounds. Recent improvements in the hyphenated technique, GC-IR, may provide a simple alternative or supplemental approach to GC-MS for the identification of certain compounds. A newly introduced instrument collects GC effluent on a liquid nitrogen cooled, IR transparent window that allows the direct analysis of the deposited solid material. This technique is superior to the IR light pipe in sensitivity, IR spectral quality, and allows direct comparison of the collected spectra to existing IR

databases. The proposed research seeks to develop procedures and protocols for the analysis of drugs yielding limited MS information via GC-IR and report to the forensic community the benefits and limitations of this technology. This research will focus on the routine identification of commonly encountered drugs, designer drugs, closely related drug isomers, as well as the fundamentals of the gas chromatography and infrared systems. Our laboratory currently owns a GC-IR instrument, and this research intends to further the work started by our laboratory velop this technology into a viable technique for the f unity.

3. Main Body

A). Purpose

The purpose of this research is to determine the benefits and limitations of the newly introduced Spectra Analysis GC-IR instrument. From this work, we will develop and make available protocols and procedures to use this instrument for routine drug analysis. This is important to the forensic community because this technology could allow the simple identification of certain compounds not routinely amenable to analysis by GC-MS.

B) Research Goal and Objectives

The objectives of this research are to fulfill the above purpose by meeting the following: 1) assessment of the GC-IR instrument to allow forensic scientists to understand the appropriate use of GC-IR and to 2) develop protocols and procedures for the efficient use of this instrument by the forensic community.

Objective 1: Our first objective is to assess the GC-IR for forensic drug identification. In most laboratories, drug submissions compose the bulk of the casework and as a result, laboratories attempt to semi-automate the drug analysis process. According to the 2006 Collaborative Testing Services drug proficiency test review, most respondents used gas chromatography-mass spectrometry for identification of the proficiency drug exhibit. GC-MS is ideally suited for drug analysis since most drug samples are mixed with any number of possible substances and GC-MS provides both the separation and structural information of the mixture of compounds seen in many forensic exhibits. This technique is easily linked to an auto-sampler which provides a semi-automated approach to drug analysis. The simplicity of use, combined separation and analysis power of the

instrument, coupled to large searchable mass spectral databases, has made GC-MS the forensic instrument of choice for routine drug identification. Samples from drug submissions may be dissolved into a suitable solvent, loaded into the auto-sampler, and analyzed un-attended while the examiner processes additional cases or reviews data from previous GC-MS analyses. This process works well for the busy forensic laboratories with backlogs and rush requests that must be analyzed in a simple, efficient, but accurate process. As with most techniques, however, the application of GC-MS for drug analysis does have its limitations and a supplementary or alternative tool employing infrared spectroscopy, could give the forensic scientist additional information to allow a more thorough identification of certain drugs. A further discussion of mass spectroscopy and infrared spectroscopy is detailed in the *Review of Relevant Literature* section.

Infrared spectroscopy is a proven tool for the positive identification of organic compounds. The routine application of traditional IR spectroscopy can be time consuming since the technique is not typically amenable to automation and the instrument requires samples to be relatively free of adulterants, often requiring some sample purification prior to IR analysis. Once a sample is relatively "clean" and ready for analysis, the specimen could be analyzed via any number of commonly employed manual methods: KBr pellet, thin film on NaCl plates, an ATR or an IR microscope accessory to name a few. All of these analytical procedures are useful, proven manual technologies. However, an infrared instrument that is coupled to a separation based technology such as gas chromatography, could offer a degree of automation that would allow the combined instrumentation to become an alternative, simple approach, for the routine analysis of certain drugs of abuse.

A number of attempts have been made to link an IR instrument to a separation technique. None of these attempts to develop a "hyphenated" technique have truly taken hold in the forensic community for a number of reasons. Previously designed instruments were either very expensive, difficult to use, had inadequate compound sensitivity or yielded poorly resolved spectra.

We have recently purchased a newly introduced GC-IR instrument offered by Spectra Analysis, Inc., Marlborough, MA. Their approach builds upon previous attempts to collect GC effluents at low temperatures for IR analysis. In this direct deposit approach, the GC effluent is deposited upon a spiraling ZnSe disk cooled with liquid nitrogen. The ZnSe disk is transparent to IR energy and the spectrum of the deposited material is captured immediately after sample deposition. This linking of a gas chromatograph instrument to an infrared detector, allows the separation of complex mixtures of substances and the subsequent collection of a full IR spectrum (4000 cm to 650 cm^{-1}). The instrument can be coupled to an auto-sampler and linked to commercially available IR libraries to allow a semi-automated approach to the analysis of drug samples. With this combination of technologies, GC-IR analysis could become a viable technique for the identification of complex drug mixtures.

Objective 2: The second objective of this project is to develop protocols and procedures for the efficient use of the GC-IR and distribute those to the forensic community. Since this instrument is newly introduced, we will need to perform a number of studies to determine the optimum operating parameters for forensic drug analysis. We intend to determine appropriate GC and IR conditions and any procedures necessary to allow forensic scientists to purchase and use this equipment with confidence.

D) Research Design and Methods

Objective 1: We intend to assess the GC-IR instrument to determine the benefits and limitations of this technology. The company, Spectra Analysis, takes "off the shelf" GC and auto-sampler components and links them to their IR detector. This IR detector system is essentially an untested system for the field of forensics, and while it may be suitable for commercial applications, a number of concerns must be answered prior to the forensic community implementing the technology. One of the issues that must be evaluated is the possibility of cross contamination of samples collected upon the reusable ZeSe disk. Two issues must be addressed here; how to identify that the disk is clean and ready for use prior to sample collection and the potential for cross contamination between separate collection tracks on the disk. We will develop a procedure to quickly scan a "cleaned" disk to determine if it is contaminant free. We will also intentionally load samples into the GC at concentrations that exceed routine limits to determine if there is any track to track contamination.

The crystalline and amorphous states of the same compound will yield different IR spectra. Various factors may affect the state of the material deposited upon the cooled zinc selenide disk. We will start our investigation of this phenomenon by looking at a wide range of compounds with the disk at a number of different temperatures and attempt to determine the conditions applicable for most forensic drug samples to maximize crystallization of the compounds of interest.

We have conducted some initial work concerning instrument sensitivity for a limited number of drugs but we intend to study additional drugs suited for GC-IR to define the sensitivity limitations of the instrument. We will also consider the difference in

sensitivity of the instrument capturing "on-the-fly" IR spectra versus re-scanning the deposited sample after the GC run has been completed. Multiple GC injections of the same sample may be performed to redeposit the GC effluent on the same disk track to concentrate the sample in an attempt to detect low concentration sample components. This mode of operation will be evaluated. The GC conditions will also have a large effect on sensitivity and will be evaluated as noted below.

In order to understand the real benefits and limitations of the system, we will need to analyze typical forensic samples. We will eval[illegible] samples to determine how the system [illegible] a wide range of drug submissions. Of interest will be p[illegible]hylamines (methamphetamine, MDMA and related compounds), psilocyn, tryptamines, and other commonly encountered drugs of abuse which yield minimal mass spectral data. These samples will be diluted in an appropriate solvent and analyzed by both GC-IR and GC-MS. A comparison will be made between the two technologies to determine if the same components are detected via both methods and to assess the protocols developed. An evaluation will be made [illegible] informational content [illegible] via the two technologies.

We also plan to define the limitations inherent in IR analysis by investigating closely related isomers. We are planning to work in conjunction with another NIJ grant recipient, Dr. Randall Clark (see attached letter of intent), to determine if GC-IR can be used to identify the varied MDMA analogs he has synthesized. Many of these compounds are not adequately discriminated by mass spectroscopy alone. IR is a powerful tool that may offer laboratories the ability to unequivocally identify closely related compounds. A variety of compounds (isomers not amenable to MS analysis) will be subjected to GC-IR

analysis. The IR of the closely related compounds will be compared along with the retention times of the compounds on different GC columns.

Objective 2: As we assess the instrument, we will learn what works well for drug analysis and develop protocols and procedures appropriate for the analysis of forensic drug samples. The GC-IR is less sensitive than a GC-MS and hence appropriate sample concentrations will need to be evaluated along with GC split ratios. To obtain the optimum separation and sensitivity we will need to evaluate GC column length, diameter, stationary phases, and carrier gas flow rates. The IR collection system will be evaluated to assess collection disk speed and IR resolution settings. In developing the protocols we will review what we learned during the assessment phase and implement those factors into a general protocol. Much of what we do will be an iterative process, where we develop a protocol and modify it by evaluating a variable and reassess the system. If time and in-house funding permits, we would also like to consider linking the IR detector to an existing GC-MS, yielding a GC-MS-IR system. This linking has been done by Spectra Analysis, but not in a forensic setting. This combined instrument would reduce the cost burden to forensic labs wishing to obtain both MS and IR information simultaneously from a sample.

E. Implications for Criminal Justice Policy and Practice

Many forensic disciplines have been challenged in the courts, and as this occurs it should prompt us to evaluate those technologies we perform to see if other strategies could add depth to our current analytical methods. The analysis of controlled substances is becoming more demanding as higher analytical standards are expected, and as the number of abused substances and designer drugs rise across the country. As we are

presented with analytical options to those methods and technologies we have been familiar with for years, it is incumbent upon us to review those technologies to determine if it makes sense to use these emerging tools to improve the analyses we offer to the criminal justice community.

GC-MS is often used for the forensic analysis of controlled substances and it is an excellent tool for routine drug analysis. However, a number of published reports have discussed the limitations of MS for certain compounds. Some of these limitations can be overcome by evaluating sample GC retention time (as compared to a retention time from a known drug) or by sample derivatization. GC retention time in combination with MS is a standard method for drug identification, but one may want to reflect upon relying on this combination of techniques for the differentiation of drugs where the compound yields a minimal MS pattern. Additionally, some regioisomers have been shown to co-elute, requiring the selection of additional GC columns and appropriate temperature programs to provide adequate compound resolution. Some "designer drugs" are nothing more than isomeric cousins to established drugs, and hence these substances could co-elute with the target compound, compromising an analysis if the mass spectra are indistinguishable. Derivatization increases the molecular weight of the target compound, which can improve the mass spectral informational content, while altering the chromatography of the molecule. In the case of amphetamines, derivatization improves the overall shape of the GC peak (1), and produces additional ions for identification purposes. Sample derivatization can improve the MS of a compound, but it adds steps to the analysis, decreases overall productivity, requires the handling of hazardous chemicals and derivatization can not be universally performed on all drugs.

Busy forensic laboratories need simple alternatives to assist the examiner in the unequivocal identification of controlled substances. The above methods are tried and true, but other techniques may provide information that is equal to, if not more compelling, through a semi-automated manner. We believe that increased sample information may be obtained simply, efficiently and in a semi-automated manner with GC-IR. Through our work we hope to show that GC-IR will be a supplementary or alternative tool to routine GC-MS, and will allow the forensic examiner to quickly and unequivocally identify compounds that have minimal or indistinguishable MS patterns. Our assessment of the instrument, and generation of protocols and procedures, would allow the forensic community to quickly evaluate the instrument for their use. We believe the emerging GC-IR technology will assist the examiner in the identification of routine drugs of abuse and those unusual substances seen today, in addition to those developed in the future.

F. Management plan and organization

A scientist with an appropriate background in chemistry will be hired and will work full-time on this project. The scientist will be assisted by Robert Shipman (see attached CV) who has been working on the GC-IR since the Vermont Forensic Laboratory (VFL) received the instrument. Mr. Shipman is a drug analyst with extensive hands-on experience with GC-MS, IR and GC-IR techniques. Dr. Eric Buel will oversee the project and his background includes forensic drug analysis. Both individuals will request funding for ~ 2 hours per week but will devote additional, un-funded time, as necessary to achieve the goals of the project.

After the project is complete, it is hoped that the state of Vermont will continue to fund the new hire, or there may be position openings due to retirement.

To date the VFL has performed some limited experiments with the instrument. The manufacturer (Spectra Analysis, Inc.) designed an instrument which, when it was received by the VFL, was suitable for research applications. The software and protocols for operation were not suited for routine forensic applications, but for use by a research institution or for solving a particular problem in an industrial/pharmaceutical application. After simple experiments were performed to conceptually show that the instrument should be of value to the forensic community, we began working with Spectra Analysis, Inc. to design and implement software and routine procedures to allow the introduction of the instrument into the forensic community. For example, suitable software needs to be finalized and tested to allow easy and routine instrument control (of both the GC and IR) with subsequent collection and appropriate reporting of the data. We believe this initial work will be done prior to receiving the grant so that the work described above can be accomplished in the allotted time.

Time Line:

Item	**Time**
Hire Scientist	Month 1
Drugs for project • Contact collaborators-specify drug samples needed • Purchase commercially available drugs	Month 1
Purchase necessary supplies- columns, solvents etc.	Month 1
Disk contamination issue • Evaluate cross contamination • Develop disk assessment protocol	Months 2-3
Crystalline and Amorphous states	Month 4

• Evaluate a wide range of drugs • Assess disk conditions to minimize amorphous state	
Sensitivity Study • On-the-fly versus re-scanning • Multiple deposition • Variations in GC conditions and disk speed	Month 5-6
Analysis of selected drugs (commercially available and from collaborators) • Routinely encountered drugs • Isomers and related compounds • Drugs with minimal MS patterns	Months 6-9
Forensic casework • Routine cases • Designer drug cases	Months 7-11
Develop and modify protocols	Months 7-12
Disseminate results to forensic community	Month 12

G. Dissemination Strategy

A major goal of our work is to distribute our findings and any derived methods to the forensic community to improve criminal justice. The cost of the Spectra Analysis instrument ($130,000, not including the GC- as per company representative), and costs relative to the operation of the instrument will be also be presented.

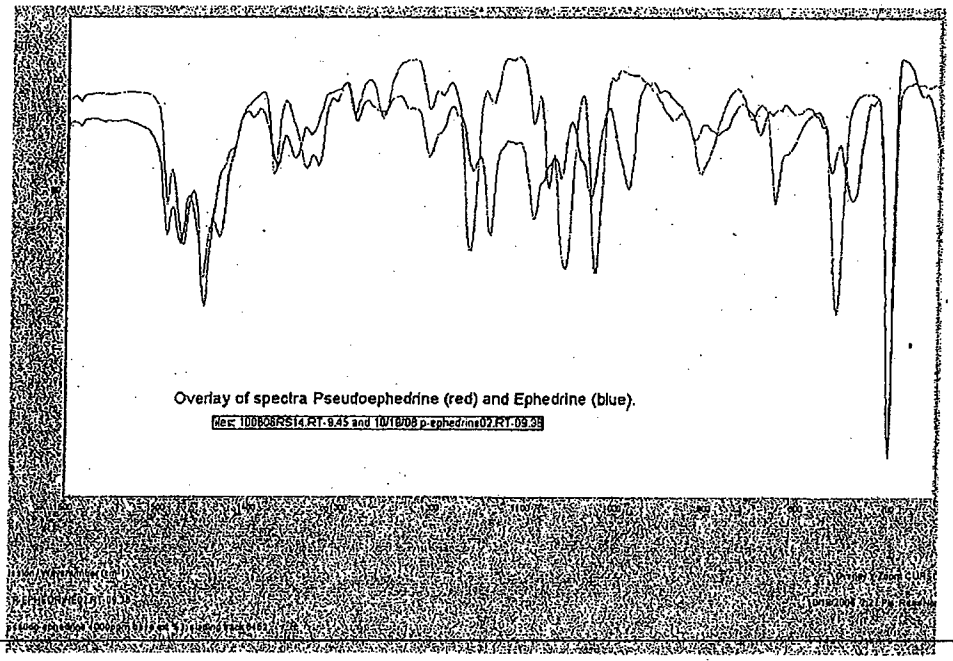
To this end, we will publish our results for peer review in the Journal of Forensic Sciences or other suitable journal and create basic protocols for others to use. We plan to present our findings at regional forensic meetings, and the American Academy of Forensic Sciences. This may take the form of poster sessions or as oral presentations. We also plan to be available by phone/e-mail to anyone interested in receiving information. We will also work with the National Forensic Science Training Center to hold a hands-on

work shop if they feel it is appropriate. I believe if one were to review our history, we have been proactive in providing peer reviewed publications, presentations, and "one-on one" information concerning any of our NIJ funded research projects.

