



# MoldnMore

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Leading the way in mold control and remediation

**To:** Dennis Smagac

**Date:** October 2, 2020

**From:** William Young

**Regarding:** Hill Laboratories Analysis Report 1663973 - Methamphetamine Decontamination

In October of 2016 Hill Laboratories Limited, 1 Clyde St. Private Bag 3205 Hamilton New Zealand (International Accreditation New Zealand (IANZ NZS/ISO/IEC 17025:2017), was commissioned to test cleaning and decontamination products to determine the effectiveness of methamphetamine decontamination in residential settings. (See attached laboratory reports included.)

Initial reports were for evaluation of three products currently being used to decontaminate contaminated meth effected properties including the parent methamphetamine as well as any metabolites left in the process of decontamination. The three products tested were Crystal Clean (3 part component US product), Green Kleen 420-4 (Single component US product) and Strike Force (Single component NZ product).

The initial evaluation was conducted in a laboratory on appropriate coupons with each product used following label instructions. Results are included in the attached reports but to summarize:

Of the three cleaning products supplied, only the Crystal Clean 3 part product was successful in removal of parent methamphetamine, presumably through peroxide initiated oxidative degradation or irreversible binding to components contained within Crystal Clean. Complete removal of parent methamphetamine was observed within 4 hours.

In November of 2017 a follow up study was conducted in a residence with known Methamphetamine contamination. The same three products were utilized and once again Crystal Clean was the only product that was effective in fully decontamination of the residence.

**Summary: [1]** The testing on this dwelling shows that Crystal Clean is an effective agent for the removal of methamphetamine and similar related compounds to well below the required level at domestic dwellings

**[2]** No methamphetamine related degradation products were detected in this test. This indicated that no stable methamphetamine related degradation products are an issue for the remediation or related clean-up and disposal.

The confirmation of the efforts of the dedicated scientists at Sandia National Laboratories that the product they developed for the purpose of neutralizing chemical and biological weapons indeed eliminates the residue of methamphetamine and the direct product of methamphetamine production. These studies, which were undertaken to confirm the effectiveness of Crystal Clean in a location where methamphetamine has caused a great deal of damage, have with direct science proven the effectiveness of this three part product both in laboratory controlled environment and in an actual contaminated residence.

Thank you,

A handwritten signature in cursive script that reads "William Young".

William Young  
CMI, CMA, CMRC



## ANALYSIS REPORT

Page 1 of 1

<b>Client:</b> Tech Consulting <b>Contact:</b> D McNaughton C/- Tech Consulting 24 Radiata Street Fairview Downs Hamilton 3214	<b>Lab No:</b> 1663973 <b>Date Received:</b> 13-Oct-2016 <b>Date Reported:</b> 09-Nov-2016 <b>Quote No:</b> 81117 <b>Order No:</b> <b>Client Reference:</b> Methamphetamine Decontamination Agent Investigation <b>Submitted By:</b> D McNaughton	SPv2
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### Amended Report

This report replaces an earlier report issued on the 02 Nov 2016 at 2:13 pm  
An additional extension report as been added.

#### Analyst's Comments

Appendix No.1 - Tech Consulting Meth 1663973 Report 1

Appendix No.2 - Tech Consulting Meth 1663973 Report 1 Extension

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

Graham Corban MSc Tech (Hons)  
Client Services Manager - Environmental

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*

<b>Description:</b>	Methamphetamine Cleaning Products – Non-Routine Experiment		
<b>Client</b>	Tech Consulting	<b>Contact:</b>	Don McNaughton
<b>Client Reference:</b>	Methamphetamine Decontamination Agent Investigation	<b>Date:</b>	01 November 2016
<b>Hills Reference:</b>	1663973	<b>Analyst:</b>	Jared Loader Cherie Boulton

## Scope

Investigate chemical removal and subsequent degradation products of methamphetamine by client supplied cleaning products. The three cleaning products supplied were:

1. Crystal Clean (3 part component US product)
2. Green Kleen 420-4 (Single component US product)
3. Strike Force (Single component NZ product)

Safety Data Sheets were supplied for each product. Tests were conducted using solutions of each product according to the manufacturer's label instructions.

For each cleaning product was subjected to the following testing scheme,

1. Methamphetamine was added to working solutions of each cleaning product to create a 1000 µg/L (parts per million or ppm) solution of methamphetamine.
2. Solutions were stood at room temperature with sub-samples taken for analysis after 4 and 24 hour time periods. Samples were diluted 100 fold prior to analysis to avoid damaging the scientific instrumentation with the high surfactant levels present in the cleaning products.
3. Control solutions of methamphetamine were subjected to the same protocol. The level of methamphetamine injected onto instrument "at analysis" was ca. 10 µg/L.
4. Samples underwent 'targeted' analysis for the presence of methamphetamine and quantitated against standard calibration curves.
5. Samples then underwent 'untargeted' analysis in order to identify any methamphetamine reaction products.
6. In order to assist in identifying any methamphetamine reaction products, via atomic mass differences, deuterium labelled methamphetamine (methamphetamine-d9) was used to prepare identical experimental solutions as outlined above, and subjected to the same processes.

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*



## **Analysis and Identification**

Samples underwent chromatographic separation on a C18 analytical column using an Ultra-High Performance Liquid Chromatography (UPLC) system coupled to a Thermo QExactive Orbitrap mass spectrometer (a High Resolution Accurate Mass instrument). Analytes were detected in full-scan mode with rapid positive/negative switching and concurrent detection using the collision cell of the QExactive Orbitrap mass spectrometer. Full scan data in positive mode was used for the quantification of methamphetamine, with the additional settings in place for aiding both the identification of reaction products and retrospective untargeted investigative analysis in the future, if required.

The Thermo QExactive Orbitrap mass spectrometer was operated with a resolving power of 70,000 FWHM, and the instrument is capable of external mass accuracy <5 ppm RMS. It is this high resolution and accurate mass which give the ability to distinguish between compounds of similar nominal masses.

Quantification of methamphetamine and methamphetamine-d9 were performed against authentic standards.

Requested metabolites (refer Appendix 1.1), were extracted from their respective untargeted analyses via their protonated molecular ion ( $[M+H]^+$ ) and individually presented as a relative percent abundance.

Methamphetamine Cleaning Products – Non-Routine ref: 1663973

## Results

### Crystal Clean Absolute Levels

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Crystal Clean are presented in Table 1.

**Table 1: Methamphetamine levels in standard controls and after treatment with Crystal Clean.**

Reference	Description	Methamphetamine conc. [µg/L]	Methamphetamine-d9 conc. [µg/L]
Control Standards			
	Standard Controls 4h	9.7	9.9
	Standard Controls 24h	10.2	10.2
Crystal Clean			
	CC blank 4h	0	0
	CC treatment 4h	0	0
	CC blank 24h	0	0
	CC treatment 24h	0	0

Results indicate complete degradation or irreversible binding of parent methamphetamine and methamphetamine-d9 after 4 hours and 24 hours.

### Crystal Clean Metabolites

Relative % levels of requested methamphetamine metabolites from the untargeted Crystal Clean analysis are presented in Table 2. Metabolites were extracted based on their protonated molecular ion masses. No methamphetamine or requested metabolites were present.

**Table 2: Relative levels in of requested metabolites present in Crystal Clean treatments.**

Name	CAS#	[M+H] <sup>+</sup> extracted ion	% Found 4 h treatment	% Found 24 h treatment
Methamphetamine	537-46-2	150.1283	0%	0%
Amphetamine	300-62-9	136.1126	0%	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%	0%
3,4-hydroxymethamphetamine	-	182.1181	0%	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%	0%
phenylacetone	103-79-7	135.0810	0%	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%	0%

Presented in Appendix 1.4 are the Total Ion Chromatogram (TIC) and methamphetamine [M+H]<sup>+</sup> extracted ion chromatogram for the Crystal Clean blank solution and 4 hour treatment. The extracted ion range of *m/z* 150.1252-150.1312 (encompassing methamphetamine) indicated the presence of a peak with a similar mass to methamphetamine at 0.87 min. However, this peak is present in the blank Crystal Clean



*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*

solution and is therefore not amphetamine related. Furthermore the retention time of the methamphetamine control standard was 2.30 min (Appendix 1.3).

No other methamphetamine oxidative or degradation products have currently been identified from the untargeted analyses performed.

### **Green Kleen 420-4 Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Green Kleen 420-4 are presented in Table 3.

**Table 3: Methamphetamine levels in standard controls and after treatment with Green Kleen 420-4.**

Reference	Description	Methamphetamine conc. [µg/L]	Methamphetamine-d9 conc. [µg/L]
Standard Controls			
	Standard controls 4h	10.3	10.1
	Standard controls 24h	10.4	10.2
Green Kleen 420-4			
	GK blank 4h	0	0
	GK treatment 4h	10.0	10.3
	GK blank 24h	0	0
	GK treatment 24h	10.1	10.3

Results indicate no significant degradation or irreversible binding of parent methamphetamine or methamphetamine-d9 after 4 hours and 24 hours.