H. Preliminary Data:

Figure 4 (below) shows the IR fingerprint region for the compounds pseudoephedrine and ephedrine. Both compounds were run separately on the GC-IR and the IR data collected. The spectra were overlaid to demonstrate the differences between these two diastereomers and to show the quality of the IR spectra typically obtained with this instrument. The mass spectra for these two compounds are essentially the same.

Figure 4



Grant Application Identifier: 2008 Controlled Substances Detection & Analysis R&D

Grant Period: 1/1/2009 12/31/2009

Adapted for VT DPS from O...

Budget Detail Worksheet

A. Personnel - List each position by title and name of employee, if available. Show the annual salary rate and the percentage of time to be devoted to the project. Compensation paid for employees engaged in grant activities must be consistent with that paid for similar work within the applicant organization.

Name, Position / Title		Computation						
		Hourly Rate	X Number of Hr's in Pay Period	X Number of Pay Periods	=	Cost for the Project Period		Total Personnel for Employee
1. Forensic Chemist II, t.b.a.	Step 2: 1/1/09-6/30/09	22.96	80	13		23,878.40		
PayGr 25, hired 'in range'	Step 2: with 2% COLA: 7/1/09-12/31/09	23.42	80	13		24,355.97	>	48,234.37
				26				
2. Robert Shipman, Forensic Chemist III	Step 6: 1/1/09-6/30/09	26.26	4	13		1,365.52		
OT only, PayGr 25	Step 6 :plus 2% COLA: 7/1/09-8/10/09	26.79	4	3		321.42		
	Step 7: with 2% COLA: 8/11/09-12/31/09	27.69	4	10		1,107.72	>	2,794.66
				26				
3. Eric Buel, Forensics Lab Director	Step 13: 1/1/09-4/9/09	41.78	4	8		1,336.96		
OT only, PayGr 29	Step 14: 4/10/09-6/30/09	42.95	4	5		859.00		
	Step 14: with 2% COLA: 7/1/09-12/31/09	43.81	4	13		2,278.07	>	4,474.03
				26				
						Sub-Total	$	55,503

B. Fringe Benefits - Fringe benefits should be based on actual known costs or an established formula. Fringe benefits are for the personnel listed in budget category (A) and only for the percentage of time devoted to the proejct. Fringe benefits on overtime hours are limited to FICA, Workman's Compensation, and Unemployment Compensation.

Name, Position / Title	Computation						Cost	
1. Forensic Chemist II, t.b.a.	Social Security at			6.20%		of salary	$	2,991
	Medicare at			1.45%		of salary	$	699
	Retirement at			9.70%		of salary	$	4,679
	Worker's Comp at			6.00%		of salary	$	2,894
	Health Ins at	$	463.00	X	26.0	80-hour pay periods	$	12,038
	Life Ins at			0.35%		of salary	$	169
	Dental Ins at	$	41.74	X	26.0	80-hour pay periods	$	1,085
	EAP at	$	1.08	X	26.0	80-hour pay periods	$	28
							$	24,583
2. Robert Shipman, Forensic Chemist III	Social Security at			6.20%		of salary	$	173
	Medicare at			1.45%		of salary	$	41
	Retirement at			9.70%		of salary	$	271
	Worker's Comp at			6.00%		of salary	$	168
							$	653
3. Eric Buel, Forensics Lab Director	Social Security at			6.20%		of OT salary	$	277
	Medicare at			1.45%		of OT salary	$	65
	Retirement at			9.70%		of OT salary	$	434
	Worker's Comp at			6.00%		of OT salary	$	268
							$	1,045
						Sub-Total	$	26,280

TOTAL PERSONNEL AND FRINGE BENEFITS: $ 81,783

Travel - Itemize travel expenses of project personnel by purpose (e.g., staff to training, field interviews, advisory group meeting, etc.). Show the basis of computation (e.g., six people to 3-day training at $X airfair, $X lodging, $X substinance). In training projects, travel and meals for trainees should be listed separately. Show the number of trianees and the unit costs involved. Identify the location of travle, if known. Indicate source of Travel Policies applied, Applicant or Federal Travel Regulations.

Purpose	Location	Computation							
		# of people	# of days	Cost Ea		Description	T. Cost Per Line		
AAFS Meeting	TBA	1	-	$	558.00	Airfare	$ 558		
		1	4	$	130.00	Lodging	$ 520		
		1	4	$	40.00	Subsistence	$ 160	$	1,238

TOTAL TRAVEL $ 1,238

D. Equipment - List non-expendable items that are to be purchased. Non-expendable equipment is tangible property having a useful life of more than two years and an acquisition cost of $5,000 or more per unit. (Note: Organization's own capitalization policy may be used for items costing less than $5,000). Expendable items should be included either in the "supplies" category or in the "Other" category. Applicants should analyze the cost benefits or purchasing versus leasing equipment, especially high cost items and those subject to rapid technical advances. Rented or leased equipment costs sh ould be listed in the "Contractual" category. Explain how the equipment is necessary for the success of the project. Attach a narrative describing the procurement method to be used.

Equipment Items	Computation				Cost
	Quantity		Cost Each		
None.	0	at	$	-	$ -

TOTAL EQUIPMENT: $ -

E. Supplies - List items by type (office supplies, postage, training materials, copying paper, and expandable equipment items costing less than $5,000, such as books, hand held tape recorders) and show the basis for computation. (Note: Organization's own capitalization policy may be used for items costingless than $5,000). Generally, supplies include any materials that are expendable or consumed during the course of the project.

Supply Items	Computation						
	Quantity	Unit		Price Per Unit		T. Cost Per Line	
Custom designed and systhezied drugs	14	each	at	$ 500.00		$ 7,000.00	
Commercially available drugs		each	at	$ 50.00		$ 1,350.00	
GC Columns		each	at	$ 500.00		$ 1,500.00	

TOTAL SUPPLIES: $ 9,850

F. Construction - As a rule, construction costs are not allowable. In some cases, minor repairs or renovations may be allowable. Check with the program office before budgeting funds in this category.

Purpose	Description of Work	Cost
None		$ -

TOTAL CONSTRUCTION: $ -

G. **Consultants/Contracts** - Indicate whether applicant's formal, written Procurement Policy or the Federal Acquisition Regulations are followed.

Consultant Fees: For each consultant enter the name, if known, service to be provided, hourly or daily fee (8-hour day), and the estimated time on the project. Consultant fees in excess of $450 per day require additional justification and prior approval from OJP.

Name of Consultant	Service Provided	Computation	Cost
None.			$ -
		Sub-Total:	$ -

Consultant Expenses: List all expenses to be paid from the grant to the individual consultants in addition to their fees (i.e., travel, meals, lodging, etc.)

Item	Location	Computation	Cost
None			$ -
		Sub-Total:	$ -

Contracts: Provide a description of the product or service to be procured by contract and an estimate of the cost. Applicants are encouraged to promote free and open competition in awarding contracts. A separate justification must be provided for sole source contracts in excess of $100,000.

Item			Cost
	at	$ -	$ -
		Sub-Total:	$ -

TOTAL CONTRACTS / CONSULTANTS: $ -

H. Other Costs - List items (e.g., rent, reproduction, telephone, janitorial or security services, and investigative or confidential funds) by major type and the basis of the computation. For example, provide the square footage and the cost per square foot for rent, or provide a monthly rental cost and how many months to rent.

Description	Computation	Cost
Program Costs:		
None	at $ -	$ -
Administrative Costs:		
Fidelity Bond Premium on State of Vermont Personal services	0.02% of Total P/S budget	$ 16.36

TOTAL OTHER: $ 16

I. Indirect Costs - Indirect costs are allowed only if the applicant has a Federally approved indirect cost rate. A copy of the rate approval (a fully executed, negotiated agreement), must be attached. If the applicant does not have an approved rate, one can be requested by contacting the applicant's cognizant Federal agency, which will review all documentation and approve a rate for the applicant organization, or if the applicant's accounting system permits, costs may be allocated in direct costs categories.

Description	Computation	Cost
None		$ -

TOTAL INDIRECT: $ -

TOTAL PROJECT COST: $ 92,888

Budget Summary

Budget Category	Amount
A. Personnel	$ 55,503
B. Fringe Benefits	$ 26,280
C. Travel	$ 1,238
D. Equipment	$ -
E. Supplies	$ 9,850
F. Construction	$ -
G. Consultants/Contracts	$ -
H. Other	$ 16
Total Direct Costs	$ 92,888
I. Indirect Costs	$ -
TOTAL PROJECT COSTS	$ 92,888
Federal Request	$92,888
Non-Federal Amount	$0

$0

[redacted]

Budget Narrative

The budget narrative should be a plain-language explanation of the proposed expenditures that are listed in the Budget Detail Worksheet above.

A. Personnel

The salary and benefits will support the hiring of a full time forensic chemist who has appropriate chemistry training for the proposed research. Robert Shipman and Eric Buel will request 2 hours of funding per week for their work on the project.

C. Travel

Travel will include a trip to the AAFS meeting to present the results of the research.

D. Equipment

None.

E. Supplies

Custom synthesized drugs will be made by Dr. Clark (see letter of support). Commercially available drugs will be purchased from standard drug supply companies. Two GC columns will be purchased to allow the development of GC separation protcols.

F. Construction

None.

G. Consultants / Contracts

None.

H. Other Costs

Program Costs:

Administrative Costs:

Costs to the Department of Public Safety for administering federal funds.

I. Indirect Costs

None.

JFO 2378

VERMONT

State of Vermont
Department of Finance & Management
109 State Street, Pavilion Building
Montpelier, VT 05620-0401

[phone] 802-828-2376
[fax] 802-828-2428

Agency of Administration

STATE OF VERMONT
FINANCE & MANAGEMENT GRANT REVIEW FORM

Grant Summary:	Supports position to perform research & development in the area of controlled substances.				
Date:	3/23/2009				
Department:	Public Safety - Criminal Justice Services - Forensic Laboratory				
Legal Title of Grant:	Research & Development in the Area of Controlled Substances				
Federal Catalog #:	16.560				
Grant/Donor Name and Address:	National Institute of Justice				
Grant Period: From:	1/1/2009	**To:**	12/31/2010		
Grant/Donation					
	SFY 1	**SFY 2**	**SFY 3**	**Total**	**Comments**
Grant Amount:	$73,704	$19,184	$	$92,888	

	# Positions	**Explanation/Comments**
Position Information:	1	Forensic chemist II

DB 3/23/09

Additional Comments:	Grant will support the Lab's primary work.

Department of Finance & Management	3/27/09	(Initial)
Secretary of Administration	RPM 4/8/09	(Initial)
Sent To Joint Fiscal Office	4/14/09	**Date**

RECEIVED
APR 16 2009
JOINT FISCAL OFFICE

Dept. of Public Safety
Administration Division
Accounting Unit

Memo

To: David Beatty, Budget & Management Analyst

From: Tracy O'Connell, Programs Administration Supervisor

Date: 12/22/08

CC: file

Re: Request for Grant Acceptance

Attached you will find an AA-1 form for the request to accept a grant from the National Institute of Justice.

If you have any questions, please contact me at 802-241-5574 or toconnel@dps.state.vt.us; or Richard Hallenbeck at 802-241-5339 or rhallenb@dps.state.vt.us.

Thank you.

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

BASIC GRANT INFORMATION				
1. Agency:				
2. Department:	Public Safety			
3. Program:	Criminal Justice Services Forensic Labratory			
4. Legal Title of Grant:	Research & Development in the Area of Controlled Substances			
5. Federal Catalog #:	16.560			
6. Grant/Donor Name and Address: National Institute of Justice; 810 Seventh St., NW; Washington, DC 20531				
7. Grant Period: **From:**	1/1/2009	**To:**	12/31/2010	
8. Purpose of Grant: The proposed research seeks to develop procedures and protocols for the analysis of drugs that currently yield limited information. This research will focus on the routine identification of commonly encountered drugs, designer drugs, and closely related drug isomers.				
9. Impact on existing program if grant is not Accepted: If successful, this project could introduce a new method of drug analysis that would be quicker, or could allow for simultaneous processing of casework with existing methods, therefore relieving backlogs in drug analysis.				

10. BUDGET INFORMATION

	SFY 1	SFY 2	SFY 3	Comments
Expenditures:	**FY** 2010	**FY** 2011	**FY**	
Personal Services	$68152	$13632	$	
Operating Expenses	$5552	$5552	$	
Grants	$	$	$	
Total	$73,704	$19,184	$	
Revenues:				
State Funds:	$	$	$	
Cash	$	$	$	
In-Kind	$	$	$	
Federal Funds:	$	$	$	
(Direct Costs)	$73704	$19184	$	
(Statewide Indirect)	$	$	$	
(Departmental Indirect)	$	$	$	
Other Funds:	$	$	$	
Grant (source)	$	$	$	
Total	$	$	$	

Appropriation No:	2140020000	**Amount:**	$92888
			$
			$
			$
			$
			$
			$

RECD DEC 2 4 2008

STATE OF VERMONT REQUEST FOR GRANT ACCEPTANCE (Form AA-1)

		Total	$92,888

PERSONAL SERVICE INFORMATION

11. Will monies from this grant be used to fund one or more Personal Service Contracts? ☐ Yes ☒ No
If "Yes", appointing authority must initial here to indicate intent to follow current competitive bidding

Appointing Authority Name: Agreed by: _ _____ (initial)

12. Limited Service Position Information:	**# Positions**	**Title**
	1	Forensic Chemist II - will convert a Forensic Chemist IV position into a Forensic Chemist II position when the incumbent retires in Sept 09.
Total Positions	1	

12a. Equipment and space for these positions: ☒ Is presently available. ☐ Can be obtained with available funds.

13. AUTHORIZATION AGENCY/DEPARTMENT

I certify that no funds have been expended or committed in anticipation of Joint Fiscal Committee Approval of this grant:	Signature: Thomas R Tremblay	Date: 12/19/08
	Title: Commissioner	

14. ACTION BY GOVERNOR

☑	Check One Box: Accepted		4/13/09
☐	Rejected	(Governor's signature)	Date:

15. SECRETARY OF ADMINISTRATION

☐	Check One Box: Request to JFO	Linda P McNeil	4/8/09
☐	Information to JFO	(Secretary's signature or designee)	Date:

16. DOCUMENTATION REQUIRED

Required GRANT Documentation	
☐ Request Memo	☐ Request Memo
☐ Dept. project approval (if applicable)	☐ Dept. project approval (if applicable)
☐ Notice of Award	☐ Notice of Donation (if any)
☐ Grant Agreement	☐ Grant (Project) Timeline (if applicable)
☐ Grant Budget	☐ Request for Extension (if applicable)

End Form AA-1

DEPARTMENT OF PUBLIC SAFETY

Memo

To: Commissioner Thomas Tremblay

From: Eric Buel, Ph.D. Laboratory Director Eric Buel

Date: December 19, 2008

Subject: R&D Controlled Substances Detection & Analysis Grant
Award #: 2008-DN-BX-K161

Commissioner,

As you know, we have been awarded a Research and Development grant in the area of controlled substances detection and analysis. The award provides funding for supplies for research and salary for one individual. Below is an outline of the application and award period for the grant.

10/19/07:
Received invitation for concept papers

11/9/07:
Submitted concept paper. Includes a "staffing plan" for 1 new FTE + OT for existing staff

1/29/08:
Received invitation to submit full proposal. Collaborated on scope and budget

2/14/08:
Approval of final budget which includes 1 FTE + OT for existing staff

2/15/08:
Submitted full proposal

7/14/08:
Responded to inquiries re classification of costs

9/18/08:
Assigned POC & Downloaded award

9/19/08:
Accepted Award

We accepted the award in September; however we delayed submitting the award to the JFO for approval due to: the fiscal environment, FY09 position reductions and the fact that we don't have any vacant civilian limited-service positions at this time (as no new positions are being created).

We have received preliminary approval from NIJ for a one-year extension on the grant, thereby extending the grant end date to 12/31/2010. Instead of requesting a new limited service position be created, I am proposing the following:

I would like to seek state permission to proceed with our drug research under this award using funds available for supplies as soon as the state approves the grant. We would use funds for overtime to support existing personnel to slowly move forward to accomplish some of the goals of the award. One individual in our laboratory will be retiring in September 2009 and we would like to use that "position number" as the position we fill with this drug grant position. This would result in a delayed start to a portion of the drug research program. During the summer of 2009, we would advertise for a qualified individual to fill the "position number" we would have available in September 2009. I believe that we will be able to meet all the expectations of the grant but it will be slightly delayed.

Department of Justice
Office of Justice Programs
National Institute of Justice

Cooperative Agreement

1. RECIPIENT NAME AND ADDRESS (Including Zip Code)

Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

4. AWARD NUMBER: 2008-DN-BX-K161

5. PROJECT PERIOD: FROM 01/01/2009 TO 12/31/2009
BUDGET PERIOD: FROM 01/01/2009 TO 12/31/2009

6. AWARD DATE 09/17/2008

7. ACTION: Initial

1A. GRANTEE IRS/VENDOR NO.
036000274

8. SUPPLEMENT NUMBER
00

9. PREVIOUS AWARD AMOUNT $ 0

3. PROJECT TITLE
VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

10. AMOUNT OF THIS AWARD $ 92,888

11. TOTAL AWARD $ 92,888

12. SPECIAL CONDITIONS

THE ABOVE GRANT PROJECT IS APPROVED SUBJECT TO SUCH CONDITIONS OR LIMITATIONS AS ARE SET FORTH ON THE ATTACHED PAGE(S).

13. STATUTORY AUTHORITY FOR GRANT

This project is supported under FY08(NIJ - COPS DNA/Forensics) Pub. L. No. 110-161, 121 Stat. 1897, 1910; 28 USC 530C

15. METHOD OF PAYMENT

PAPRS

[redacted] AGENCY APPROVAL [redacted]

16. TYPED NAME AND TITLE OF APPROVING OFFICIAL

Jeffrey L. Sedgwick
Acting Assistant Attorney General

17. SIGNATURE OF APPROVING OFFICIAL

Jeffrey L. Sedgwick

[redacted] GRANTEE ACCEPTANCE [redacted]

18. TYPED NAME AND TITLE OF AUTHORIZED GRANTEE OFFICIAL

Thomas Tremblay
Commissioner

19. SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL

Thomas R. Tremblay

19A. DATE

9/19/08

[redacted] AGENCY USE ONLY [redacted]

20. ACCOUNTING CLASSIFICATION CODES

FISCAL YEAR	FUND CODE	BUD. ACT.	OFC.	DIV. REG.	SUB.	POMS	AMOUNT
X	B	DN	60	00	00		92888

21. HDNSGT0088

PROJECT NUMBER 2008-DN-BX-K161 AWARD DATE 09/17/2008

SPECIAL CONDITIONS

1. The recipient agrees to comply with the financial and administrative requirements set forth in the current edition of the Office of Justice Programs (OJP) Financial Guide.

2. The recipient acknowledges that failure to submit an acceptable Equal Employment Opportunity Plan (if recipient is required to submit one pursuant to 28 C.F.R. Section 42.302), that is approved by the Office for Civil Rights, is a violation of its Certified Assurances and may result in suspension or termination of funding, until such time as the recipient is in compliance.

3. The recipient agrees to comply with the organizational audit requirements of OMB Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations, as further described in the current edition of the OJP Financial Guide, Chapter 19.

4. Recipient understands and agrees that it cannot use any federal funds, either directly or indirectly, in support of the enactment, repeal, modification or adoption of any law, regulation or policy, at any level of government, without the express prior written approval of OJP.

5. Due to the substantial Federal involvement contemplated in completion of this project, the National Institute of Justice (NIJ) has elected to enter into a cooperative agreement rather than a grant. This decision is based on NIJ's ongoing responsibility to assist and coordinate projects that deal with research, technology development, and assessment. NIJ will provide input and re-direction to the program as needed, in consultation with the Recipient, and will actively monitor the project by methods including but not limited to ongoing contact with the Recipient.

   In meeting programmatic responsibilities, NIJ and the Recipient will be guided by the following principles: responsibility for the day-to-day operations of this project rests with the Recipient in implementation of the Recipient's approved proposal, the Recipient's approved budget, and the terms and conditions specified in this award. Responsibility for general oversight and re-direction of the project, if necessary, rests with NIJ.

   Where appropriate, the Recipient will act jointly with NIJ in accomplishing the following tasks:
   a. determination of research design,
   b. design of data collection instruments, and/or
   c. determination of sites for research.
   Data collection, analysis, and interpretation of data and analyses are the responsibility of the Recipient.

   In addition to its programmatic responsibilities, the Recipient agrees to provide necessary information as requested by the Office of Justice Programs and NIJ. Information requests may include, but are not limited to, specific submissions related to: performance, including measurement of project outputs/outcomes; meeting performance specifications; developmental decision points; changes in project scope or personnel; budget modifications; and/or coordination of related projects.

PROJECT NUMBER 2008-DN-BX-K161 AWARD DATE 09/17/2008

SPECIAL CONDITIONS

6. Within 45 days after the end of any conference, meeting, retreat, seminar, symposium, training activity, or similar event funded under this award, and the total cost of which exceeds $20,000 in award funds, the recipient must provide the program manager with the following information and itemized costs:

   1) name of event;

   2) event dates;

   3) location of event;

   4) number of federal attendees;

   5) number of non-federal attendees;

   6) costs of event space, including rooms for break-out sessions;

   7) costs of audio visual services;

   8) other equipment costs (e.g., computer fees, telephone fees);

   9) costs of printing and distribution;

   10) costs of meals provided during the event;

   11) costs of refreshments provided during the event;

   12) costs of event planner;

   13) costs of event facilitators; and

   14) any other costs associated with the event.

   The recipient must also itemize and report any of the following attendee (including participants, presenters, speakers) costs that are paid or reimbursed with cooperative agreement funds:

   1) meals and incidental expenses (M&IE portion of per diem);

   2) lodging;

   3) transportation to/from event location (e.g., common carrier, Privately Owned Vehicle (POV)); and,

   4) local transportation (e.g., rental car, POV) at event location.

   Note that if any item is paid for with registration fees, or any other non-award funding, then that portion of the expense does not need to be reported.

   OJP will provide further instructions regarding the submission of this data at a later time.

PROJECT NUMBER 2008-DN-BX-K161 AWARD DATE 09/17/2008

SPECIAL CONDITIONS

7. The award recipient shall provide all products specified in the proposal. In addition, ninety (90) days prior to the end of the project period, the recipient shall submit to NIJ the following documents in electronic format: (1) A Draft Final Technical Report. The Draft Final Technical Report shall describe the project's activities in sufficient detail to permit replication of the design, including a review of relevant literature, methods including detailed description of data collection and analysis procedures, modifications to or problems with the original research design, findings, and conclusions. (2) A 2,500 to 4,000 word Draft Summary suitable for publication and/or dissemination which describes results, findings and conclusions from the project, including implications for criminal justice operations. (3) A Draft 600 word Abstract. The abstract should serve as a succinct and accurate description of the project. Research goals and objectives, research design, and methods for achieving the goals and objectives should be concisely described. The abstract should include statement of purpose, description of research subjects, methods, results and conclusions.

   The Draft Final Technical Report, Abstract and Summary will, with few exceptions, be submitted to peer review. The recipient shall be responsive to peer reviewers' comments and other issues raised in the review and understand that the review process has implications with respect to publication and dissemination decisions made by NIJ. The recipient shall make appropriate revisions to these documents based on the reviewers' comments and/or any comments from NIJ.

8. The recipient must deliver to NIJ, by the termination of the award period, an electronic copy of the Final Technical Report, Abstract and Summary.

   Final Technical Reports, Abstracts, and Summaries should be in Microsoft Word or Corel WordPerfect format. Graphic files should be provided in Adobe Illustrator, Macro media Freehand, Corel Draw or Delta Graph. Included images should adhere to GIFF, JPEG, PICT, and TIFF format standards, with GIFF and PICT images preferred.

   Final Technical Reports are, in general, made available to the public through the National Criminal Justice Reference Service (NCJRS) and may be electronically posted in the NCJRS virtual library.

9. The recipient may not obligate, expend, or draw down $5,000 until the recipient submits, in a form satisfactory to NIJ, the draft final research/technical report required by the special conditions of this award. The draft final report must be accepted by NIJ as meeting usual scientific standards for form and content. Approval will be provided through a Grant Adjustment Notice that will clear this special condition.

10. The recipient agrees to submit quarterly financial status reports to the Office of Justice Programs using Standard Form SF 269A on the Internet at https://grants.ojp.usdoj.gov . These reports shall be submitted on-line not later than 45 days after the end of each calendar quarter. The final report shall be submitted not later than 90 days following the end of the grant period.

11. The recipient shall submit semiannual progress reports. Progress reports shall be submitted within 30 days after the end of the reporting periods, which are June 30 and December 31, for the life of the award. These reports will be submitted to the Office of Justice Programs, on line-through the Internet at https://grants.ojp.usdoj.gov/.

12. The recipient agrees to submit a final report at the end of this award documenting all relevant project activities during the entire period of support under this award. This report will include detailed information about the project(s) funded, including, but not limited to, information about how the funds were actually used for each purpose area, data to support statements of progress, and data concerning individual results and outcomes of funded projects reflecting project successes and impacts. The final report is due no later than 90 days following the close of this award period or the expiration of any extension periods. This report will be submitted to the Office of Justice Programs, on line-through the Internet at https://grants.ojp.usdoj.gov/.

SPECIAL CONDITIONS

13. The Project Director and key program personnel designated in the application shall be replaced only for compelling reasons and with the concurrence of OJP. OJP will not unreasonably withhold concurrence. All successors to key personnel must be approved, and such approval is contingent upon submission of appropriate information, including, but not limited to, a resume. Changes in other program personnel require only notification to OJP and submission of resumes, unless otherwise designated in the award document.

14. The Recipient agrees to comply with all Federal, State, and local environmental laws and regulations applicable to the development and implementation of the activities to be funded under this award. Environmental Assessment (EA): The Recipient agrees and understands that funded activities (whether conducted by the recipient or subrecipients or contractors) may require the preparation of an environmental assessment (EA) as defined by the Council on Environmental Quality's Regulations for implementing the Procedural Provisions of the National Environmental Policy Act (NEPA), found at 40 CFR Part 1500. An EA is a concise public document that briefly provides sufficient analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact for the proposed activity. If in completing an EA for a proposed activity, potential adverse environmental impacts are identified, the EA will serve as a vehicle for developing either alternative approaches or mitigation measures for avoiding or reducing the identified adverse environmental impacts. Modifications: Throughout the term of this award, the Recipient agrees that for any activity that is the subject of a completed Environmental Assessment (EA), it will inform NIJ of (1) any change(s) that it is considering making to the previously assessed activity; (2) any changed circumstances, such as a change in the project site's conditions; or (3) any significant new information. The Recipient will not implement a proposed change until NIJ, with the assistance of the Recipient, has determined whether the proposed change will require additional review under NEPA. Likewise, in the case of new circumstances or information arising, NIJ, with the assistance of the Recipient, will determine if any additional environmental impact analysis is necessary. The approval will not be unreasonably withheld as long as any requested modification(s) is consistent with eligible program purposes and found acceptable under an NIJ-conducted environmental impact review process.

15. The recipient may not obligate, expend, or draw down any funds until the program office has verified that the recipient has submitted all necessary documentation required to comply with the Department of Justice Procedures for Implementing the National Environmental Policy Act found at 28 CFR Part 61 and a Grant Adjustment Notice has been issued removing this condition.

16. To assist in information sharing, the award recipient shall provide the grant manager with a copy of all interim and final reports and proposed publications (including those prepared for conferences and other presentations) resulting from this agreement. Submission of such materials prior to or simultaneous with their public release aids NIJ in responding to any inquiries that may arise. Any publications (written, visual, or sound) - excluding press releases and newsletters - whether published at the recipient's or government's expense, shall contain the following statement: This project was supported by Award No. _____ awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication/program/exhibition are those of the author(s) and do not necessarily reflect those of the Department of Justice.

    NIJ defines publications as any planned, written, visual or sound material substantively based on the project, formally prepared by the award recipient for dissemination to the public.

17. The recipient shall transmit to the grant monitor copies of all official grant-related press releases at least ten (10) working days prior to public release. Advance notice permits time for coordination of release of information by NIJ where appropriate and to respond to press or public inquiries.

SPECIAL CONDITIONS

18. Recipient acknowledges that the Office of Justice Programs reserves a royalty-free, non-exclusive, and irrevocable license to reproduce, publish, or otherwise use, and authorize others to use (in whole or in part, including in connection with derivative works), for Federal purposes: (1) the copyright in any work developed under an award or subaward; and (2) any rights of copyright to which a recipient or subrecipient purchases ownership with Federal support.

Recipient acknowledges that the Office of Justice Programs has the right to (1) obtain, reproduce, publish, or otherwise use the data first produced under an award or subaward; and (2) authorize others to receive, reproduce, publish, or otherwise use such data for Federal purposes.

It is the responsibility of the recipient (and of each subrecipient, if applicable) to ensure that this condition is included in any subaward under this award.

19. Patents and Inventions.

The clauses at 37 C.F.R. section 401.14 (together, the "Patents Rights Clause") are incorporated by reference, with the following modifications.

(1) Where italicized, the terms "contract," "contractor," and "contracting officer" are replaced, respectively, by the terms "award," "award recipient," and "OJP program manager";

(2) Patent Rights Clause paragraph (f) is modified by adding the following at the end:

"(5) The award recipient agrees to provide a report prior to the close out of the award listing all subject inventions or stating that there were none.

(6) The award recipient agrees to provide, upon request, the filing date, patent application number and title; a copy of the patent application; and patent number and issue date for any subject invention in any country in which the award recipient has applied for a patent.";

(3) Patent Rights Clause paragraph (g) is modified to read as follows:

"(g) Subawards and Subcontracts

"The award recipient will include this Patent Rights Clause, suitably modified to identify the parties, in all subawards and subcontracts, regardless of tier, for experimental, developmental, or research work. The subaward recipient or subcontractor will retain all rights provided for the award recipient in this clause, and the award recipient will not, as a part of the consideration for awarding the subaward or subcontract, obtain rights in the subaward recipient's or subcontractor's subject inventions."; and

(4) Patent Rights Clause paragraph (l) is modified to read as follows:

"(l) Communications

"Communications on matters relating to this Patent Rights Clause should be directed to the General Counsel, Office of Justice Programs, United States Department of Justice.".

With respect to any subject invention in which the award recipient, or a subaward recipient or subcontractor, retains title, the Federal government shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States the subject invention throughout the world.

PROJECT NUMBER 2008-DN-BX-K161 AWARD DATE 09/17/2008

SPECIAL CONDITIONS

20. The award recipient agrees to comply with the requirements of 28 CFR Part 46 and all other Department of Justice/Office of Justice Programs policies and procedures regarding the protection of human research subjects, including informed consent procedures and obtainment of Institutional Review Board (IRB) approval, if appropriate.

21. The award recipient will not be permitted to draw down any funds for any research involving human subjects until (1) it has submitted adequate documentation to demonstrate that it will conduct or perform research involving human subjects in accordance with an approved Federal-wide assurance issued by HHS or a Single Project Assurance issued by OJP/NIJ, and that the research has been determined, by an appropriate IRB (or the Office of the General Counsel/OJP), to be an exempt research activity, or has been reviewed and approved by an appropriate IRB in accordance with the requirements of 28 CFR Part 46, (2) the NIJ Human Subjects Protection Officer has authorized, in writing, removal of this special condition, and (3) a Grant Adjustment Notice (GAN) has been issued removing this special condition.

22. The award recipient agrees, as a condition of award approval, to comply with the requirements of 28 CFR Part 22, including the requirement to submit a properly executed Privacy Certificate that is in compliance with 28 CFR § 22.23 to the National Institute of Justice for approval.

23. The applicant budget is pending review or approval. The recipient may not obligate, expend or draw down any grant funds until the Office of the Chief Financial Officer, Office of Justice Programs has issued clearance of the application budget, and a Grant Adjustment Notice has been issued removing this special condition.