### **Green Kleen 420-4 Metabolites**

Relative % levels of requested methamphetamine metabolites from the untargeted Green Kleen 420-4 analysis are presented in Table 4. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.

**Table 4: Relative levels in of requested metabolites present in Green Kleen 420-4 treatments.**

Name	CAS#	[M+H] <sup>+</sup> extracted ion	% Found 4 h treatment	% Found 24 h treatment
Methamphetamine	537-46-2	150.1283	100%	100%
Amphetamine	300-62-9	136.1126	0%	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%	0%
3,4-hydroxymethamphetamine	-	182.1181	0%	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%	0%
phenylacetone	103-79-7	135.0810	0%	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%	0%

Presented in Appendix 1.5 are the Total Ion Chromatogram (TIC) and methamphetamine [M+H]<sup>+</sup> extracted ion chromatogram for the Green Kleen 420-4 blank solution and 4 hour treatment. The extracted ion range of *m/z* 150.1252-150.1312 confirmed the presence of methamphetamine at 2.30 min.



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### **Strike Force Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Strike Force are presented in Table 5.

**Table 5: Methamphetamine levels in standard controls and after treatment with Strike Force.**

Reference	Description	Methamphetamine conc. [µg/L]	Methamphetamine-d9 conc. [µg/L]
Standard Controls			
	Standard controls 4h	9.8	10.5
	Standard controls 24h	11.0	10.0
Strike Force			
	SF blank 4h	0	0
	SF treatment 4h	12.5	10.8
	SF blank 24h	0	0
	SF treatment 24h	10.2	10.7

There was some signal enhancement of methamphetamine (~10%) observed at the 4 hour analysis. This is within acceptable and expected levels. Results indicate no significant degradation or irreversible binding of parent methamphetamine or methamphetamine-d9 after 4 hours and 24 hours.

### **Strike Force Metabolites**

Relative % levels of requested methamphetamine metabolites from the untargeted Strike Force analysis are presented in Table 6. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.

**Table 6: Relative levels in of requested metabolites present in Strike Force treatments.**

Name	CAS#	[M+H] <sup>+</sup> extracted ion	% Found 4 h treatment	% Found 24 h treatment
Methamphetamine	537-46-2	150.1283	100%	100%
Amphetamine	300-62-9	136.1126	0%	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%	0%
3,4-hydroxymethamphetamine	-	182.1181	0%	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%	0%
phenylacetone	103-79-7	135.0810	0%	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%	0%

Presented in Appendix 1.6 are the Total Ion Chromatogram (TIC) and methamphetamine [M+H]<sup>+</sup> extracted ion chromatogram for the Strike Force blank solution and 4 hour treatment. The extracted ion range of *m/z* 150.1252-150.1312 confirmed the presence of methamphetamine at 2.30 min.

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*



## **Summary**

Of the three cleaning products supplied, only the Crystal Clean 3 part product was successful in removal of parent methamphetamine, presumably through peroxide initiated oxidative degradation or irreversible binding to components contained within Crystal Clean. Complete removal of parent methamphetamine was observed within 4 hours.

Green Kleen 420-4 and Strike Force showed no evidence of parent methamphetamine degradation or irreversible binding after 24 hours.

No methamphetamine metabolites have so far been identified from either of the three cleaning products.

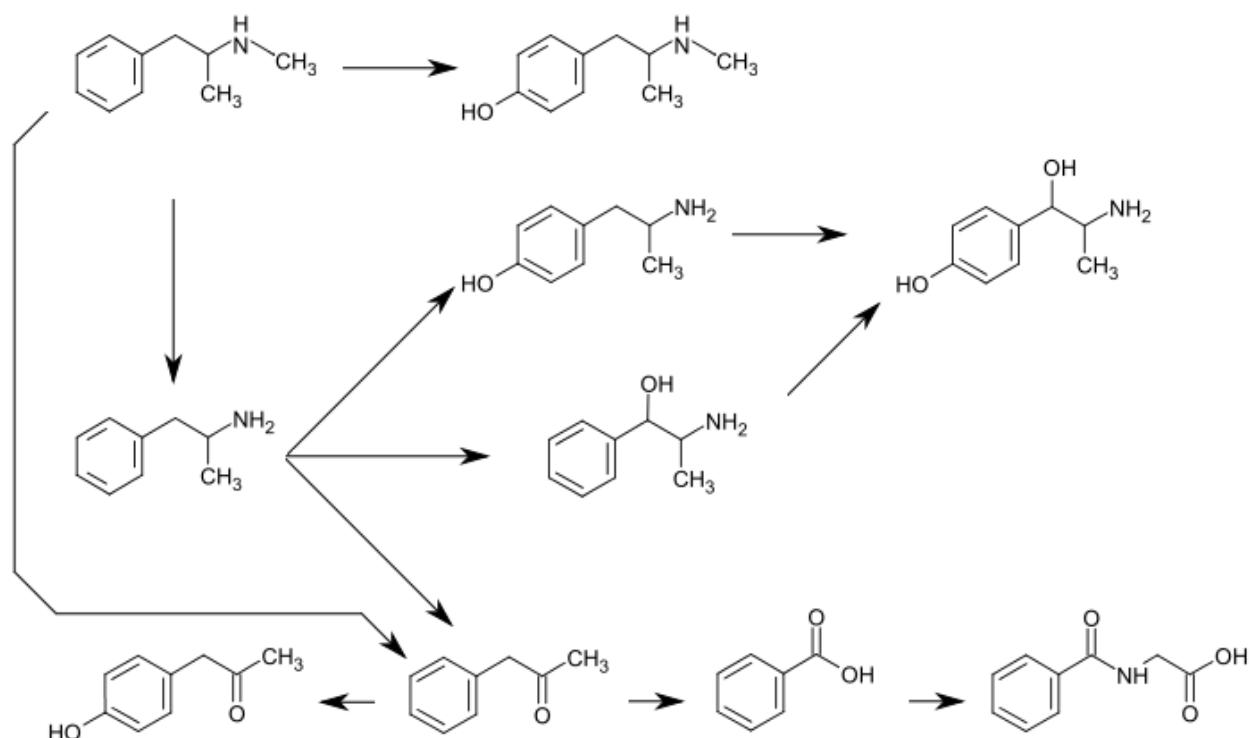
## **Further Work**

Further experimentation has been undertaken, wherein a higher concentration solution of methamphetamine has been treated with Part 2 only of the Crystal Clean system and again with the complete Crystal Clean system (as per manufacturer instructions). It is envisaged that the higher concentration of methamphetamine may allow for identification of peroxide oxidation or degradation products. The reaction has been monitored at time periods of T=0, 1 and 4 hours. At the present time the experimental data has been collected on the QExactive Orbitrap. Further data analysis is required to identify any methamphetamine by-products.

## Appendix

### Appendix 1.1

Supplied Metabolic Pathway and Requested List of Metabolites



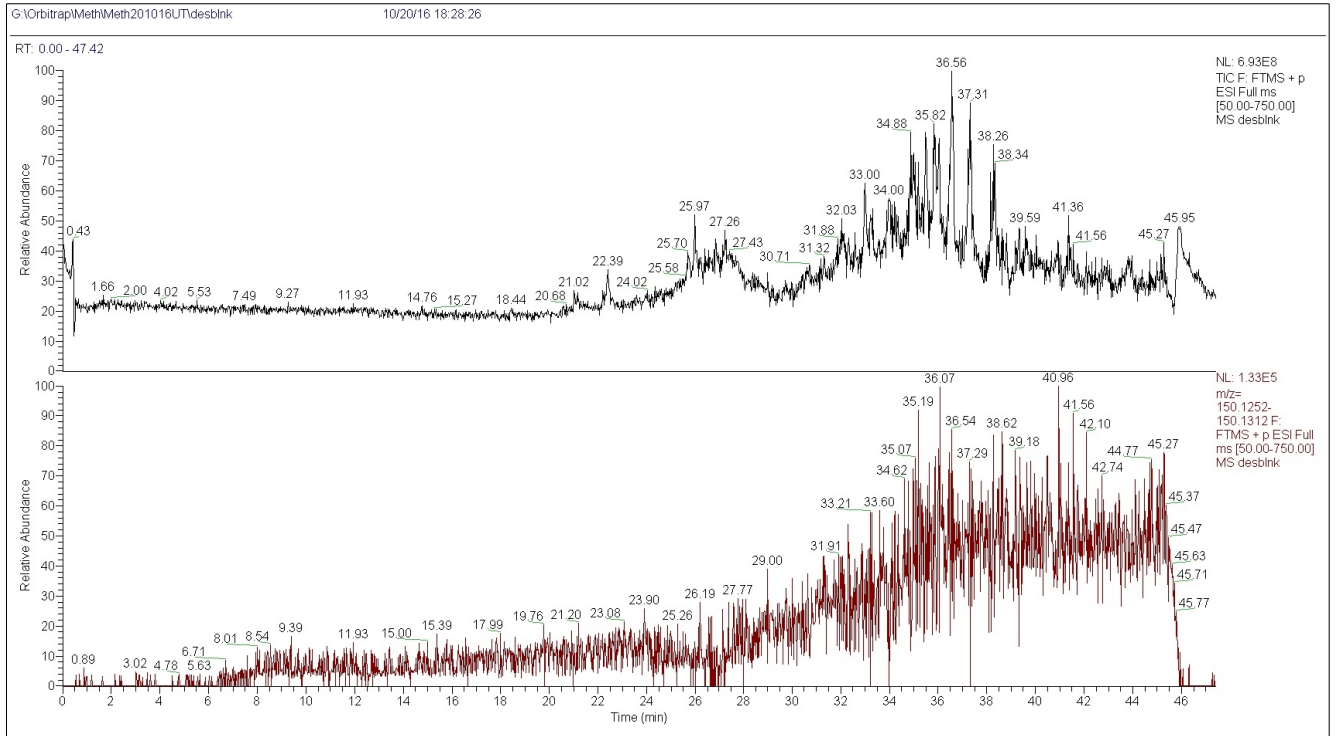
	Name	CAS#	Monoisotopic Mass
1	Methamphetamine	537-46-2	149.12045
2	Amphetamine	300-62-9	135.1048
3	4-hydroxymethamphetamine	370-14-9	165.11536
4	3,4-dihydroxyamphetamine	-	181.1103
5	4-hydroxyamphetamine	1518-86-1	151.0997
6	phenylacetone	103-79-7	134.0732
7	4-hydroxyphenylacetone	770-39-8	150.0681