Department of Justice

Office of Justice Programs

National Institute of Justice

Washington, D.C. 20531

Memorandum To: Official Grant File

From: Frances Scott, Program Manager

Subject: Environmental Assessment for Vermont Department of Public Safety

The Recipient agrees to comply with all Federal, State, and local environmental laws and regulations applicable to the development and implementation of the activities to be funded under this award. Environmental Assessment (EA): The Recipient agrees and understands that funded activities (whether conducted by the recipient or subrecipients or contractors) may require the preparation of an environmental assessment (EA) as defined by the Council on Environmental Quality's Regulations for implementing the Procedural Provisions of the National Environmental Policy Act (NEPA), found at 40 CFR Part 1500. An EA is a concise public document that briefly provides sufficient analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact for the proposed activity. If in completing an EA for a proposed activity, potential adverse environmental impacts are identified, the EA will serve as a vehicle for developing either alternative approaches or mitigation measures for avoiding or reducing the identified adverse environmental impacts. Modifications: Throughout the term of this award, the Recipient agrees that for any activity that is the subject of a completed Environmental Assessment (EA), it will inform NIJ of (1) any change(s) that it is considering making to the previously assessed activity; (2) any changed circumstances, such as a change in the project site's conditions; or (3) any significant new information. The Recipient will not implement a proposed change until NIJ, with the assistance of the Recipient, has determined whether the proposed change will require additional review under NEPA. Likewise, in the case of new circumstances or information arising, NIJ, with the assistance of the Recipient, will determine if any additional environmental impact analysis is necessary. The approval will not be unreasonably withheld as long as any requested modification(s) is consistent with eligible program purposes and found acceptable under an NIJ-conducted environmental impact review process.

Department of Justice
Office of Justice Programs

National Institute of Justice

GRANT MANAGER'S MEMORANDUM, PT. I: PROJECT SUMMARY

Cooperative Agreement

PROJECT NUMBER
2008-DN-BX-K161

This project is supported under FY08(NIJ - COPS DNA/Forensics) Pub. L. No. 110-161, 121 Stat. 1897, 1910; 28 USC 530C

1. STAFF CONTACT (Name & telephone number)

Frances Scott
(202) 305-9950

2. PROJECT DIRECTOR (Name, address & telephone number)

Eric Buel
VT Forensics Lab Director
103 South Main Street
Waterbury, VT 05671
(802) 241-5489

3a. TITLE OF THE PROGRAM

NIJ FY 08 Research and Development in Forensic Analysis of Controlled Substances: Invited Full Proposals

3b. POMS CODE (SEE INSTRUCTIONS ON REVERSE)

4. TITLE OF PROJECT

VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

5. NAME & ADDRESS OF GRANTEE

Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

6. NAME & ADRESS OF SUBGRANTEE

7. PROGRAM PERIOD

FROM: 01/01/2009 TO: 12/31/2009

8. BUDGET PERIOD

FROM: 01/01/2009 TO: 12/31/2009

9. AMOUNT OF AWARD

$ 92,888

10. DATE OF AWARD

09/17/2008

11. SECOND YEAR'S BUDGET

12. SECOND YEAR'S BUDGET AMOUNT

13. THIRD YEAR'S BUDGET PERIOD

14. THIRD YEAR'S BUDGET AMOUNT

15. SUMMARY DESCRIPTION OF PROJECT (See instruction on reverse)

The proposed research seeks to develop procedures and protocols for the analysis of drugs yielding limited MS information via GC-IR and report to the forensic community the benefits and limitations of this technology. This research will focus on the routine identification of commonly encountered drugs, designer drugs, closely related drug isomers, as well as the fundamentals of the gas chromatography and infrared systems. If successful, this project could introduce a new method of drug analysis that would be quicker, or could allow for simultaneous processing of casework with existing methods and so should relieve backlogs in drug analysis.

ca/ncf

Department of Justice
Office of Justice Programs
Office for Civil Rights

Washington, D.C. 20531

September 17, 2008

Commissioner Thomas Tremblay
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

Dear Commissioner Tremblay:

Congratulations on your recent award. In establishing financial assistance programs, Congress linked the receipt of Federal funding to compliance with Federal civil rights laws. The Office for Civil Rights (OCR), Office of Justice Programs (OJP), U.S. Department of Justice is responsible for ensuring that recipients of financial aid from OJP, its component offices and bureaus, the Office on Violence Against Women (OVW), and the Office of Community Oriented Policing Services (COPS) comply with applicable Federal civil rights statutes and regulations. We at OCR are available to help you and your organization meet the civil rights requirements that come with Justice Department funding.

Ensuring Access to Federally Assisted Programs

As you know, Federal laws prohibit recipients of financial assistance from discriminating on the basis of race, color, national origin, religion, sex, or disability in funded programs or activities, not only in respect to employment practices but also in the delivery of services or benefits. Federal law also prohibits funded programs or activities from discriminating on the basis of age in the delivery of services or benefits.

Providing Services to Limited English Proficiency (LEP) Individuals

In accordance with Department of Justice Guidance pertaining to Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, recipients of Federal financial assistance must take reasonable steps to provide meaningful access to their programs and activities for persons with limited English proficiency (LEP). For more information on the civil rights responsibilities that recipients have in providing language services to LEP individuals, please see the website at http://www.lep.gov.

Ensuring Equal Treatment for Faith-Based Organizations

The Department of Justice has published a regulation specifically pertaining to the funding of faith-based organizations. In general, the regulation, Participation in Justice Department Programs by Religious Organizations; Providing for Equal Treatment of all Justice Department Program Participants, and known as the Equal Treatment Regulation 28 C.F.R. part 38, requires State Administering Agencies to treat these organizations the same as any other applicant or recipient. The regulation prohibits State Administering Agencies from making award or grant administration decisions on the basis of an organization's religious character or affiliation, religious name, or the religious composition of its board of directors.

The regulation also prohibits faith-based organizations from using financial assistance from the Department of Justice to fund inherently religious activities. While faith-based organizations can engage in non-funded inherently religious activities, they must be held separately from the Department of Justice funded program, and customers or beneficiaries cannot be compelled to participate in them. The Equal Treatment Regulation also makes clear that organizations participating in programs funded by the Department of Justice are not permitted to discriminate in the provision of services on the basis of a beneficiary's religion. For more information on the regulation, please see OCR's website at http://www.ojp.usdoj.gov/ocr/etfbo.htm.

State Administering Agencies and faith-based organizations should also note that the Safe Streets Act, as amended; the Victims of Crime Act, as amended; and the Juvenile Justice and Delinquency Prevention Act, as amended, contain prohibitions against discrimination on the basis of religion in employment. Despite these nondiscrimination provisions, the Justice Department has concluded that the Religious Freedom Restoration Act (RFRA) is reasonably construed, on a case-by-case basis, to require that its funding agencies permit faith-based organizations applying for funding under the applicable program statutes both to receive DOJ funds and to continue considering religion when hiring staff, even if the statute that authorizes the funding program generally forbids considering of religion in employment decisions by grantees.

Questions about the regulation or the application of RFRA to the statutes that prohibit discrimination in employment may be directed to this Office.

Enforcing Civil Rights Laws

All recipients of Federal financial assistance, regardless of the particular funding source, the amount of the grant award, or the number of employees in the workforce, are subject to the prohibitions against unlawful discrimination. Accordingly, OCR investigates recipients that are the subject of discrimination complaints from both individuals and groups. In addition, based on regulatory criteria, OCR selects a number of recipients each year for compliance reviews, audits that require recipients to submit data showing that they are providing services equitably to all segments of their service population and that their employment practices meet equal employment opportunity standards.

Complying with the Safe Streets Act or Program Requirements

In addition to these general prohibitions, an organization which is a recipient of financial assistance subject to the nondiscrimination provisions of the Omnibus Crime Control and Safe Streets Act (Safe Streets Act) of 1968, 42 U.S.C. § 3789d(c), or other Federal grant program requirements, must meet two additional requirements:(1) complying with Federal regulations pertaining to the development of an Equal Employment Opportunity Plan (EEOP), 28 C.F.R. § 42.301-.308, and (2) submitting to OCR Findings of Discrimination (see 28 C.F.R. §§ 42.205(5) or 31.202(5)).

1) Meeting the EEOP Requirement

In accordance with Federal regulations, Assurance No. 6 in the Standard Assurances, COPS Assurance No. 8.B, or certain Federal grant program requirements, your organization must comply with the following EEOP reporting requirements:

If your organization has received an award for $500,000 or more and has 50 or more employees (counting both full- and part-time employees but excluding political appointees), then it has to prepare an EEOP and submit it to OCR for review **within 60 days from the date of this letter**. For assistance in developing an EEOP, please consult OCR's website at http://www.ojp.usdoj.gov/ocr/eeop.htm. You may also request technical assistance from an EEOP specialist at OCR by dialing (202) 616-3208.

If your organization received an award between $25,000 and $500,000 and has 50 or more employees, your organization still has to prepare an EEOP, but it does not have to submit the EEOP to OCR for review. Instead, your organization has to maintain the EEOP on file and make it available for review on request. In addition, your organization has to complete Section B of the Certification Form and return it to OCR. The Certification Form can be found at http://www.ojp.usdoj.gov/ocr/eeop.htm.

If your organization received an award for less than $25,000; or if your organization has less than 50 employees, regardless of the amount of the award; or if your organization is a medical institution, educational institution, nonprofit organization or Indian tribe, then your organization is exempt from the EEOP requirement. However, your organization must complete Section A of the Certification Form and return it to OCR. The Certification Form can be found at http://www.ojp.usdoj.gov/ocr/eeop.htm.

2) Submitting Findings of Discrimination

In the event a Federal or State court or Federal or State administrative agency makes an adverse finding of discrimination against your organization after a due process hearing, on the ground of race, color, religion, national origin, or sex, your organization must submit a copy of the finding to OCR for review.

Ensuring the Compliance of Subrecipients

If your organization makes subawards to other agencies, you are responsible for assuring that subrecipients also comply with all of the applicable Federal civil rights laws, including the requirements pertaining to developing and submitting an EEOP, reporting Findings of Discrimination, and providing language services to LEP persons. State agencies that make subawards must have in place standard grant assurances and review procedures to demonstrate that they are effectively monitoring the civil rights compliance of subrecipients.

If we can assist you in any way in fulfilling your civil rights responsibilities as a recipient of Federal funding, please call OCR at (202) 307-0690 or visit our website at http://www.ojp.usdoj.gov/ocr/.

Sincerely,

Michael L. Alston
Director

cc: Grant Manager
Financial Analyst

OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

* 1. Type of Submission:	* 2. Type of Application:	* If Revision, select appropriate letter(s):
☐ Preapplication	☑ New	
☑ Application	☐ Continuation	* Other (Specify)
☐ Changed/Corrected Application	☐ Revision	

* 3. Date Received:	4. Applicant Identifier:
Completed by Grants.gov upon submission.	

5a. Federal Entity Identifier:	*5b. Federal Award Identifier:

State Use Only:

6. Date Received by State:	7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name: Vermont Department of Public Safety

* b. Employer/Taxpayer Identification Number (EIN/TIN):	* c. Organizational DUNS:
03-2000274	809376692

d. Address:

* Street1:	103 South Main Street
Street2:	
* City:	Waterbury
County:	Washington
* State:	VT: Vermont
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	05671

e. Organizational Unit:

Department Name:	Division Name:

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:	Dr.	* First Name:	Eric
Middle Name:			
* Last Name:	Buel		
Suffix:			

Title: VT Forensics Lab Director

Organizational Affiliation:

* Telephone Number:	802-241-5489	Fax Number:	

* Email: grantnotification@dps.state.vt.us

OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

9. Type of Applicant 1: Select Applicant Type:

A: State Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

National Institute of Justice

11. Catalog of Federal Domestic Assistance Number:

16.560

CFDA Title:

National Institute of Justice Research, Evaluation, and Development Project Grants

*** 12. Funding Opportunity Number:**

2008-NIJ-1791

* Title:

NIJ FY 08 Research and Development in the Area of Controlled Substances Detection and Analysis: Invited Full Proposals

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

Statewide

*** 15. Descriptive Title of Applicant's Project:**

VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424 — Version 02

16. Congressional Districts Of:

* a. Applicant: 00 * b. Program/Project: 00

Attach an additional list of Program/Project Congressional Districts if needed.

Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: 01/01/2009 * b. End Date: 12/31/2009

18. Estimated Funding ($):

* a. Federal	92,888.00
* b. Applicant	0.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	92,888.00

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

☐ a. This application was made available to the State under the Executive Order 12372 Process for review on .

☐ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

☑ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes", provide explanation.)**

☐ Yes ☑ No Explanation

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☑ **** I AGREE**

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix:	Mr.
* First Name:	Thomas
Middle Name:	R
* Last Name:	Tremblay
Suffix:	
* Title:	Commissioner
* Telephone Number:	802-244-8718
Fax Number:	
* Email:	ttremblay@dps.state.vt.us
* Signature of Authorized Representative:	Completed by Grants.gov upon submission.
* Date Signed:	Completed by Grants.gov upon submission.

Department of Justice

Office of Justice Programs

Office of the Assistant Attorney General *Washington, D.C. 20531*

September 17, 2008

Commissioner Thomas Tremblay
Vermont Department of Public Safety
103 South Main Street
Waterbury, VT 05671

Dear Commissioner Tremblay:

On behalf of Attorney General Michael B. Mukasey, it is my pleasure to inform you that the Office of Justice Programs has approved your application for funding under the Research and Development in the Area of Controlled Substances Detection and Analysis in the amount of $92,888 for Vermont Department of Public Safety. The title of this project is, "VT 2008 Research and Development in the Area of Controlled Substances Detection and Analysis."

Enclosed you will find the Grant Award and Special Conditions documents. This award is subject to all administrative and financial requirements, including the timely submission of all financial and programmatic reports, resolution of all interim audit findings, and the maintenance of a minimum level of cash-on-hand. Should you not adhere to these requirements, you will be in violation of the terms of this agreement and the award will be subject to termination for cause or other administrative action as appropriate.

If you have questions regarding this award, please contact:

- Program Questions, Frances Scott, Program Manager at (202) 305-9950; and
- Financial Questions, the Office of the Chief Financial Officer, Customer Service Center (CSC) at (800) 458-0786, or you may contact the CSC at ask.ocfo@usdoj.gov.

Congratulations, and we look forward to working with you.

Sincerely,

Jeffrey L. Sedgwick
Acting Assistant Attorney General

Enclosures

Forensic drug identification by Gas Chromatography- Infrared Spectroscopy

Eric Buel, P.I.

PROGRAM NARRATIVE

Abstract:

The primary goal of the forensic drug examiner is the unequivocal identification of any controlled substance present in a drug exhibit. Most forensic laboratories routinely employ GC-MS as the preferred method for this examination. The technique provides a rapid, semi-automated analysis of the sample and typically yields sufficient information to identify the compounds in question. However, the application of GC-MS for drug analysis does have its limitations.

Certain drugs yield minimal mass spectral fragmentation patterns using electron impact MS, while other compounds, such as some diastereomers and positional isomers, are not readily differentiated by mass spectroscopy. Forensic scientists have been concerned for many years with the differentiation of isomers as evidenced by the work in the 1970's to distinguish the diethyl amide and methylpropylamide isomers of LSD and more recently the diastereomers ephedrine/pseudoephedrine and the isomers of phenethylamines. Infrared spectroscopy provides an alternate technique to mass spectroscopy for the identification of organic compounds. Recent improvements in the hyphenated technique, GC-IR, may provide a simple alternative or supplemental approach to GC-MS for the identification of certain compounds. A newly introduced instrument collects GC effluent on a liquid nitrogen cooled, IR transparent window that allows the direct analysis of the deposited solid material. This technique is superior to the IR light pipe in sensitivity, IR spectral quality, and allows direct comparison of the collected spectra to existing IR

databases. The proposed research seeks to develop procedures and protocols for the analysis of drugs yielding limited MS information via GC-IR and report to the forensic community the benefits and limitations of this technology. This research will focus on the routine identification of commonly encountered drugs, designer drugs, closely related drug isomers, as well as the fundamentals of the gas chromatography and infrared systems. Our laboratory currently owns a GC-IR instrument, and this research intends to further the work started by our laboratory [illegible] this technology into a viable technique for the [illegible] community.

2. TABLE OF CONTENTS

3. Main Body

A). Purpose

The purpose of this research is to determine the benefits and limitations of the newly introduced Spectra Analysis GC-IR instrument. From this work, we will develop and make available protocols and procedures to use this instrument for routine drug analysis. This is important to the forensic community because this technology could allow the simple identification of certain compounds not routinely amenable to analysis by GC-MS.

B) Research Goal and Objectives

The objectives of this research are to fulfill the above purpose by meeting the following: 1) assessment of the GC-IR instrument to allow forensic scientists to understand the appropriate use of GC-IR and to 2) develop protocols and procedures for the efficient use of this instrument by the forensic community.