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**Appendix 1.2**

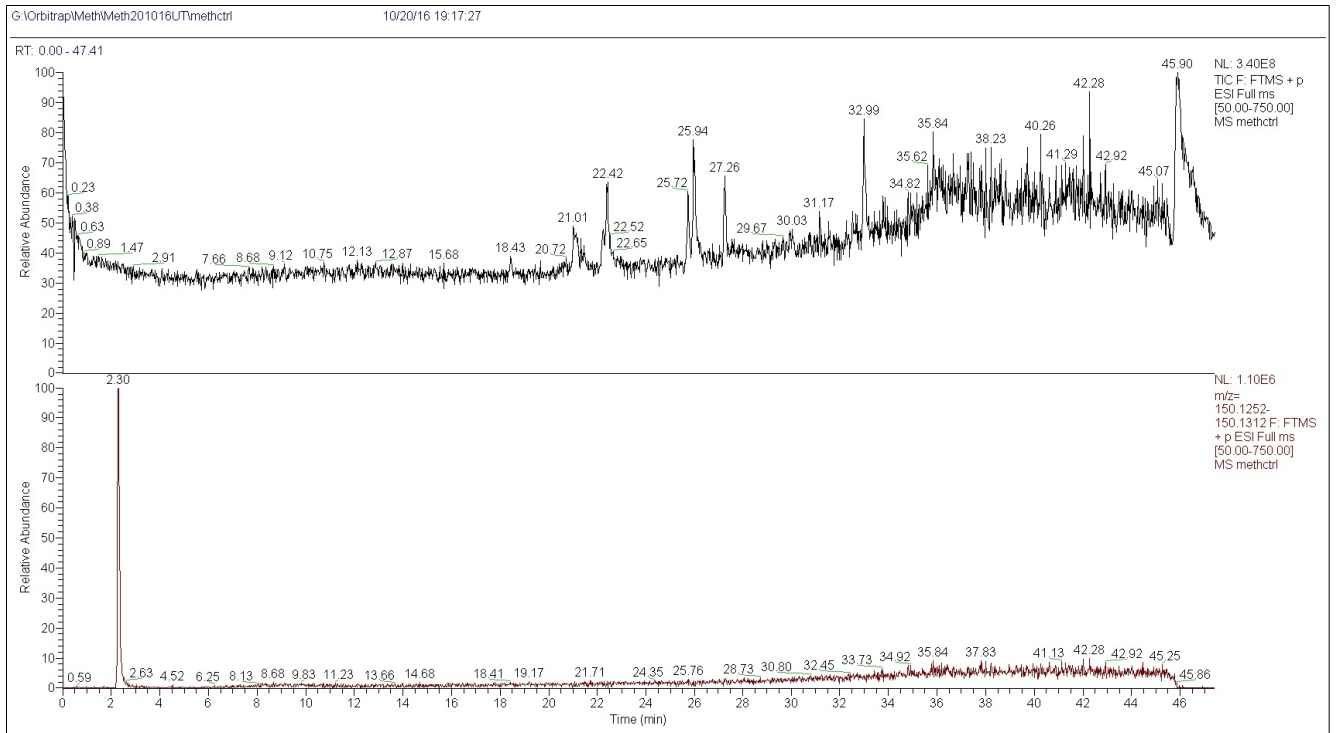
Blank desorption solution TIC and methamphetamine extracted ion chromatogram.



No methamphetamine present.

**Appendix 1.3**

Methamphetamine 10 µg/L Control Standard TIC and methamphetamine extracted ion chromatogram.

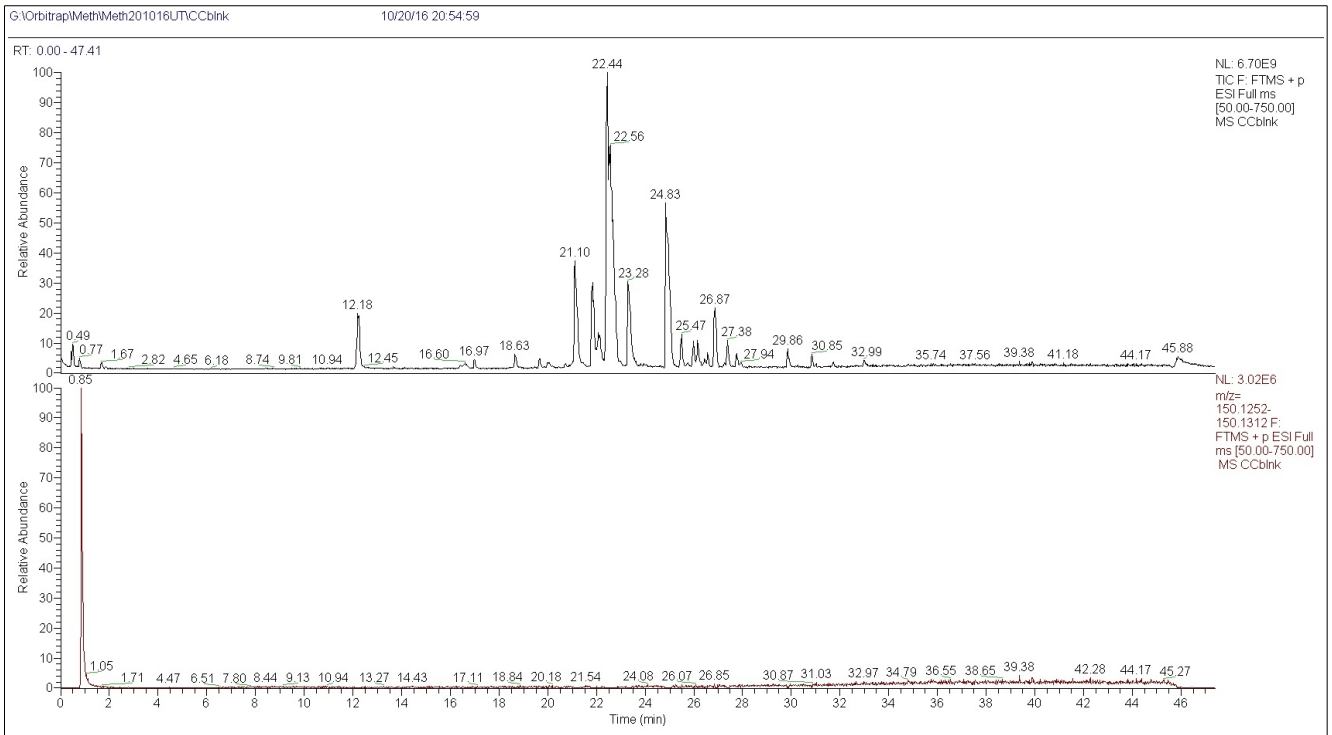


Methamphetamine present at 2.30 min.

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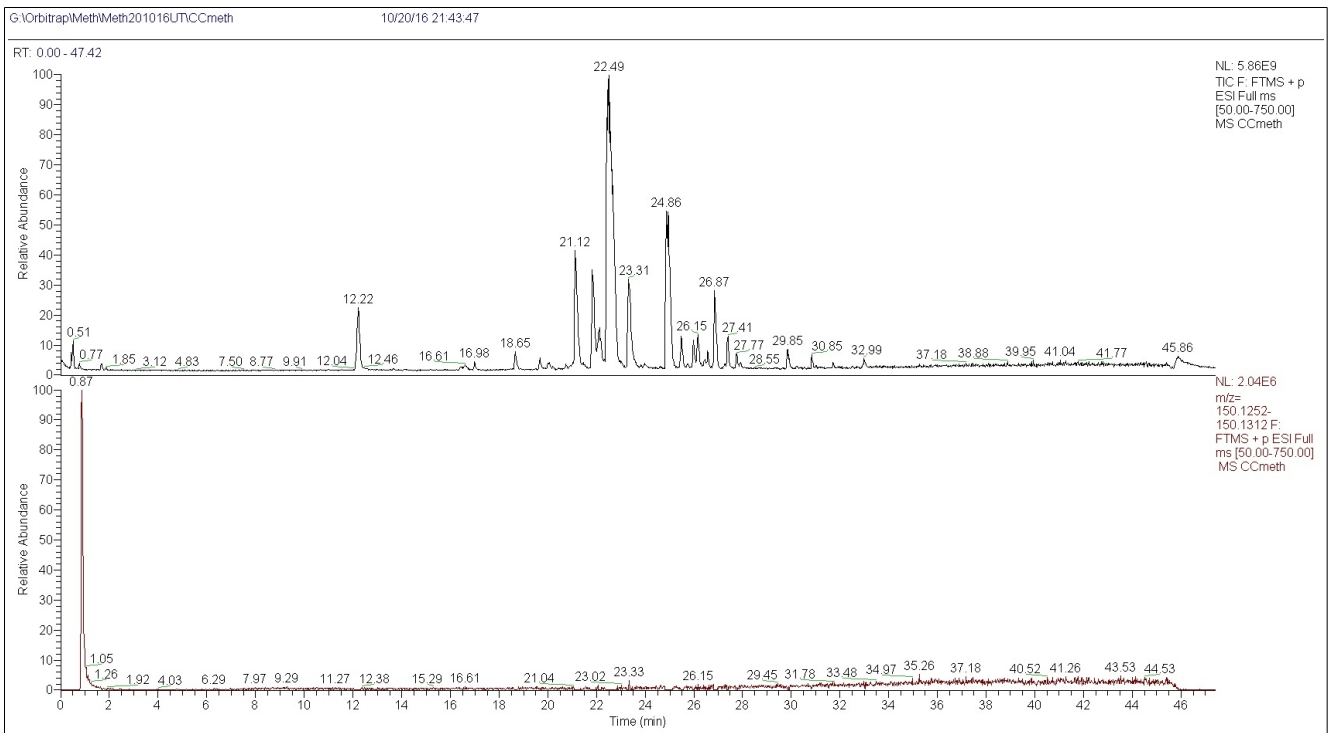
**Appendix 1.4**

## A) Crystal Clean blank TIC and methamphetamine extracted ion chromatogram.



No methamphetamine present.

## B) Crystal Clean 4 h treated methamphetamine solution TIC and methamphetamine extracted ion chromatogram.



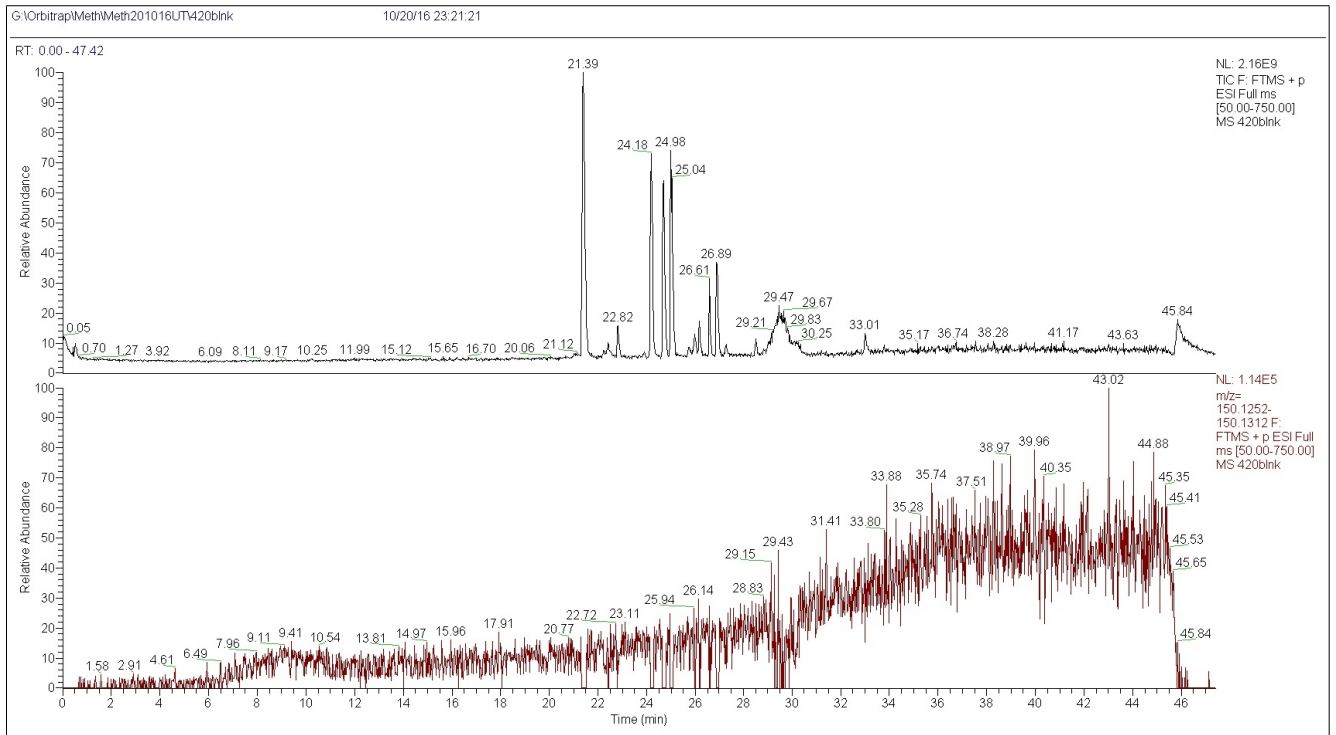
No methamphetamine present.

Methamphetamine Cleaning Products – Non-Routine ref: 1663973



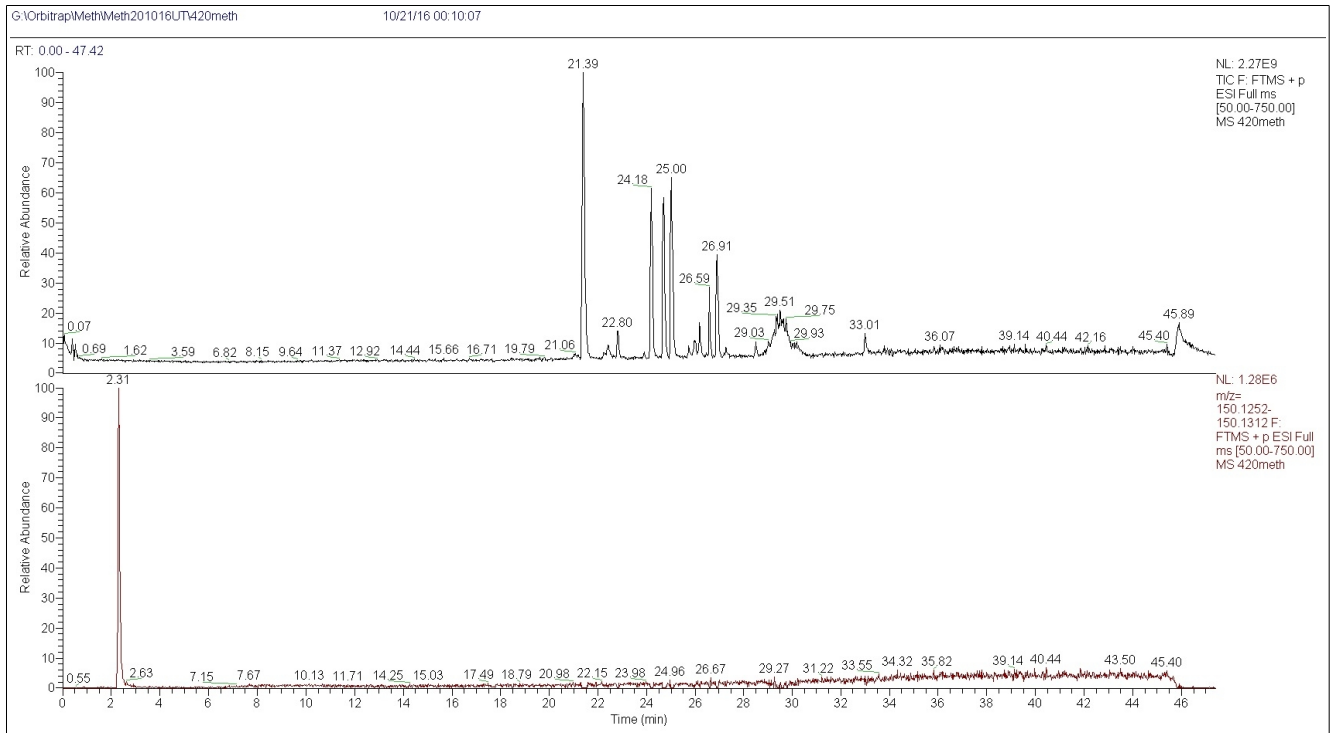
**Appendix 1.5**

**A) Green Kleen 420-4 blank TIC and methamphetamine extracted ion chromatogram.**



No methamphetamine present.