Objective 1: Our first objective is to assess the GC-IR for forensic drug identification. In most laboratories, drug submissions compose the bulk of the casework and as a result, laboratories attempt to semi-automate the drug analysis process. According to the 2006 Collaborative Testing Services drug proficiency test review, most respondents used gas chromatography-mass spectrometry for identification of the proficiency drug exhibit. GC-MS is ideally suited for drug analysis since most drug samples are mixed with any number of possible substances and GC-MS provides both the separation and structural information of the mixture of compounds seen in many forensic exhibits. This technique is easily linked to an auto-sampler which provides a semi-automated approach to drug analysis. The simplicity of use, combined separation and analysis power of the

instrument, coupled to large searchable mass spectral databases, has made GC-MS the forensic instrument of choice for routine drug identification. Samples from drug submissions may be dissolved into a suitable solvent, loaded into the auto-sampler, and analyzed un-attended while the examiner processes additional cases or reviews data from previous GC-MS analyses. This process works well for the busy forensic laboratories with backlogs and rush requests that must be analyzed in a simple, efficient, but accurate process. As with most techniques, however, the application of GC-MS for drug analysis does have its limitations and a supplementary or alternative tool employing infrared spectroscopy, could give the forensic scientist additional information to allow a more thorough identification of certain drugs. A further discussion of mass spectroscopy and infrared spectroscopy is detailed in the *Review of Relevant Literature* section.

Infrared spectroscopy is a proven tool for the positive identification of organic compounds. The routine application of traditional IR spectroscopy can be time consuming since the technique is not typically amenable to automation and the instrument requires samples to be relatively free of adulterants, often requiring some sample purification prior to IR analysis. Once a sample is relatively "clean" and ready for analysis, the specimen could be analyzed via any number of commonly employed manual methods: KBr pellet, thin film on NaCl plates, an ATR or an IR microscope accessory to name a few. All of these analytical procedures are useful, proven manual technologies. However, an infrared instrument that is coupled to a separation based technology such as gas chromatography, could offer a degree of automation that would allow the combined instrumentation to become an alternative, simple approach, for the routine analysis of certain drugs of abuse.

A number of attempts have been made to link an IR instrument to a separation technique. None of these attempts to develop a "hyphenated" technique have truly taken hold in the forensic community for a number of reasons. Previously designed instruments were either very expensive, difficult to use, had inadequate compound sensitivity or yielded poorly resolved spectra.

We have recently purchased a newly introduced GC-IR instrument offered by Spectra Analysis, Inc., Marlborough, MA. Their approach builds upon previous attempts to collect GC effluents at low temperatures for IR analysis. In this direct deposit approach, the GC effluent is deposited upon a spiraling ZnSe disk cooled with liquid nitrogen. The ZnSe disk is transparent to IR energy and the spectrum of the deposited material is captured immediately after sample deposition. This linking of a gas chromatograph instrument to an infrared detector, allows the separation of complex mixtures of substances and the subsequent collection of a full IR spectrum (4000 cm to 650 cm^{-1}). The instrument can be coupled to an auto-sampler and linked to commercially available IR libraries to allow a semi-automated approach to the analysis of drug samples. With this combination of technologies, GC-IR analysis could become a viable technique for the identification of complex drug mixtures.

Objective 2: The second objective of this project is to develop protocols and procedures for the efficient use of the GC-IR and distribute those to the forensic community. Since this instrument is newly introduced, we will need to perform a number of studies to determine the optimum operating parameters for forensic drug analysis. We intend to determine appropriate GC and IR conditions and any procedures necessary to allow forensic scientists to purchase and use this equipment with confidence.

C. Review of Relevant Literature

A mass spectrum is often unique for a particular compound and has been used extensively by the forensic community to identify controlled substances. This technique, especially when linked to a gas chromatograph, has stood the test of time and court challenges. However, there are various substances which may yield minimal mass spectral fragmentation patterns or patterns too similar to allow one to distinguish between isomers or similar compounds bearing related structures.

Two forensically relevant phenethylamines, amphetamine and methamphetamine, can be characterized as drugs that yield minimal electron-impact (EI) mass spectral patterns and have been reviewed by Cody in Handbook of Forensic Drug Analysis (1). Cody describes the EI mass spectra of amphetamine and methamphetamine as very simple since the spectrum of amphetamine is "dominated by an ion at m/z 48", and methamphetamine "characterized by an ion as m/z 58"(p. 378). Cody describes derivatization procedures which alleviate the dearth of MS fragments observed with the un-derivatized molecule. Derivatization, as noted by Cody, will result in a greater molecular mass and "results in fragmentation, yielding several characteristic ions" (p. 378). As a result, Cody notes, "... the identification is much easier and more reliable, because the increased mass and number of fragments make the spectra more unique" (p. 378). In addition to amphetamine, a number of other drugs yield very limited mass spectral patterns. Amitriptyline and psilocyn are two such drugs, both yield a base peak of 58, with all other peaks in the spectrum below the 10% relative abundance level (2).

In addition to compounds with limited mass spectral characteristics, some isomers may not lend themselves to an unequivocal identification with mass spectrometry. Smyrl et al.

(3) in their 1992 paper in Applied Spectroscopy, describe a limitation of GC-MS. As noted by the authors, "One of the most important limitations of GC-MS is in distinguishing between similar (e.g. positional) isomers." Lang and Richwine (4) reinforce this thought in discussing that GC-MS has some limitations in differentiating structural isomers. Kenneth Busch (personal communication) also states that EI usually will not differentiate diastereomers. Clark et al. (5) states "For major drugs of abuse, such as the amphetamines and MDMAs, there are many positional isomers (regioisomers) in the alkyl side chain or in the aromatic ring substitution pattern that can yield nearly an identical mass spectrum" (p. 230). Further, Clark et al. (6) have synthesized and studied a number of regioisomeric compounds equivalent to 3, 4, MDMA (ecstasy) and state that electron impact mass spectroscopy alone would not yield sufficient data to differentiate these isomers. (the article does provide additional information to assist in identification of these isomers and is detailed below) These statements should be reviewed in context and not be taken as blanket statements since some positional isomers, and occasionally diastereomers, may be identified by their mass spectrum (7).

When the mass spectrum of a compound is ambiguous, or provides insufficient structural information to uniquely describe a particular compound, investigators have used other methods in conjunction with MS to identify the compound. As noted above, derivatization has been suggested to identify phenethylamines (1). This was shown to be effective by both increasing the number of fragments in the mass spectrum (useful for compounds with minimal mass spectra), and providing characteristic mass spectra for some positional isomers (5).

Linking gas chromatography to mass spectrometry to obtain and compare retention times from a standard to the unknown has also been used to provide compound identification. Hugel et al. (7) notes that certain isomers of LSD give essentially the same mass spectra but can be identified through a comparison of retention times to standards. Clark et al. (6) also describe a combination of mass spectrometry and gas chromatography to resolve 10 regioisomers of ecstasy. However, they note that at least one of the regioisomeric equivalents of 3, 4,-MDMA co-eluted, and that more polar stationary phases and specific temperature programs were required to resolve the isomers (8). Another approach to improve upon the original MS of a compound is to expand the abundance scale to make a secondary ion full scale while driving the base peak off scale (7, 9). Hugel et al. (7) note that this approach can be used to identify structural isomers and is sometimes successful in that regard.

Chemical ionization is another technique used in mass spectrometry that may give supplementary information for compound identification. This form of ionization may be either positive or negative, which yield spectra with a high abundance of molecular ions (10). More expensive MS instruments provide tandem mass spectrometers (MS/MS) which can yield additional fragments for identification when "daughter ions" are created from ions produced during the initial fragmentation. Both of these techniques are useful but not usually applied to routine forensic casework analysis.

Infrared spectroscopy (IR) has long been a powerful tool for the identification of organic compounds and has been used extensively in the forensic community. IR is useful for the identification of compounds with similar mass spectra, structurally related compounds, i.e. positional isomers, and can be used to differentiate diastereomers (i.e.

pseudoephedrine/ephedrine). Skoog and West (11) describe infrared spectroscopy: "With the exception of optical isomers, no two compounds have identical absorption curves" (p.131). Hugel et al. (7) notes that small differences in a molecules structure, i.e. isomers, will yield different IR spectra and the technique can be used to differentiate diastereomers. Probably the best review of the power of IR is to examine the IR and MS spectra obtained from some select compounds. Since our proposal is seeking to be a supplemental tool to mass spectrometry, the spectra detailed here show the power of infrared spectroscopy in comparison to mass spectrometry with respect to this select group.

Figures 1 and 2 show the mass spectra and infrared spectra of amitriptyline and 5-Methoxy-N, N-diemethyltryptamine (2). These compounds fall into the category of drugs that yield a minimal fragmentation pattern by MS. The IR spectra of these two compounds show a wealth of information that allows the examiner to unequivocally identify the substance. Figure 3 shows the mass spectrum of ephedrine. The mass spectrum of pseudoephedrine is nearly identical except for some possible minor abundance ratios for a few of the minor ions. These two diastereomeric compounds, identical substances except for the orientation at a chiral center, can be easily differentiated by IR spectroscopy (figure 4 - Preliminary Data Section). The IR spectra shown in figure 4 were generated by examiners at the Vermont Forensic Laboratory using the Spectra Analysis GC-IR instrument. The discussed compounds offer a representation of those substances which yield minimal MS patterns. One could review the volumes by Mills and Roberson (2) to become aware of further examples such as dimethyltryptamine, diphenhydramine, phentermine, propoxyphene, or evaluate the work

of Clark (5) concerning the regioisomers of MDMA to notice the number of compounds that fit into this categorization.

The collection of an infrared spectrum works best if the compound of interest is relatively pure. This is not the typical case with forensic drug samples. The hyphenated technique, GC-IR, allows for the collection of IR spectra from discrete compounds within a mixture. This technique may be accomplished via different analytical strategies. A traditional approach transfers the GC effluent to a light pipe containing windows transparent to IR radiation. The IR spectrum can be collected while the compound is resident in the pipe. This technique allows the collection of an IR spectrum but it is far less sensitive than GC-MS analysis and the collected spectra are different than condensed phase IR spectra, which necessitates the use of vapor phase spectral libraries for appropriate library searches.

An alternative approach to the light pipe is to condense the GC effluent into individual fractions. This may be accomplished through condensing the effluent onto an IR transparent window or IR reflective surface cooled with liquid nitrogen. The moving window or surface allows the collection of discrete compounds as they elute from the GC and the IR spectrum is either collected through a transmission mode or an absorbance via reflection off the substrate. This "cryogenic-trapping" approach allows for the collection of "live" IR data and since the material is deposited on the substrate, post run analysis may be performed to improve sensitivity compared to the light pipe where measurements are truly "on-the-fly" and can not be revaluated.

The collection of the GC effluent upon a liquid nitrogen cooled surface may result in the deposition of material in crystalline or amorphous states (or perhaps a mixture of both).

These different states, crystalline and glass-like or amorphous, will yield slightly different IR spectra for the same compound. The crystalline form typically details sharper IR peaks where as somewhat broader peaks typify the amorphous compound. Spectral comparison libraries would need to be established for both forms if the compounds of interest were not routinely observed either in crystalline or amorphous states. Preliminary testing of a small subset of drugs using the Spectra Analysis instrument in Vermont's Forensic Laboratory indicates that the deposition of the drug upon the cooled substrate results in a crystalline material.

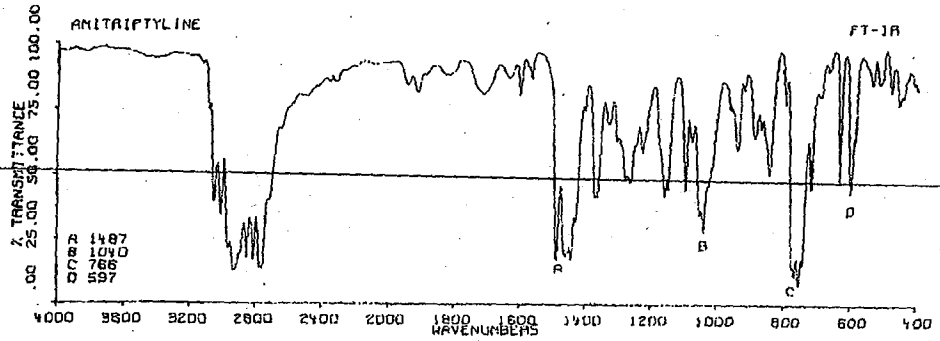
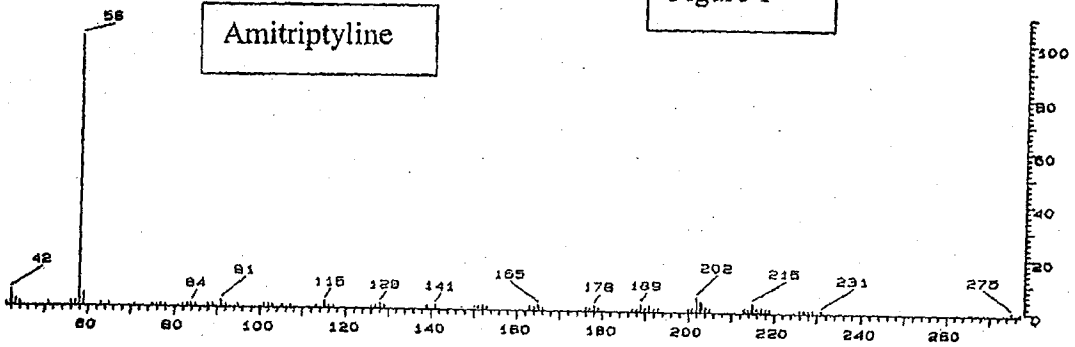


Figure 1

Amitriptyline



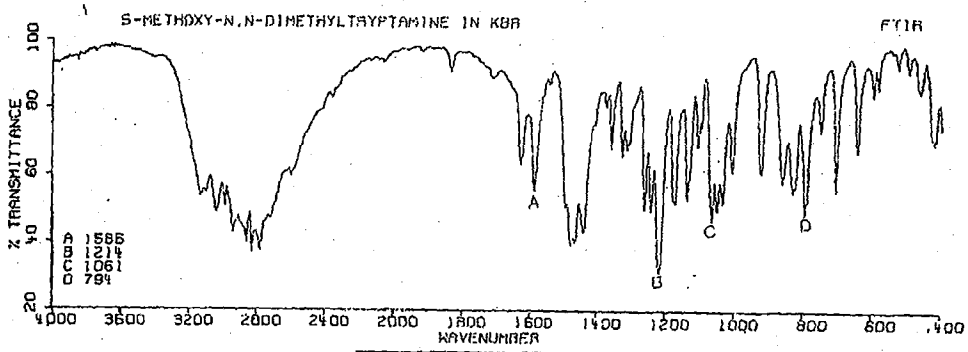
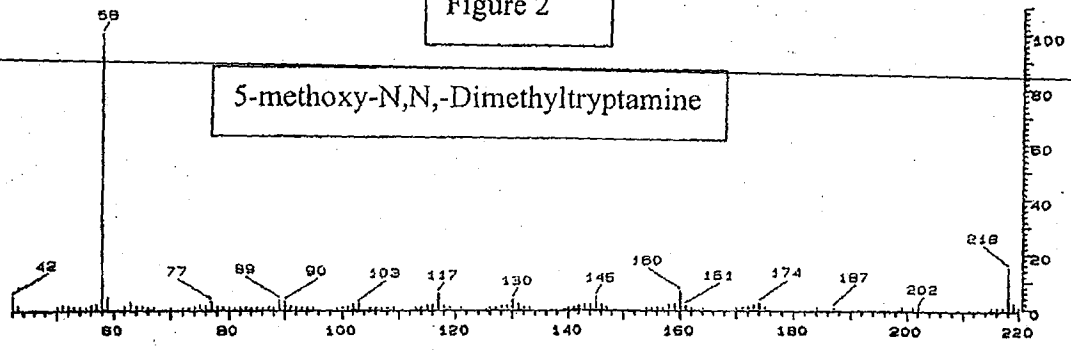
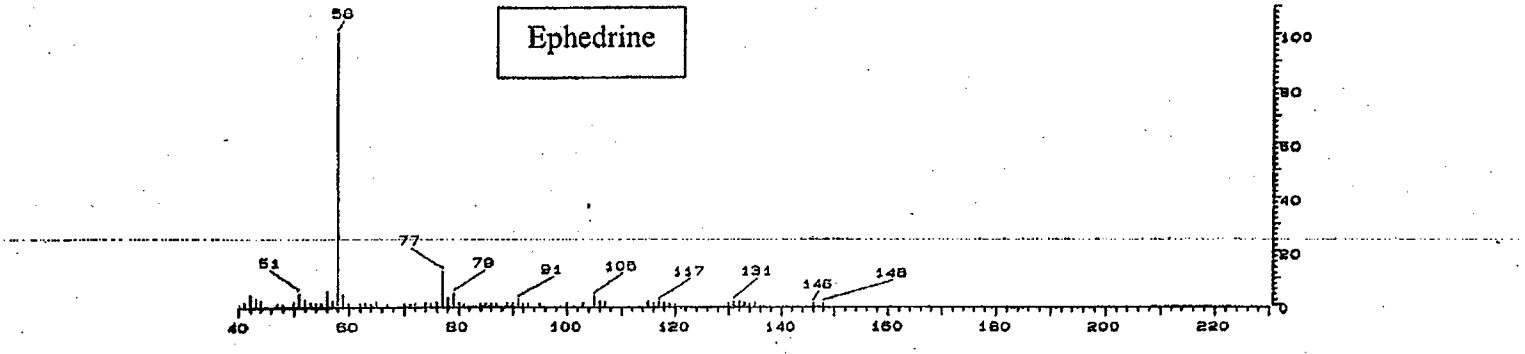


Figure 2

5-methoxy-N,N,-Dimethyltryptamine




Ephedrine
58
77
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117
131
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148
100
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180
200
220

Figure 3

D) Research Design and Methods

Objective 1: We intend to assess the GC-IR instrument to determine the benefits and limitations of this technology. The company, Spectra Analysis, takes "off the shelf" GC and auto-sampler components and links them to their IR detector. This IR detector system is essentially an untested system for the field of forensics, and while it may be suitable for commercial applications, a number of concerns must be answered prior to the forensic community implementing the technology. One of the issues that must be evaluated is the possibility of cross contamination of samples collected upon the reusable ZeSe disk. Two issues must be addressed here; how to identify that the disk is clean and ready for use prior to sample collection and the potential for cross contamination between separate collection tracks on the disk. We will develop a procedure to quickly scan a "cleaned" disk to determine if it is contaminant free. We will also intentionally load samples into the GC at concentrations that exceed routine limits to determine if there is any track to track contamination.

The crystalline and amorphous states of the same compound will yield different IR spectra. Various factors may affect the state of the material deposited upon the cooled zinc selenide disk. We will start our investigation of this phenomenon by looking at a wide range of compounds with the disk at a number of different temperatures and attempt to determine the conditions applicable for most forensic drug samples to maximize crystallization of the compounds of interest.

We have conducted some initial work concerning instrument sensitivity for a limited number of drugs but we intend to study additional drugs suited for GC-IR to define the sensitivity limitations of the instrument. We will also consider the difference in

sensitivity of the instrument capturing "on-the-fly" IR spectra versus re-scanning the deposited sample after the GC run has been completed. Multiple GC injections of the same sample may be performed to redeposit the GC effluent on the same disk track to concentrate the sample in an attempt to detect low concentration sample components. This mode of operation will be evaluated. The GC conditions will also have a large effect on sensitivity and will be evaluated as noted below.

In order to understand the real benefits and limitations of the system, we will need to analyze typical forensic samples. We will evaluate casework samples to determine how the system performs with a wide range of drug submissions. Of interest will be phenylalkylamines (methamphetamine, MDMA and related compounds), psilocyn, tryptamines, and other commonly encountered drugs of abuse which yield minimal mass spectral data. These samples will be diluted in an appropriate solvent and analyzed by both GC-IR and GC-MS. A comparison will be made between the two technologies to determine if the same components are detected via both methods and to assess the protocols developed. An evaluation will be made of the informational content obtained via the two technologies.

We also plan to define the limitations inherent in IR analysis by investigating closely related isomers. We are planning to work in conjunction with another NIJ grant recipient, Dr. Randall Clark (see attached letter of intent), to determine if GC-IR can be used to identify the varied MDMA analogs he has synthesized. Many of these compounds are not adequately discriminated by mass spectroscopy alone. IR is a powerful tool that may offer laboratories the ability to unequivocally identify closely related compounds. A variety of compounds (isomers not amenable to MS analysis) will be subjected to GC-IR

analysis. The IR of the closely related compounds will be compared along with the retention times of the compounds on different GC columns.

Objective 2: As we assess the instrument, we will learn what works well for drug analysis and develop protocols and procedures appropriate for the analysis of forensic drug samples. The GC-IR is less sensitive than a GC-MS and hence appropriate sample concentrations will need to be evaluated along with GC split ratios. To obtain the optimum separation and sensitivity we will need to evaluate GC column length, diameter, stationary phases, and carrier gas flow rates. The IR collection system will be evaluated to assess collection disk speed and IR resolution settings. In developing the protocols we will review what we learned during the assessment phase and implement those factors into a general protocol. Much of what we do will be an iterative process, where we develop a protocol and modify it by evaluating a variable and reassess the system. If time and in-house funding permits, we would also like to consider linking the IR detector to an existing GC-MS, yielding a GC-MS-IR system. This linking has been done by Spectra Analysis, but not in a forensic setting. This combined instrument would reduce the cost burden to forensic labs wishing to obtain both MS and IR information simultaneously from a sample.

E. Implications for Criminal Justice Policy and Practice

Many forensic disciplines have been challenged in the courts, and as this occurs it should prompt us to evaluate those technologies we perform to see if other strategies could add depth to our current analytical methods. The analysis of controlled substances is becoming more demanding as higher analytical standards are expected, and as the number of abused substances and designer drugs rise across the country. As we are

presented with analytical options to those methods and technologies we have been familiar with for years, it is incumbent upon us to review those technologies to determine if it makes sense to use these emerging tools to improve the analyses we offer to the criminal justice community.

GC-MS is often used for the forensic analysis of controlled substances and it is an excellent tool for routine drug analysis. However, a number of published reports have discussed the limitations of MS for certain compounds. Some of these limitations can be overcome by evaluating sample GC retention time (as compared to a retention time from a known drug) or by sample derivatization. GC retention time in combination with MS is a standard method for drug identification, but one may want to reflect upon relying on this combination of techniques for the differentiation of drugs where the compound yields a minimal MS pattern. Additionally, some regioisomers have been shown to co-elute, requiring the selection of additional GC columns and appropriate temperature programs to provide adequate compound resolution. Some "designer drugs" are nothing more than isomeric cousins to established drugs, and hence these substances could co-elute with the target compound, compromising an analysis if the mass spectra are indistinguishable. Derivatization increases the molecular weight of the target compound, which can improve the mass spectral informational content, while altering the chromatography of the molecule. In the case of amphetamines, derivatization improves the overall shape of the GC peak (1), and produces additional ions for identification purposes. Sample derivatization can improve the MS of a compound, but it adds steps to the analysis, decreases overall productivity, requires the handling of hazardous chemicals and derivatization can not be universally performed on all drugs.

Busy forensic laboratories need simple alternatives to assist the examiner in the unequivocal identification of controlled substances. The above methods are tried and true, but other techniques may provide information that is equal to, if not more compelling, through a semi-automated manner. We believe that increased sample information may be obtained simply, efficiently and in a semi-automated manner with GC-IR. Through our work we hope to show that GC-IR will be a supplementary or alternative tool to routine GC-MS, and will allow the forensic examiner to quickly and unequivocally identify compounds that have minimal or indistinguishable MS patterns. Our assessment of the instrument, and generation of protocols and procedures, would allow the forensic community to quickly evaluate the instrument for their use. We believe the emerging GC-IR technology will assist the examiner in the identification of routine drugs of abuse and those unusual substances seen today, in addition to those developed in the future.

F. Management plan and organization

A scientist with an appropriate background in chemistry will be hired and will work full-time on this project. The scientist will be assisted by Robert Shipman (see attached CV) who has been working on the GC-IR since the Vermont Forensic Laboratory (VFL) received the instrument. Mr. Shipman is a drug analyst with extensive hands-on experience with GC-MS, IR and GC-IR techniques. Dr. Eric Buel will oversee the project and his background includes forensic drug analysis. Both individuals will request funding for ~ 2 hours per week but will devote additional, un-funded time, as necessary to achieve the goals of the project.

After the project is complete, it is hoped that the state of Vermont will continue to fund the new hire, or there may be position openings due to retirement.

To date the VFL has performed some limited experiments with the instrument. The manufacturer (Spectra Analysis, Inc.) designed an instrument which, when it was received by the VFL, was suitable for research applications. The software and protocols for operation were not suited for routine forensic applications, but for use by a research institution or for solving a particular problem in an industrial/pharmaceutical application. After simple experiments were performed to conceptually show that the instrument should be of value to the forensic community, we began working with Spectra Analysis, Inc. to design and implement software and routine procedures to allow the introduction of the instrument into the forensic community. For example, suitable software needs to be finalized and tested to allow easy and routine instrument control (of both the GC and IR) with subsequent collection and appropriate reporting of the data. We believe this initial work will be done prior to receiving the grant so that the work described above can be accomplished in the allotted time.

Time Line:

Item	**Time**
Hire Scientist	Month 1
Drugs for project • Contact collaborators-specify drug samples needed • Purchase commercially available drugs	Month 1
Purchase necessary supplies- columns, solvents etc.	Month 1
Disk contamination issue • Evaluate cross contamination • Develop disk assessment protocol	Months 2-3
Crystalline and Amorphous states	Month 4

• Evaluate a wide range of drugs • Assess disk conditions to minimize amorphous state	
Sensitivity Study • On-the-fly versus re-scanning • Multiple deposition • Variations in GC conditions and disk speed	Month 5-6
Analysis of selected drugs (commercially available and from collaborators) • Routinely encountered drugs • Isomers and related compounds • Drugs with minimal MS patterns	Months 6-9
Forensic casework • Routine cases • Designer drug cases	Months 7-11
Develop and modify protocols	Months 7-12
Disseminate results to forensic community	Month 12

G. Dissemination Strategy

A major goal of our work is to distribute our findings and any derived methods to the forensic community to improve criminal justice. The cost of the Spectra Analysis instrument ($130,000, not including the GC- as per company representative), and costs relative to the operation of the instrument will be also be presented.

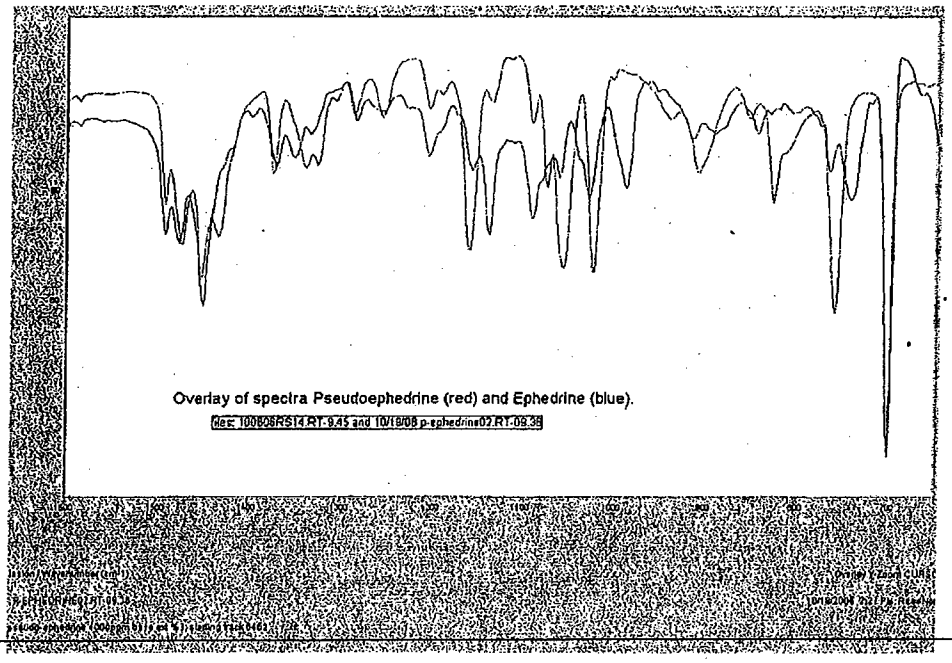
To this end, we will publish our results for peer review in the Journal of Forensic Sciences or other suitable journal and create basic protocols for others to use. We plan to present our findings at regional forensic meetings, and the American Academy of Forensic Sciences. This may take the form of poster sessions or as oral presentations. We also plan to be available by phone/e-mail to anyone interested in receiving information. We will also work with the National Forensic Science Training Center to hold a hands-on

work shop if they feel it is appropriate. I believe if one were to review our history, we have been proactive in providing peer reviewed publications, presentations, and "one-on one" information concerning any of our NIJ funded research projects.

H. Preliminary Data:

Figure 4 (below) shows the IR fingerprint region for the compounds pseudoephedrine and ephedrine. Both compounds were run separately on the GC-IR and the IR data collected. The spectra were overlaid to demonstrate the differences between these two diastereomers and to show the quality of the IR spectra typically obtained with this instrument. The mass spectra for these two compounds are essentially the same.

Figure 4



Appendixes

a. References:

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8. Awad, T., DeRuiter, J., & Clark, C. R., (2007) Chromatographic and Mass Spectral Studies on Methoxy Methyl Methamphetamines related to 3,4-Methylenedioxymethamphetamine,. *Journal of Chromatographic Science*, 45(September) 466-477.
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11. Skoog, D. A., West, D. M., (1971). *Principles of Instrumental Analysis*, New York: Holt, Rinehart and Winston, INC.

b. List of Key Personnel:

Eric Buel, Ph.D., Director, Vermont Forensic Laboratory, 103 South Main Street, Waterbury, VT 05671, TEL: (802) 241-5489, E-MAIL: ebuel@dps.state.vt.us

Robert Shipman, Forensic Chemist III, Vermont Forensic Laboratory, 103 South Main Street, Waterbury, VT 05671, TEL: (802) 241-5290, E-MAIL: rshipman@dps.state.vt.us

Chemist to be hired

c. Resumes of Key Personnel

CURRICULUM VITAE

ERIC BUEL

EDUCATION:

University of Delaware, Newark, Delaware, 1971-1975, B.A. Chemistry.

University of Missouri-Kansas City, Kansas City, Missouri, 1975-1979, Ph.D. in Chemistry (Biochemistry emphasis).

Undergraduate and graduate research:

Undergraduate Research at University of Delaware:

Selenium determination on various salt water marsh plants. Director: Dr. T. M. Church, College of Marine Studies.
Enzymatic Modification of E. Coli asparaginase. Director: Dr. J. C. Wriston, Department of Chemistry.

Graduate Research at University of Missouri:

Doctoral dissertation on "Purification and Properties of the Normal and Variant Forms of Adenosine Deaminase from Human Red Blood Cells." Director: Dr. R. A. MacQuarrie.

Employment:

1975-1979: University of Missouri 9/75-5/78 Teaching Assistant: Supervised student labs and led discussion sections in general chemistry, organic chemistry, and biochemistry. 6/78-8/78 Research Assistant 9/78-8/79 Teaching Assistant

1979 to present: State of Vermont Forensic Laboratory 12/79-2/82 Chemist-Criminalist: Performed chemical biochemical and serological analyses on evidence using wet, instrumental, and electrophoretic techniques; testified on results as expert witness in court.

3/83-4/98: Senior Forensic Chemist: Supervisor of chemistry unit, performing supervisory duties in addition to chemist-criminalist duties.

5/98 to present: Laboratory Director

PROFESSIONAL ORGANIZATION AFFILIATIONS:

Northeastern Association of Forensic Scientists
American Chemical Society

American Academy of Forensic Sciences
Journal of Forensic Sciences Editorial Board
Member of the "Technical Working Group on DNA Analysis Methods" 1990-1998
Member of the "Technical Working Group on Crime Scene Investigation" 1998
National Institute of Justice Grant Review Board for Forensic Projects
American Society of Crime Laboratory Directors- board member, 2002-2005
Guest Editor for Forensic Science International, 1999
DNA Forensics Technical Working Group 2005-present

GRANTS/AWARDS:

2007 Forensic DNA Research and Development National Institute of Justice grant, "Forensic stain identification by Real Time-PCR analysis." Continuation of funding from 2005

2005 Forensic DNA Research and Development, National Institute of Justice grant," Improving the efficiency of DNA casework analysis through simple, effective, PCR-based Screening methods"

2004 Forensic DNA Research and Development, National Institute of Justice grant, "Development of an automated system to detect spermatozoa on laboratory slides to increase productivity in the analysis of sexual assault cases"

2004 Forensic DNA Research and Development National Institute of Justice grant, "Forensic stain identification by Real Time-PCR analysis."