**B) Green Kleen 420-4 4 h treated methamphetamine solution TIC and methamphetamine extracted ion chromatogram.**



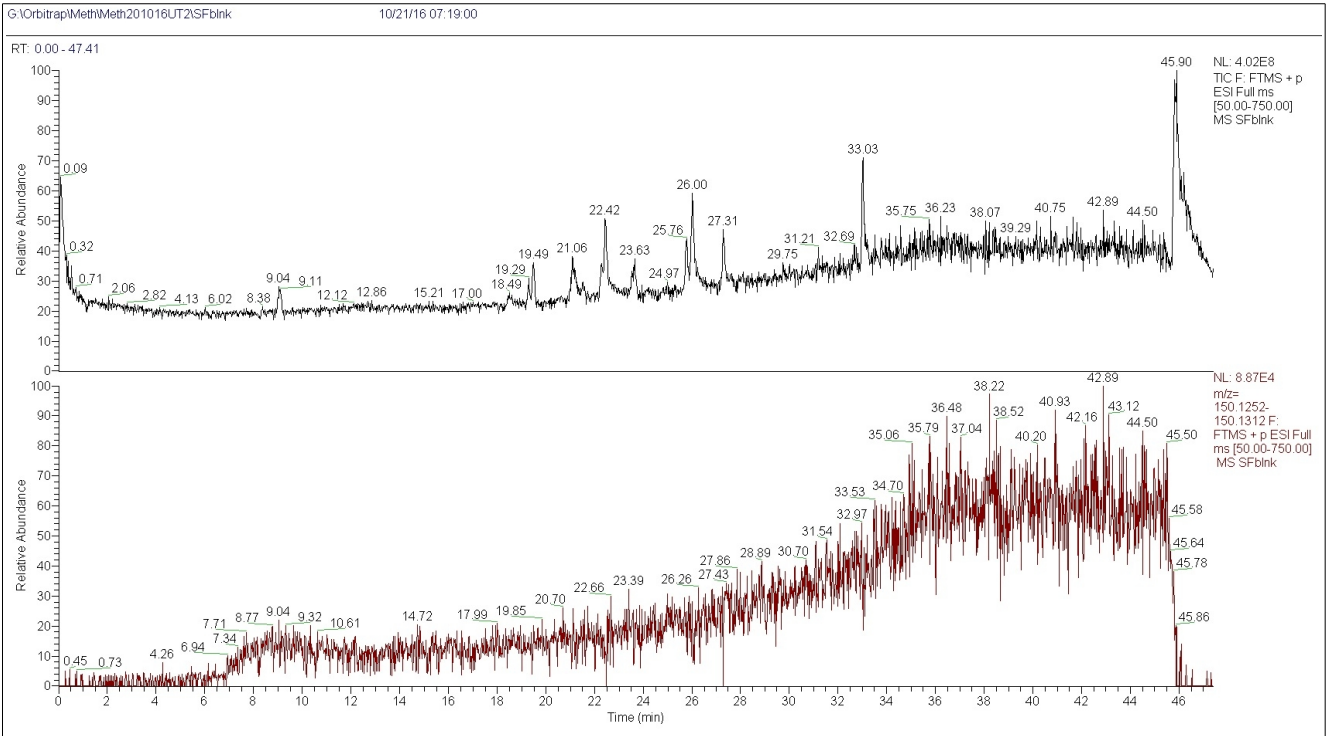
Methamphetamine present at 2.31 min.

Methamphetamine Cleaning Products – Non-Routine ref: 1663973



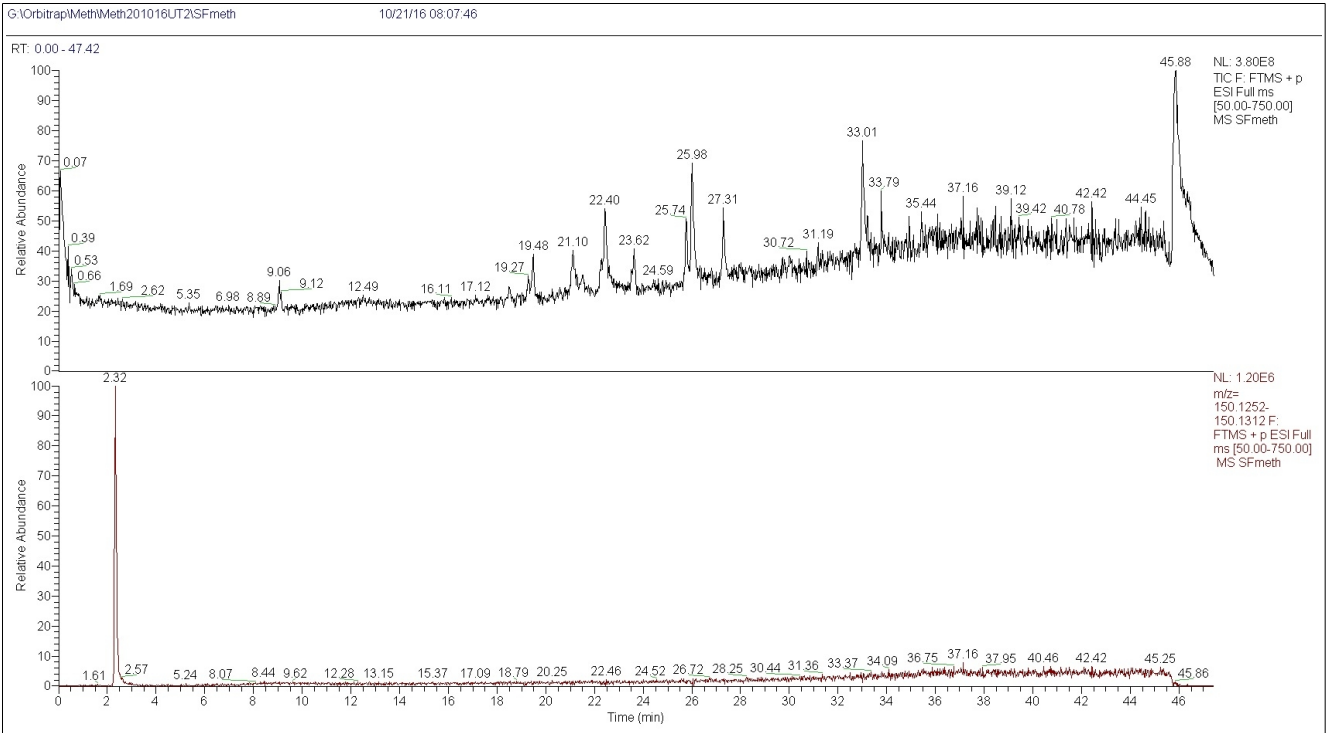
**Appendix 1.6**

**A) Strike Force blank TIC and methamphetamine extracted ion chromatogram.**



No methamphetamine present.

**B) Strike Force 4 h treated methamphetamine solution TIC and methamphetamine extracted ion chromatogram.**



Methamphetamine present at 2.32 min.