2002 Forensic DNA Research and Development, National Institute of Justice, grant for "Simple, Rapid and Accurate Quantitation of Human DNA."

2000 Forensic DNA Research and Development, National Institute of Justice, grant for "A Microplate Assay for the Quantitation of Human DNA."

1998 Forensic DNA Laboratory Program, National Institute of Justice, grant for "Increasing DNA Sample Analysis Throughput: Enhancement of DNA Specimen Identification and Processing Coupled with STR Analysis."

1997 Forensic DNA Laboratory Program, National Institute of Justice, grant for "Capillary Electrophoresis for STR Analysis: "Validation and Cost Effectiveness - Part Two"

1996 Forensic DNA Laboratory Program, National Institute of Justice, grant for "Capillary Electrophoresis for STR Analysis: "Validation and Cost Effectiveness"

1995 U.S. Department of Justice, STOP Violence Against Women Grant, for "Expanding Availability of PCR Analysis for Sexual Assaults and Other Crimes Against Women"

1994 Forensic Sciences Foundation, Acorn Grant Program, for "Gender Determination for Deer and Moose Specimens"

1992 Forensic Sciences Foundation, Acorn Grant Program, for "Application of DNA Technology to Deer Family Identity and Sex"

SCIENTIFIC PRESENTATIONS AND PAPERS :

"Purification and Properties of Human Red Blood Cell Adenosine Deaminase," E. Buel and R. A. MacQuarrie, Missouri Academy of Sciences, April 1979

"Purification and Properties of the Normal and Variant Forms of Adenosine Deaminase from Human Red Blood Cells," E. Buel and R. A. MacQuarrie, 178th ACS National Meeting, September 1979

"Purification of Adenosine Deaminase from Human Red Blood Cells," E. Buel and R. A. MacQuarrie, Preparative Biochemistry, 11(4), 363-380 (1981)

"Physical and Catalytic Properties of the Isozymes of Adenosine Deaminase from Human Red Blood Cells," R. A. MacQuarrie and E. Buel, Molecular and Cellular Biochemistry, 48, 121-126 (1982)

"The Separation of Cannabinoids by Circular Development Thin Layer Chromatography," E. Buel, Microgram, XIII(12), 198-200 (1980)

"An evaluation of a Partition Thin Layer Chromatography System for the Identification of Cannabinoids," E. Buel, C. Plum, and S. Frisbie, Microgram, XV(9), 145-157 (1982)

"A Partition Thin Layer Chromatography System for the Identification of Cannabinoids," E. Buel, presented at Northeastern Association of Forensic Sciences, October 1982

"A Computer Program for the Calculation of Retention Index Values," E. Buel, F. Durkee, Microgram, XIX(4), 52-55 (1986) and also presented at the Northeastern Association of Forensic Sciences, October 1986

"Isolation of Methamphetamine from Procaine-Methamphetamine Mixtures," E. Buel, F. Durkee, G. Welker, Microgram, XX(5),72-73 (1987)

"Simple Macro Programs for the Hewlett-Packard GC/MSD Workstation," E. Buel, presented at the Northeastern Association of Forensic Sciences, October 1987

"Computer Programs to Calculate Retention Index Values," E. Buel, presented at "An International Symposium on the Forensic Aspects of Controlled Substances," hosted by the DEA and FBI at Quantico, VA, March 1988

"The Effect of Divalent Metal Cations on the Activity of Hae III " Buel, E. and Gills, J.J., presented at the October 1990 meeting of the Canadian Society of Forensic Science held at Ottawa, Ontario, and the Abstract published in "Canadian society of Forensic Science Journal, Vol. 23: Number 4, December 1990.

A Study of the Effects of Various Contaminants on the RFLP Technique", Buel, E. and Gills, J.J., presented at the October 1990 meeting of the Northeastern Association of Forensic Scientists held in Providence, RI.

"A Preliminary Report on Binned General Population Data on Six VNTR Loci in Caucasians, Blacks and Hispanics from the United States", Budowle, Bruce.... Buel, Eric et al., Crime Laboratory Digest, Vol. 18, No. 1, Pages 9-26, January 1991.

"Guidelines For A Quality Assurance Program For DNA Analysis", Mudd, James L., ... Buel, Eric et al., Crime Laboratory Digest, Vol. 18, No. 2, Pages 44-75, April 1991.

"Quality Assurance in the DNA Laboratory", Buel, Eric; Welker, Glenn; and Gills, Joell, presented at the October 1991 meeting of The Northeastern Association of Forensic Scientists held at Huntington, NY.

"LSD Derivitization for GC/MS", McMahon, Brendan and Buel, Eric, presented at the October 1991 meeting of The Northeastern Association of Forensic Scientists held at Huntington, NY.

"Estimation of Cocaine Concentration Prior to GC/MS Analysis", Schwartz, Margaret; McMahon, Brendan; and Buel, Eric; Microgram, XXV(4), 110-112 (1992).

"The Use of DAPI as a Replacement for Ethidium Bromide in Forensic DNA Analysis", Buel, Eric and Schwartz, Margaret, presented at the February 1993 Meeting of The American Academy of Forensic

Sciences held at Boston, MA and presented at the Northeastern Association of Forensic Scientists Meeting in October of 1993, held at Springfield, MA.

"DAPI, A Simple Sensitive Alternative to Ethidium Bromide Staining of DNA in Agarose Gels", Buel, Eric and Schwartz, Margaret, Applied and Theoretical Electrophoresis (1993), 3, 253-255.

"Differentiation of Deer and Moose Meat by Detection of DNA Satellite Bands After Endonuclease Digestion", Schwartz, Margaret and Buel, Eric, presented at the October 1993 meeting of the Northeastern Association of Forensic Scientists, held at Springfield, MA.

"Validation of Probe EFD52 (D17S26) for Forensic DNA Analysis", Nelson, M. E., ..., Buel. E., Schwartz, M., et. al., presented at the Third International Symposium on Human Identification, held at Phoenix, AZ, September 1993.

"A Guide for Conducting a DNA Quality Assurance Audit", Mudd, J. L., Buel. E., et. al., Crime Laboratory Digest Vol. 20 No. 1, p 8-18, January 1993.

"Guidelines for DNA Proficiency Test Manufacturing and Reporting", Kearney, J. J., Mudd, J. L., ..., Buel. E., et. al., Crime Laboratory Digest Vol. 21, No. 2, p 27-32, April 1994.

"The use of DAPI as a Replacement for Ethidium Bromide in Forensic DNA Analysis", Buel, Eric and Schwartz, Margaret, Journal of Forensic Sciences, Vol. 40, No. 2. March 1995, pp. 275-278.

"The use of Microcons as an Alternative to Ethanol Precipitation in RFLP Procedure", Wang, G., Schwartz, M., and Buel., E., presented at the October 1994 meeting of the Northeastern Association of Forensic Scientists held at New York City.

"A Validation Study on a PCR Sex Typing Method Employing the Amelogenin Gene", Wang, G., Schwartz, M., and Buel, E., presented at the October 1994 meeting of the Northeastern Association of Forensic Scientists held at New York City.

"Identification of Dog Repellent in the Clothes of an Assault Suspect Using Gas Chromatography Mass Spectrometry", Mongan, A. and Buel, E., Journal of Forensic Sciences, Vol. 40, No. 3. May 1995, pp. 513-514.

"PCR Amplification of Animal DNA with X-Y Amelogenin Primers Used in Gender Determination", Buel, E., Wang, G., and Schwartz, M., Journal of Forensic Sciences, Vol. 40, No. 4 July 1995, pp. 641-644.

"Image Enhancement of RFLP Autoradiograms through the use of Neutral Density Filters", Barna, C., and Buel, E., Journal of Forensic Sciences, Vol. 41,No 3, May 1996 pp. 485-486.

"Interlaboratory Comparison of Autoradiographic DNA Profiling Measurements. 3. Repeatability and Reproductibility of Restriction Fragment Length Polymorphism Band Sizing, Particularly Bands of Molecular Size>10K Base Pairs", Stolorow, A.M., Duewer, D. L., and Reeder, D. J. Chemical Science and Technology Laboratory, National Institute of Standards and Technology; Buel, E., State of Vermont Forensic Laboratory; George Herrin, Jr., Division of Forensic Sciences, Georgia Bureau of Investigation, Analytical Chemistry Volume 68, Number 11, pp. 1941-1947.

"Validation of Probe EFD52 (D17S26) for Forensic DNA Analysis" Mark S. Nelson, Elizabeth A. Benzinger, Michael J. Budzynski, Mark T. Boodee, Anita Matthews, Eric Buel, Margaret B. Schwartz, Cecilia Von Beroldingen, Randall L. Wampler, Terrry M.

Coons, James Bixby, William E. Frank, and D. A. Metzger, Journal of Forensic Sciences, Vol. 41, No.4 July 1996, pp. 557-569.

Presentation, Seventh International Symposium on Human Identification Scottsdale, Arizona 1996,"Closer than cousins, but not quite brothers", Schwartz, M. B. and Buel, E.

Presentation, Eight International Symposium on Human Identification Scottsdale, Arizona 1997, "Evaluation of Capillary Electrophoresis for the Forensic Analysis of Short Tandem Repeats", Buel, E., Herrin, G., LaFountain, M., and Schwartz, M. B.

Presentation, Northeastern Association of Forensic Scientists, White Plains, New York 1997, "Validation of the Amelogenin Locus for Capillary Electrophoresis", LaFountain, M., Schwartz, M. B., Cormier, J., and Buel, E.

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Capillary Electrophoresis STR analysis: Comparison of Gel-Based Systems, Buel, E., Schwartz, M. LaFountain, M. A., Journal of Forensic Sciences, Vol. 43, No. 1 January 1998, pp.164-170.

Presentation, Northeastern Association of Forensic Scientists, Newport, Rhode Island, 1998, "Resolution issues in Capillary Electrophoresis Analysis", LaFountain, M., Schwartz, M. B., and Buel, E.

Validation of Capillary Electrophoresis for Analysis of the X-Y Homologous Amelogenin Gene, LaFountain M., Schwartz M., Cormier J., and Buel E., Journal of Forensic Sciences, Vol. 43, No 6, 1188-1194, 1998

Normalization of Residual Ions after Removal of the Base Peak in Electron Impact Mass Spectrometry, Steeves J., Gagne H., and Buel E., Journal of Forensic Sciences, Vol. 45, No 4, 882-885, 2000

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Evaluation of Capillary Electrophoresis Performance Through Resolution Measurements, Buel, E., LaFountain, M., Schwartz, M., and Walkinshaw, M., Journal of Forensic Sciences, Vol. 46, No 2, 341-345, 2001.

TWGDAM Validation of the AmpFlSTR Profiler Plus and AmpFlSTR COfiler STR Multiplex Systems Using Capillary Electrophoresis, LaFountain, M., Schwartz, M., Svete, P., Walkinshaw, M., and Buel, E., Journal of Forensic Sciences, Vol. 46, No 5, 1191-1198, 2001.

Detection of Gamma-Butyrolactone (GBL) as a Natural Component in Wine, Vose, J., Tighe, T., Schwartz, M., and Buel, E. Journal of Forensic Sciences, Vol. 46, No 5, 1164-1167, 2001.

Validation of a 16-Locus Fluorescent Multiplex System, Krenke, B., Tereba, A., Anderson, S., Buel, E., Culhane, S., Finis, C., Tomsey, C., Zachetti, J., Masibay, A., Rabbach, D., Amiott, E., and Sprecher, C., Journal of Forensic Sciences, Vol. 47, No 4, 773-785, 2002.

Using resolution calculations to assess changes in capillary electrophoresis run parameters, Buel, E., LaFountain, M., and Schwartz, M., Journal of Forensic Sciences, Vol. 48, No 1, 77-79, 2003.

Development of an *Alu*-based, QSY 7-labeled primer PCR method for quantitation of human DNA in forensic samples, Nicklas JA, Buel E, Journal of Forensic Sciences, Vol. 48, No 2, 282-291, 2003.

Development of an *Alu*-based, real-time PCR method for quantitation of human DNA in forensic samples, Nicklas JA, Buel E, Journal of Forensic Sciences, Vol. 48, No 5, 936-944, 2003.

Quantitation of DNA in Forensic Samples, Nicklas JA, Buel E, Analytical and Bioanalytical Chemistry, Vol 376, No. 8, 1160-1167, 2003.

Forensic DNA typing by Capillary Electrophoresis: Using the ABI Prism 310 and 3100 Genetic Analyzers for STR Analysis, Butler JM, Buel E, Crivellente F, and McCord BR, Electrophoresis 25, 1397–1412, 2004.

An *Alu*-Based, MGB Eclipse Real-Time PCR Method for Quantitation of Human DNA in Forensic Samples, Nicklas JA, Buel E, Journal of Forensic Sciences, Vol. 50, No 5, 1081-1090, 2005.

Simultaneous determination of total human and male DNA using a duplex real-time PCR assay, Nicklas JA, Buel E, Journal of Forensic Sciences, Vol. 51, No5,1005-1015, 2006.

Evaluation and Quantification of Nuclear DNA from Human Telogen Hairs, Opel KI, Fleishaker EI, Nicklas JA, Buel E, and McCord, BR, Journal of Forensic Sciences- In Press.

A Real-Time Multiplex SNP Melting Assay to Discriminate Individuals, Nicklas JA, Buel E, Submitted to the Journal of Forensic Sciences

Robert J. Shipman
Vermont Forensic Lab
103 South Main St.
Waterbury, VT 05671
Work: (802) 241-5290

Education: Graduate Level coursework in Engineering and Env. Chemistry, 1984-86.
SUNY College of Env. Science and Forestry, Syracuse, NY

Bachelor of Science in Chemistry, May 1983
Hartwick College, Oneonta, NY

Memberships: Current with Northeastern Assoc. of Forensic Scientists (NEAFS)

Continuing Education:

NEAFS Drug Chem. & Tox. Sessions, 1 day-An. Meeting	2007
NEAFS Clandestine Pharmaceuticals Class, 1 day	2007
Nat. Forensic Sc. Tech. Center, LC/MS Workshop, 2 days	2007
Thermo Scientific FTIR seminar, 1 day	2007
NEAFS Drug Chem. and Toxicology Sessions, 1 day	2006
NEAFS GC-IR Presentation, Annual meeting	2006
Spectra Analysis GC/IR soft/hardware training, 2 days	2006
FBI Lab Analysis of Fire Debris class,1 week- FBI Acad.	2006
Agilent GC/MS Chemstation class, 2 days-NEAFS	2005
NEAFS Drug Chem. Session, 1 day-Annual meeting	2005
Preventing Improper Lab Practices, 1 day-NLTN	2005
LC/MS Seminar, 1 day-Agilent Technologies	2005
DEA Drug Analog Seminar, 1-day- NE Region	2005
LC and GC Seminar, 1 day- Agilent Technologies	2004
DEA Forensic Chemist Seminar, 1 week- DEA	2004
NEAFS Drug Chem. Session, 1 day-Annual meeting	2003

Employment:

Forensic Chemist III at The Vermont Forensic Laboratory, 2/03-present.
Analysis and testing of samples for Controlled Substances by GC/MS, FTIR, TLC, spot color testing and other techniques. Court room testimony experience as an expert witness.

Chemist at Scitest, Inc., 3/88 – 2/03.
- Oversee Organic Group.