Methamphetamine Cleaning Products – Non-Routine ref: 1663973



Appendix 1.7

Crystal Clean SDS – Chemical Composition Information

EFT Holdings, Inc.		MATERIAL SAFETY DATA SHEET		EFFECTIVE DATE: January 22, 2007	
CREATION DATE: 1/19/07		NAME OF FINISHED SOLUTION: Crystal Clean 200-3313		REVISION DATE: 03/22/13	
TRADE NAMES/SYNONYMS: Crystal Clean® Methamphetamine Decontaminant					
EMERGENCY TELEPHONE NUMBER: 24 Hour Emergency Assistance: ChemTrec: 800-424-9300; 703-527-3887					
MANUFACTURER'S NAME & ADDRESS: Intelagard, Inc. 1275 Rock Creek Circle Lafayette, CO 80026 - (303) 309 - 6309					
SECTION I: MATERIAL IDENTIFICATION					
Name & Part Number of Individual Component		Part One 3000		Part Two 0300	
SECTION II: COMPOSITION & INFORMATION ON INGREDIENTS					
EXPOSURE LIMITS: COMPONENT CAS# QUANTITY %	Quaternary Ammonium Compounds, CAS: 68424-65-1 5.5-6.5% Benzyl-C12-C16 Alkyl Dimethyl Chlorides, CAS: 68424-65-1 5.5-6.5%				
OSHA PEL-ppm mg/m3, AGIH TLVppm/mg/m3	1 - OSHA PEL-ppm, 1 - AGIH TLVppm				
COMPONENT CAS# QUANTITY %	Quaternary Ammonium Compounds, N,N,N,N - Tetramethyl-N Tallow Alkyl-trimethylendecyl Chlorides, CAS: 68501-29-4 1.5-2.5%				
OSHA PEL-ppm mg/m3, AGIH TLVppm/mg/m3	1 - OSHA PEL-ppm, 1 - AGIH TLVppm				
INERT INGREDIENTS wt. %:					
Balance of formula					
SECTION III: PHYSICAL DATA					
BOILING POINT:	200F				
FREEZING POINT:	26F				
SPECIFIC GRAVITY (H2O=1):	1.09 g/cc; 9.255 Lb/gal; (Finished Blend 1.075 g/cc; 8.971 Lb/gal)				
EVAPORATION RATE:	NA				
SOLUBILITY IN WATER:	Complete				
PH:	10.5-10.7; (Finished Blend, 9.6-9.9)				
APPEARANCE:	Clear, pale yellow liquid				
ODOR:	Sweet, soapy				
VAPOR PRESSURE (mmHg):	1, 0, 0, 0				
VAPOR DENSITY (AIR=1):	1, 0, 0, 0				
Haz. Rate: Health, Fire, React, Personal Protection	1, 0, 0, 0				
SECTION IV: FIRE & EXPLOSION DATA					
FIRE AND EXPLOSION HAZARDS:					
Low fire hazard. In a fire, overheated sealed containers may explode from overpressure.					
EXTINGUISHING MEDIA:					
FLASH POINT:					
NONE, by Cleveland open cup					
FIRE FIGHTING:					
Move container from fire area if it can be done without risk. Cool well after the fire is out. Reduce vapors with water spray. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.					
SECTION V: HEALTH HAZARD DATA					
EYE:					
Contact with eyes may cause irritation; prolonged eye contact may cause permanent damage.					
SKIN:					
Prolonged contact with skin may cause irritation					
INGESTION:					
Can cause damage to mucous membranes. Strong emetic, may cause vomiting and nausea for 24hrs					
INHALATION:					
No known effects. Aspiration of liquid into respiratory passages may cause damage to mucous membranes.					
CARCINOGENICITY:					
This product or (components of its mixture) is not listed in AARC Monograph, the NTP Sixth Annual Report or the current ACGIH TLVs as a carcinogen or potential carcinogen.					
EMERGENCY AND FIRST AID PROCEDURES:					
EYE CONTACT:					
Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.					
SKIN CONTACT:					
Flush with cool running water. If irritation develops get medical attention.					
Flush with cool running water. If irritation develops get medical attention					
Immediately flush eyes with plenty of water for at least 15 minutes. Then get occasionally lifting the upper and lower eyelids. Then get immediate medical attention.					
Immediately wash skin with soap and copious amounts of water while removing contaminated clothing and shoes. Wash contaminated clothing before reuse. If irritation develops get medical attention.					



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**Appendix 1.8**

## Green Kleen 420-4 SDS - Chemical Composition Information

**SECTION 1: PRODUCT AND COMPANY IDENTIFICATION**Product Name: **GREEN KLEEN 420-4**

Revision Date: February 23 2015

Chemical Description: Surfactant based cleaner

## Manufacturer Information;

IndusCo, Ltd.  
 2319 Joe Brown Drive  
 Greensboro, NC 27405  
 Main Telephone No. 336-375-7555  
 CHEMTREC-For Emergencies Only 1-800-262-8200 (24 hours)

**COMPOSTION/INFORMATION ON INGREDIENTS**

<u>Ingredient</u>	<u>CAS #</u>	<u>Percent by Weight</u>
Alkyl phenol ethoxylate	26027-38-3	0.25-1.0
Quaternary ammonium compound	68391-01-5, 68956-79-6	0.25-1.0

**PHYSICAL AND CHEMICAL PROPERTIES**

Physical State	Liquid
Color	Light green
Odor	Floral
pH	12.0-12.5
Specific Gravity	1.01
Flash Point	None
Solubility	Soluble in cold or hot water

**CHEMICAL STABILITY AND REACTIVITY**

Chemical Stability           Material is stable under normal conditions.  
 Conditions to Avoid           None known.

Incompatible Materials   Inorganic acids and bases. Avoid contact with oxidizing agents (for example, nitric acid, peroxides, and chromates.)

Hazardous Decomposition Products           Carbon monoxide. Organic compounds which may be toxic.  
 Hazardous Polymerization           Hazardous polymerization will not occur.

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*

## **Appendix 1.9**

### **Strike Force SDS – Chemical Composition Information**

**Product Name** *Strike Force*

#### **PRODUCT AND COMPANY IDENTIFICATION**

**Recommended use:** Heavy duty and general-purpose cleaner degreaser

**Company Details:** Advance International Cleaning System

**Address:** 663 Great South Road, Penrose

Auckland. New Zealand

**Telephone Number:** +64 9 525 3792

**Emergency Telephone Number:** National Poison Information Centre 0800 764 766

**Date of Preparation:** 1/11/2012

#### **COMPOSITION/INFORMATION ON INGREDIENTS**

**Ingredient CAS # Concentration %**

Non hazardous >75

Anionic surfactant <5

Non ionic surfactant <5

Benzenesulphonic acid 1300-72-2 <5

2 bytoxy –1 ethanol 111-76-2 <10

Phosphate 7758-29-4 <5

#### **PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance:** Clear pink

**Physical State:** Liquid

**Odour:** Odourless

**pH:** 10..5 +/- 0.5

**Solubility:** soluble in water

**Vapour Density:** Not available

**Boiling point:** >100 deg

**Freezing Point:** degree

**Ignition Point:** Not available

**Flash Point:** Not available

**Specific Gravity:** 1.00

**Vapour pressure:** Not available

**% Volatilities**

#### **STABILITY AND REACTIVITY**

**Chemical Stability:** Stable at room temperature and pressure

**Conditions to avoid:** Avoid excessive heat, direct sunlight, moisture, high temperatures

**Incompatible Materials:** Incompatible with oxidizing agents, acidic agents, including acidic clays and sources of ignition

**Hazardous decomposition:** When involved in a fire, this product will generate carbon monoxide

**Hazardous reactions:** Oxidizing agents, mineral acids, halogenated organic compounds.

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*

<b>Description:</b>	Crystal Clean Product – Non-Routine Experiment		
<b>Client</b>	Tech Consulting	<b>Contact:</b>	Don McNaughton
<b>Client Reference:</b>	Methamphetamine Decontamination Agent Investigation	<b>Date:</b>	09 November 2016
<b>Hills Reference:</b>	1663973	<b>Analyst:</b>	Jared Loader Cherie Boulton

## Scope

Investigate chemical removal and subsequent degradation products of methamphetamine by “Crystal Clean”, a 3 part component US cleaning product supplied by the client.

This is an extension of the original investigative work (Report supplied 01/11/16) and was performed on higher methamphetamine solution concentrations of 10 mg/L (parts per million or ppm).

Two tests were conducted. Firstly using the full Crystal Clean system, mixed according to the manufacturer’s label instructions, and secondly using only part 2 of the Crystal Clean system containing hydrogen peroxide at 7.9% (refer SDS Appendix 1.8).

Each Crystal Clean test solution was subjected to the following testing scheme,

- 1:1 mixtures of Test Solution:Methamphetamine were created by adding 500 µL of test solution to 500 µL of a 20 mg/L methamphetamine solution, resulting in a 10 mg/L solution concentration of methamphetamine.
- Solutions were mixed and stood at room temperature. Sub-samples were taken for analysis immediately upon mixing (t=0), and after 1 (t=1) and 4 (t=4) hour time periods. Samples were diluted 10 fold prior to analysis to avoid damaging the scientific instrumentation with the high surfactant levels present in the cleaning products.
- The level of methamphetamine injected onto instrument “at analysis” was *ca.* 1 mg/L.
- Samples underwent 'untargeted' analysis on a Thermo QExactive Orbitrap for the presence of methamphetamine and any methamphetamine reaction products. Quantitation to external calibration standards was not performed.

## Analysis and Identification

Samples underwent chromatographic separation on a C18 analytical column using an Ultra-High Performance Liquid Chromatography (UPLC) system coupled to a Thermo QExactive Orbitrap mass spectrometer (a High Resolution Accurate Mass instrument). Analytes were detected in full-scan mode with rapid positive/negative switching and concurrent detection using the collision cell of the QExactive Orbitrap mass spectrometer.

The Thermo QExactive Orbitrap mass spectrometer was operated with a resolving power of 70,000 FWHM, and the instrument is capable of external mass accuracy <5 ppm RMS. It is this high resolution and accurate mass which give the ability to distinguish between compounds of similar nominal masses.

Requested metabolites (refer Appendix 1.1), were extracted from their respective untargeted analyses via their protonated and deprotonated molecular ions.

## Results

### Crystal Clean 'Part 2 Component' – Hydrogen Peroxide

It was envisaged that treatment of methamphetamine with only Crystal Clean part 2 would simplify the reaction mixture and the identification of degradation products.

The active ingredient in Crystal Clean part 2 is listed on the container label as 'Liquid Hydrogen Peroxide 7.9%' (Appendix 1.8). Hydrogen peroxide is known to degrade methamphetamine via the formation of *N*-hydroxy, *N*-oxide and phenyl ring-hydroxy oxidation products (Tanaka *et al.* 2001).