- Expertise in Liquid and Gas Chromatography including HPLC, GC/MS, and GC/ECD using EPA methods. Experienced in equipment repair including MS cleanings and trouble shooting several types of equipment. Analysis included Volatile, Semivolatile, PCB, Aromatics, TPH, Carbamates, by Drinking water & Wastewater methods.
- Maintain and calibrate field instruments.
- Computer formats proficient with includes Quattro Pro, Hewlett-Packard ChemStation and Aquarius, Lab Information Management System (LIMS).
- Experienced with Lab certification in several States: proficiency testing, responses, and on-site inspections.
- Site Projects work includes:
    - Grid sampling for an electric utility PCB site closure
    - Air monitoring of houses for gasoline vapors
    - Air and groundwater(GW) monitoring for "perc" at a school
    - Contract Lab Protocol (CLP) for GW sampling and analysis

Staff Chemical Technician at NYSEG Labs, 2/86- 12/87.
Analyzed Coal Tar sites by CLP and EPA SW-846 procedures
Analyzed for PCBs, Pesticides, and Natural Gas for BTU content
Used Atomic Absorption (AA) for metal analysis
Wet Chemistry methods used for some Inorganic Analysis

Senior Technician at O'Brien & Gere Engineers, Inc., 6/83- 2/86.
Analyzed all matrices by EPA and NYDEC methods using GC, TOX, and GC/MS systems.
Some experience with Metals (AA) and Wet Chemistry methods

02/2008

d. List of Previous and Current Awards

Current NIJ Awards

2005 Forensic DNA Research and Development Grant (2005-DA-BX-K003), "Improving the Efficiency of DNA Casework Analysis through Simple, Effective, PCR-Based Screening Methods".

2004 Forensic DNA Research and Development Grant (2004-DN-BX-K003), "Development of an automated system to detect spermatozoa on laboratory slides to increase productivity in the analysis of sexual assault cases".

2004 Forensic DNA Research and Development Grant (2004-DN-BX-K002), "Forensic Stain Identification by RT-PCR Analysis".

Previous NIJ Awards

2003 Forensic DNA Research and Development Grant (2003-IJ-CX-K012), "Increasing Efficiency of Forensic DNA Analysis through Real-Time PCR", Final report filed.

2002 Forensic DNA Research and Development Grant (2002-IJ-CX-K012), "Simple, Rapid, and Accurate Quantitation of Human DNA", Final report filed.

2000 Forensic DNA Research and Development Grant (2000-IJ-CX-K012), "A Microplate Assay for the Quantitation of Human DNA", Final report filed. Five papers from the 2000, 2002 and 2003 DNA Research grants are published:

- Nicklas JA, Buel E (2003) Development of an *Alu*-based, QSY 7-labeled primer PCR method for quantitation of human DNA in forensic samples. J Forensic Sci 48:282-291.
- Nicklas JA, Buel E (2003) Development of an *Alu*-based, real-time PCR method for quantitation of human DNA in forensic samples. J Forensic Sci 48:936-944.
- Nicklas JA, Buel E (2003) Quantitation of DNA in Forensic Samples. Anal Bioanal Chem 376:1160-1167.
- Nicklas JA, Buel E (2005) An Alu-based, MGB Eclipse Real-Time PCR Method for Quantitation of Human DNA in Forensic Samples. J Forensic Sci 50:1081-1090.
- Nicklas JA, Buel E (2006) Simultaneous determination of total human and male DNA using a duplex real-time PCR assay. J Forensic Sci 51:1005-1015.

1998 Forensic DNA Laboratory Program, NIJ Grant, "Increasing DNA Sample Analysis Throughput: Enhancement of DNA Specimen Identification and Processing Coupled with STR Analysis", Final report filed.

1997 Forensic DNA Laboratory Program, NIJ Grant, "Capillary Electrophoresis for STR Analysis: "Validation and Cost Effectiveness - Part Two", Final report filed.

1996 Forensic DNA Laboratory Program, NIJ Grant, "Capillary Electrophoresis for STR Analysis: "Validation and Cost Effectiveness", Final report filed. Six papers from the 1996, 1997 and 1998 DNA Laboratory Programs are published:

- Buel E, Schwartz M, LaFountain MA (1998) Capillary Electrophoresis STR analysis: Comparison of Gel-Based Systems. J Forensic Sci 43(1):164-170.
- LaFountain M, Schwartz M, Cormier J, Buel E (1998) Validation of Capillary Electrophoresis for Analysis of the X-Y Homologous Amelogenin Gene. J Forensic Sci 43(6):1188-1194.
- McCord B, Buel E (2000) Analytical Techniques: Capillary Electrophoresis in Forensic Biology. Encyclopedia of Forensic Sciences.
- Buel E, LaFountain M, Schwartz M, Walkinshaw M (2001) Evaluation of Capillary Electrophoresis Performance Through Resolution Measurements. J Forensic Sci 46(2):341-345.
- LaFountain M, Schwartz M, Svete P, Walkinshaw M, Buel E (2001) TWGDAM Validation of the AmpFlSTR Profiler Plus and AmpFlSTR COfiler STR Multiplex Systems Using Capillary Electrophoresis. J Forensic Sci 46(5):1191-1198.
- Buel E, LaFountain M, Schwartz M (2003) Using resolution calculations to assess changes in capillary electrophoresis run parameters. J Forensic Sci 48(1):77-9.

e. Letter of support:

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HARRISON SCHOOL OF PHARMACY
DEPARTMENT OF PHARMACAL SCIENCES

February 11, 2008

Dr Eric Buel
Vermont Forensic Laboratory
103 South Main Street
Waterbury, Vermont 05671

Dear Dr. Buel:

This is to confirm our commitment to collaborate with you on your forensic drug analysis project related to GC-IR studies on some methylenedioxyphenethylamine regioisomers. Our group will supply you with analytical quantities (10 to 50 mgs) of a series of 12 to 15 regioisomeric and isobaric substances related to the methylenedioxyphenethylamines. The cost of these materials will be approximately $7,000.00.

We look forward to working with you on this very interesting project. I know that the results of your work will have a significant impact on the quality of forensic drug identification.

If you need any additional information please let me know.

Sincerely,

C. Randall Clark

C. Randall Clark, Ph.D.
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Owing much to the past, Auburn's greater debt is ever to the future.

f. Time Line:

Item	Time
Hire Scientist	Month 1
Drugs for project • Contact collaborators-specify drug samples needed • Purchase commercially available drugs	Month 1
Purchase necessary supplies- columns, solvents etc.	Month 1
Disk contamination issue • Evaluate cross contamination • Develop disk assessment protocol	Months 2-3
Crystalline and Amorphous states • Evaluate a wide range of drugs • Assess disk conditions to minimize amorphous state	Month 4
Sensitivity Study • On-the-fly versus re-scanning • Multiple deposition • Variations in GC conditions and disk speed	Month 5-6
Analysis of selected drugs (commercially available and from collaborators) • Routinely encounter drugs • Isomers and related compounds • Drugs with minimal MS patterns	Months 6-9
Forensic casework • Routine cases • Designer drug cases	Months 7-11
Develop and modify protocols	Months 7-12
Disseminate results to forensic community	Month 12

Budget Narrative File(s)

* Mandatory Budget Narrative	2008 Controlled Substances_Budget Detail_and_Budget Narrative.xls

Add Mandatory Budget Narrative | Delete Mandatory Budget Narrative | View Mandatory Budget Narrative

To add more Budget Narrative attachments, please use the attachment buttons below.

Add Optional Budget Narrative | Delete Optional Budget Narrative | View Optional Budget Narrative

Grant Application Identifier: 2008 Controlled Substances Detection & Analysis R&D

Grant Period: 1/1/2009 12/31/2009

Adapted for VT DPS from OMB 1121-0188

Budget Detail Worksheet

A. Personnel - List each position by title and name of employee, if available. Show the annual salary rate and the percentage of time to be devoted to the project. Compensation paid for employees engaged in grant activities must be consistent with that paid for similar work within the applicant organization.

Name, Position / Title		Computation: Hourly Rate	X Number of Hr's in Pay Period	X Number of Pay Periods	= Cost for the Project Period		Total Personnel for Employee
1. Forensic Chemist II, t.b.a.	Step 2: 1/1/09-6/30/09	22.96	80	13	23,878.40		
PayGr 25, hired 'in range'	Step 2: with 2% COLA: 7/1/09-12/31/09	23.42	80	13	24,355.97	>	48,234.37
				26			
2. Robert Shipman, Forensic Chemist III	Step 6: 1/1/09-6/30/09	26.26	4	13	1,365.52		
OT only, PayGr 25	Step 6 :plus 2% COLA: 7/1/09-8/10/09	26.79	4	3	321.42		
	Step 7: with 2% COLA: 8/11/09-12/31/09	27.69	4	10	1,107.72	>	2,794.66
				26			
3. Eric Buel, Forensics Lab Director	Step 13: 1/1/09-4/9/09	41.78	4	8	1,336.96		
OT only, PayGr 29	Step 14: 4/10/09-6/30/09	42.95	4	5	859.00		
	Step 14: with 2% COLA: 7/1/09-12/31/09	43.81	4	13	2,278.07	>	4,474.03
				26			

Sub-Total $ 55,503

B. Fringe Benefits - Fringe benefits should be based on actual known costs or an established formula. Fringe benefits are for the personnel listed in budget category (A) and only for the percentage of time devoted to the proejct. Fringe benefits on overtime hours are limited to FICA, Workman's Compensation, and Unemployment Compensation.

Name, Position / Title	Computation						Cost
1. Forensic Chemist II, t.b.a.	Social Security at		6.20%		of salary	$	2,991
	Medicare at		1.45%		of salary	$	699
	Retirement at		9.70%		of salary	$	4,679
	Worker's Comp at		6.00%		of salary	$	2,894
	Health Ins at	$ 463.00	X	26.0	80-hour pay periods	$	12,038
	Life Ins at		0.35%		of salary	$	169
	Dental Ins at	$ 41.74	X	26.0	80-hour pay periods	$	1,085
	EAP at	$ 1.08	X	26.0	80-hour pay periods	$	28
						$	24,583
2. Robert Shipman, Forensic Chemist III	Social Security at		6.20%		of salary	$	173
	Medicare at		1.45%		of salary	$	41
	Retirement at		9.70%		of salary	$	271
	Worker's Comp at		6.00%		of salary	$	168
						$	653
3. Eric Buel, Forensics Lab Director	Social Security at		6.20%		of OT salary	$	277
	Medicare at		1.45%		of OT salary	$	65
	Retirement at		9.70%		of OT salary	$	434
	Worker's Comp at		6.00%		of OT salary	$	268
						$	1,045

Sub-Total $ 26,280

TOTAL PERSONNEL AND FRINGE BENEFITS: $ 81,783

C. Travel - Itemize travel expenses of project personnel by purpose (e.g., staff to training, field interviews, advisory group meeting, etc.). Show the basis of computation (e.g., six people to 3-day training at $X airfair, $X lodging, $X substinance). In training projects, travel and meals for trainees should be listed separately. Show the number of trianees and the unit costs involved. Identify the location of travle, if known. Indicate source of Travel Policies applied, Applicant or Federal Travel Regulations.

Purpose	Location	Computation					T. Cost Per Line	
		# of people	# of days	Cost Ea		Description		
AAFS Meeting	TBA	1	-	$ 558.00		Airfare	$ 558	
		1	4	$ 130.00		Lodging	$ 520	
		1	4	$ 40.00		Subsistence	$ 160	$ 1,238

TOTAL TRAVEL $ 1,238

D. Equipment - List non-expendable items that are to be purchased. Non-expendable equipment is tangible property having a useful life of more than two years and an acquisition cost of $5,000 or more per unit. (Note: Organization's own capitalization policy may be used for items costing less than $5,000). Expendable items should be included either in the "supplies" category or in the "Other" category. Applicants should analyze the cost benefits or purchasing versus leasing equipment, especially high cost items and those subject to rapid technical advances. Rented or leased equipment costs sh ould be listed in the "Contractual" category. Explain how the equipment is necessary for the success of the project. Attach a narrative describing the procurement method to be used.

Equipment Items	Computation			Cost
	Quantity		Cost Each	
None.	0	at	$ -	$ -

TOTAL EQUIPMENT: $ -

E. Supplies - List items by type (office supplies, postage, training materials, copying paper, and expandable equipment items costing less than $5,000, such as books, hand held tape recorders) and show the basis for computation. (Note: Organization's own capitalization policy may be used for items costingless than $5,000). Generally, supplies include any materials that are expendable or consumed during the course of the project.

Supply Items	Computation					T. Cost Per Line
	Quantity	Unit		Price Per Unit		
Custom designed and systhezied drugs	14	each	at	$ 500.00		$ 7,000.00
Commercially available drugs	27	each	at	$ 50.00		$ 1,350.00
GC Columns	3	each	at	$ 500.00		$ 1,500.00

TOTAL SUPPLIES: $ 9,850

F. Construction - As a rule, construction costs are not allowable. In some cases, minor repairs or renovations may be allowable. Check with the program office before budgeting funds in this category.

Purpose	Description of Work	Cost
None		$ -

TOTAL CONSTRUCTION: $ -

G. Consultants/Contracts - Indicate whether applicant's formal, written Procurement Policy or the Federal Acquisition Regulations are followed.

Consultant Fees: For each consultant enter the name, if known, service to be provided, hourly or daily fee (8-hour day), and the estimated time on the project. Consultant fees in excess of $450 per day require additional justification and prior approval from OJP.

Name of Consultant	Service Provided	Computation	Cost
None.			$ -
			Sub-Total: $ -

Consultant Expenses: List all expenses to be paid from the grant to the individual consultants in addition to their fees (i.e., travel, meals, lodging, etc.)

Item	Location	Computation	Cost
None			$ -
			Sub-Total: $ -

Contracts: Provide a description of the product or service to be procured by contract and an estimate of the cost. Applicants are encouraged to promote free and open competition in awarding contracts. A separate justification must be provided for sole source contracts in excess of $100,000.

Item			Cost
	at	$ -	$ -
			Sub-Total: $ -

TOTAL CONTRACTS / CONSULTANTS: $ -

H. Other Costs - List items (e.g., rent, reproduction, telephone, janitorial or security services, and investigative or confidential funds) by major type and the basis of the computation. For example, provide the square footage and the cost per square foot for rent, or provide a monthly rental cost and how many months to rent.

Description	Computation	Cost
Program Costs:		
None	at $ -	$ -
Administrative Costs:		
Fidelity Bond Premium on State of Vermont Personal services	0.02% of Total P/S budget	$ 16.36

TOTAL OTHER: $ 16

I. Indirect Costs - Indirect costs are allowed only if the applicant has a Federally approved indirect cost rate. A copy of the rate approval (a fully executed, negotiated agreement), must be attached. If the applicant does not have an approved rate, one can be requested by contacting the applicant's cognizant Federal agency, which will review all documentation and approve a rate for the applicant organization, or if the applicant's accounting system permits, costs may be allocated in direct costs categories.

Description	Computation	Cost
None		$ -

TOTAL INDIRECT: $ -

TOTAL PROJECT COST: $ 92,888

Budget Summary

Budget Category	Amount
A. Personnel	$ 55,503
B. Fringe Benefits	$ 26,280
C. Travel	$ 1,238
D. Equipment	$ -
E. Supplies	$ 9,850
F. Construction	$ -
G. Consultants/Contracts	$ -
H. Other	$ 16
Total Direct Costs	$ 92,888
I. Indirect Costs	$ -
TOTAL PROJECT COSTS	$ 92,888

Federal Request	$92,888	$0
Non-Federal Amount	$0	

Budget Narrative

The budget narrative should be a plain-language explanation of the proposed expenditures that are listed in the Budget Detail Worksheet above.

A. Personnel

The salary and benefits will support the hiring of a full time forensic chemist who has appropriate chemistry training for the proposed research. Robert Shipman and Eric Buel will request 2 hours of funding per week for their work on the project.

C. Travel

Travel will include a trip to the AAFS meeting to present the results of the research.

D. Equipment

None.

E. Supplies

Custom synthesized drugs will be made by Dr. Clark (see letter of support). Commercially available drugs will be purchased from standard drug supply companies. Two GC columns will be purchased to allow the development of GC separation protcols.

F. Construction

None.

G. Consultants / Contracts

None.

H. Other Costs

Program Costs:

Administrative Costs:

Costs to the Department of Public Safety for administering federal funds.

I. Indirect Costs

None.

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STATE OF VERMONT
JOINT FISCAL OFFICE

MEMORANDUM

To: Representative William Lippert

From: Nathan Lavery, Fiscal Analyst

Date: April 17, 2009

Subject: JFO #2378

Representative Michael Obuchowski asked that I forward to you a copy of the enclosed grant materials and cover memo. He requests your observations regarding the enclosed item.

cc: Rep. Michael Obuchowski
Stephen Klein

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