Treatment of methamphetamine with only Crystal Clean part 2 resulted in no observable methamphetamine chemical removal or breakdown across a 4 hour time period. Levels of methamphetamine from t=0 to t=4 remained constant. No methamphetamine reactions products were observed or identified.

This result was unexpected. It is assumed that the hydrogen peroxide contained in Crystal Clean Part 2 is stabilised and not available to oxidise methamphetamine until activation via mixing with Crystal Clean parts 1 and 3.

### **Crystal Clean**

Treatment of methamphetamine with the full Crystal Clean system resulted in complete degradation or irreversible binding of parent methamphetamine after 4 hours. It is evident from Table 1 that parent methamphetamine was rapidly removed. This is consistent with our previous experimentation observations.

**Table 1: Percent methamphetamine (relative to t=0) remaining after treatment with Crystal Clean.**

Sub-sample	Description	Methamphetamine Percent
t=0	Time zero sub-sample	100%
t=1	1 hour sub-sample	17%
t=4	4 hour sub-sample	0%

### **Crystal Clean Metabolites**

Interrogation of the data identified a peak (metabolite A) with an  $m/z$  166.12 at 8.1 min the t=0 chromatogram. Metabolite A was also present in the t=1 and t=4 chromatograms. The relative peak area decreased across the 4 hour time period from t=0 (100% relative) to t=1 (56%) to t=4 (2.5%), and is presented in Table 2.

**Table 1: Percent  $m/z$  166.12 metabolite (relative to t=0).**

Sub-sample	Description	$m/z$ 166.12 Metabolite A percentage
t=0	Time zero sub-sample	100%
t=1	1 hour sub-sample	56%
t=4	4 hour sub-sample	2.5%

This observation indicates metabolite A is rapidly formed and then degrades or undergoes conversion to further metabolite(s). Chromatograms of Crystal Clean blank, and methamphetamine treated time periods t=0, 1 and 4 hours are presented in Appendices 1.2 – 1.5. The chromatograms illustrate the appearance and disappearance of Metabolite A from t=0 to t=4 and the disappearance of methamphetamine from t=0 to t=4.

It is believed the  $m/z$  166.12 ion exhibited by metabolite A is a positive protonated molecular ion  $[M+H]^+$ , and is consistent with the addition of an oxygen atom to methamphetamine (via oxide or hydroxyl formation). Common hydroxylated methamphetamine analogues are (*para*-, *meta*- and *ortho*-) ring-hydroxy methamphetamines, ephedrine and pseudoephedrine, and *N*-hydroxy, *N*-oxide methamphetamine. Observed and expected mass spectral structural fragments for methamphetamine, ring-hydroxy methamphetamines, ephedrine and pseudoephedrine are presented in Appendix 1.6.

The mass spectral fragmentation pattern observed for Metabolite A is presented in Appendix 1.7 and is consistent with *N*-oxide or *N*-hydroxyl formation. These observations are consistent with Tanaka *et al.* (2001) where hydrogen peroxide treated methamphetamine resulted initially in the formation of *N*-hydroxy

*Methamphetamine Cleaning Products – Non-Routine ref: 1663973*

and/or *N*-oxide methamphetamine before converting (within 24h) to *para*-, *meta*- and *ortho*-hydroxy methamphetamine products.

In this current work however no evidence of any ring-hydroxy methamphetamine metabolites were observed from the degradation of metabolite A. In addition, the retention time of the Metabolite A (8.1 min) is later than parent methamphetamine (3.6 min), whereas Tanaka *et al.* (2001) observed earlier elution of methamphetamine hydroxylated metabolites. Although inconsistent, the reaction mixtures of Tanaka *et al.* (2001) were closely controlled clean solutions consisting of only methamphetamine and hydrogen peroxide. The experiment conducted herein is complicated by the presence of a complex mix of surfactants and proprietary ingredients contained in Crystal Clean which could effect metabolite solution interactions, chromatographic separation, retention times and masking of metabolites by surfactants and binding agents.

The mass spectral data obtained for Metabolite A is consistent with an *N*-hydroxy or *N*-oxide methamphetamine derivative and that its chromatographic retention time is later than expected due to interactions with Crystal Clean components.

No other metabolites corresponding to the requested metabolites list were identified.

No other methamphetamine oxidative or degradation products have currently been identified from the untargeted analyses performed.

## Summary

Treatment of methamphetamine at 10 mg/L with the complete Crystal Clean system identified an *N*-hydroxy or *N*-oxide methamphetamine derivative, consistent in chemical structure to that previously reported in literature. This compound was rapidly formed and then diminished over a 4 hour time period. Parent methamphetamine was completely removed within 4 hours, presumably through peroxide initiated oxidative degradation or irreversible binding to components contained within Crystal Clean.

Treatment of methamphetamine at 10 mg/L with only part 2 of the Crystal Clean system, containing 7.9% liquid hydrogen peroxide, resulted in no methamphetamine breakdown or removal over a 4 hour time period. This indicates stabilisation of the hydrogen peroxide in Crystal Clean part 2, and activation occurs upon mixing with parts 1 and 3.

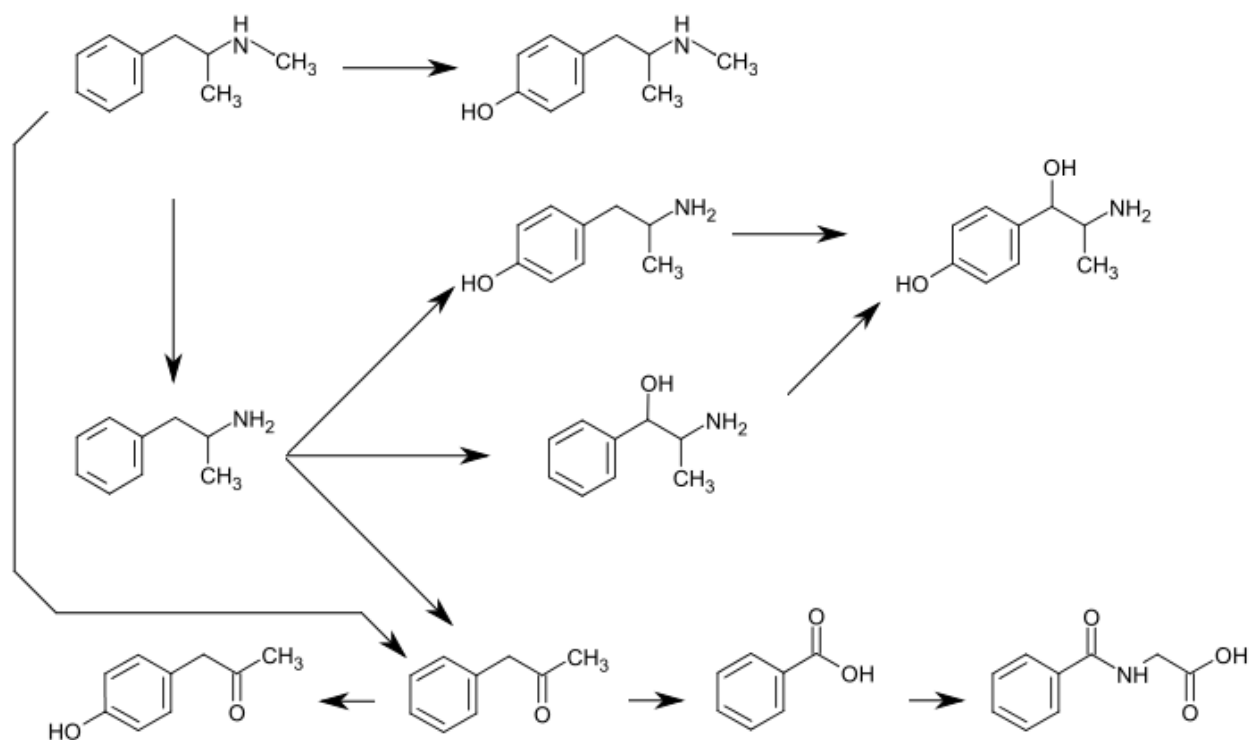
## References

Tanaka S1, Iio R, Chinaka S, Takayama N, Hayakawa K.; Identification of reaction products of methamphetamine and hydrogen peroxide in hair dye and decolorant treatments by high-performance liquid chromatography/mass spectrometry; *Biomedical Chromatography*. 2001 Feb;15(1):45-9.

## Appendices

### Appendix 1.1

Supplied Metabolic Pathway and Requested List of Metabolites

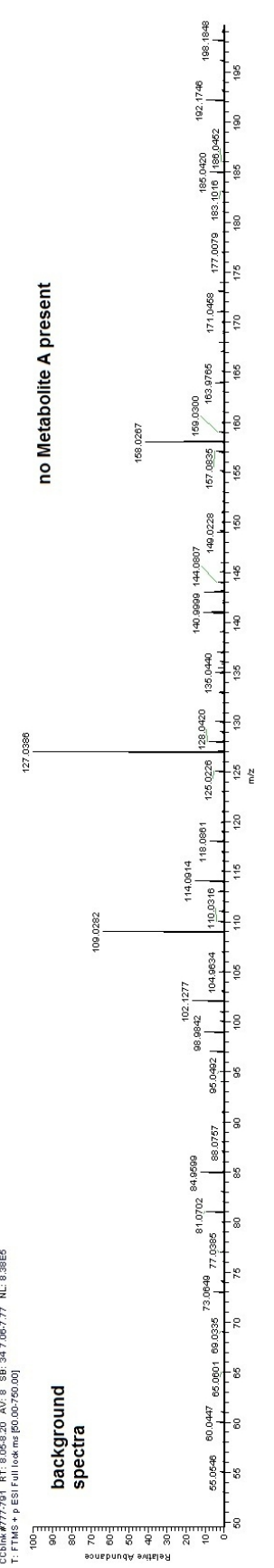
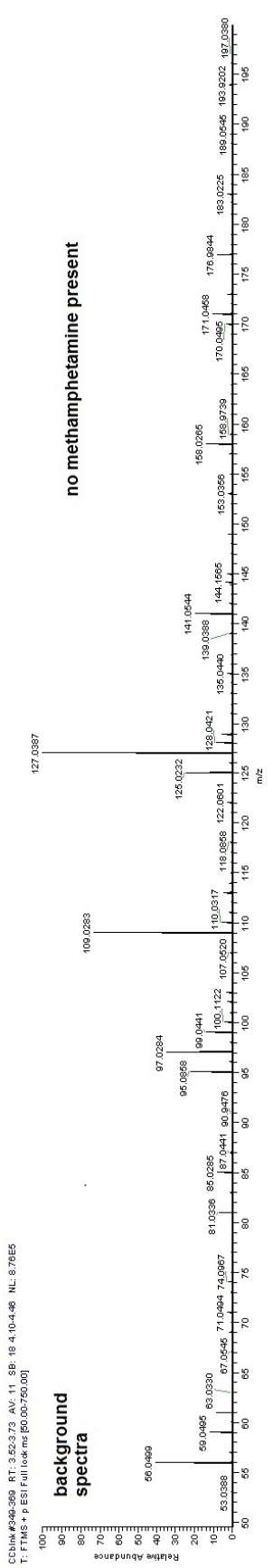
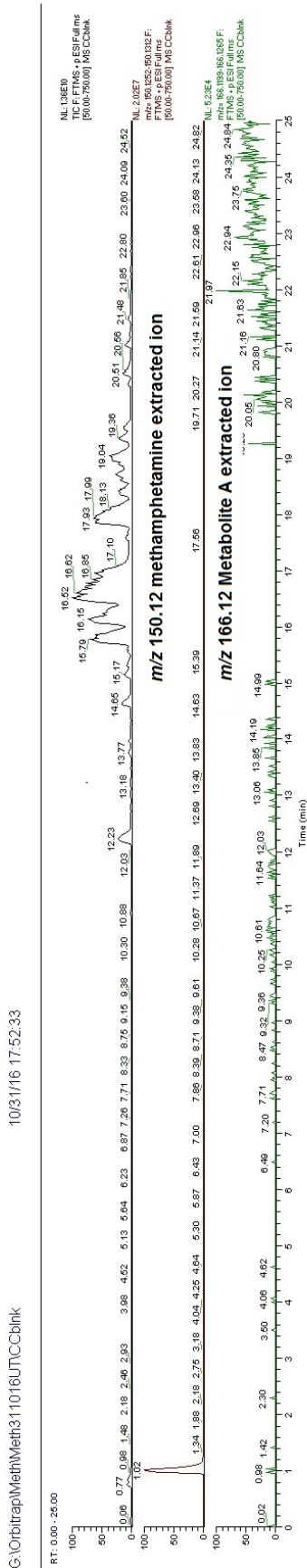


	Name	CAS#	Monoisotopic Mass
1	Methamphetamine	537-46-2	149.12045
2	Amphetamine	300-62-9	135.1048
3	4-hydroxymethamphetamine	370-14-9	165.11536
4	3,4-dihydroxymethamphetamine	-	181.1103
5	4-hydroxyamphetamine	1518-86-1	151.0997
6	phenylacetone	103-79-7	134.0732
7	4-hydroxyphenylacetone	770-39-8	150.0681
8	Phenol	108-95-2	94.04186
9	Benzoic acid	65-85-0	122.03678

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**Appendix 1.2**

Total Ion Chromatogram for Crystal Clean blank. Methamphetamine and Metabolite A extracted [M+H]<sup>+</sup> ions presented and background fragmentation at respective retention times (RT).



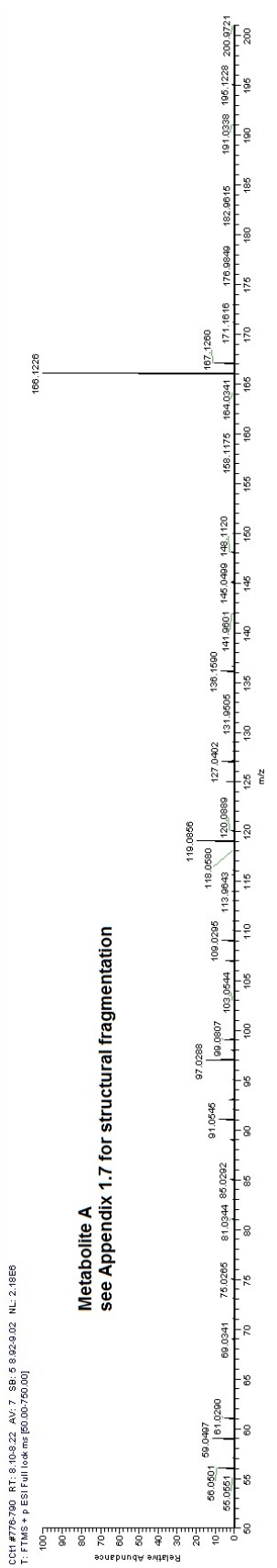
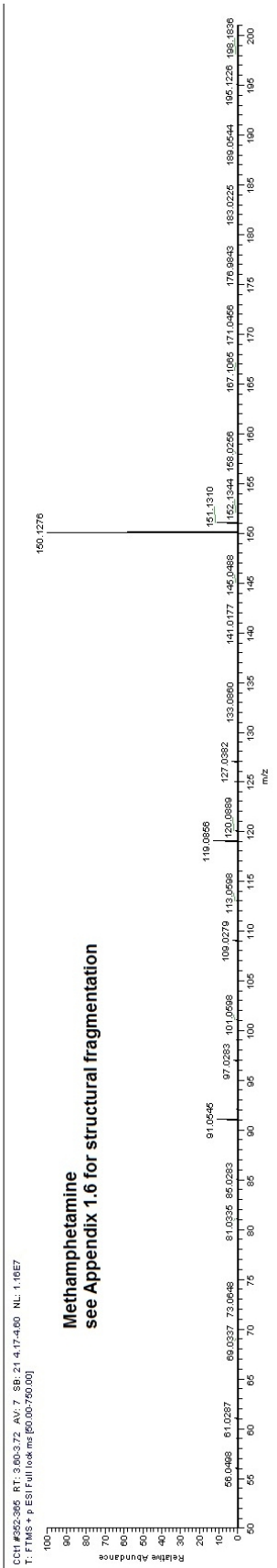
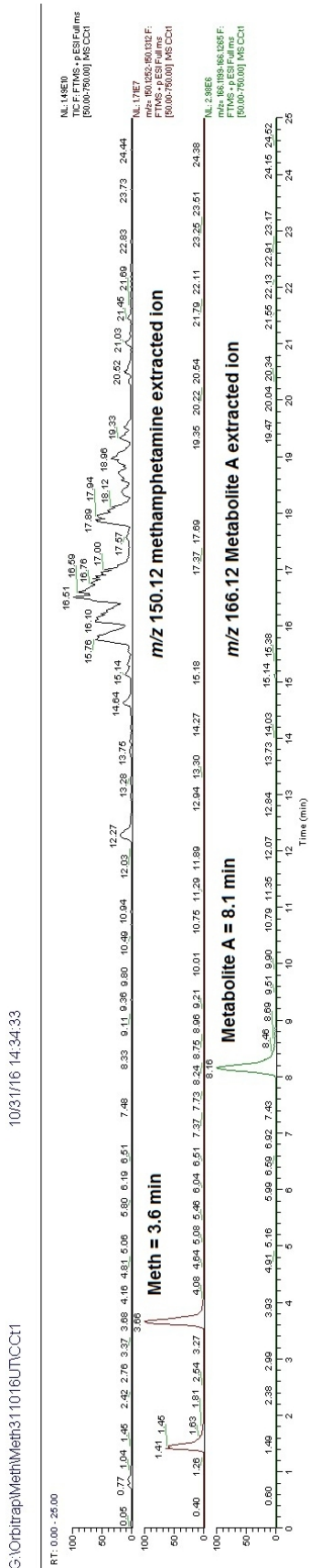




Methamphetamine Cleaning Products – Non-Routine ref: 1663973

**Appendix 1.4**

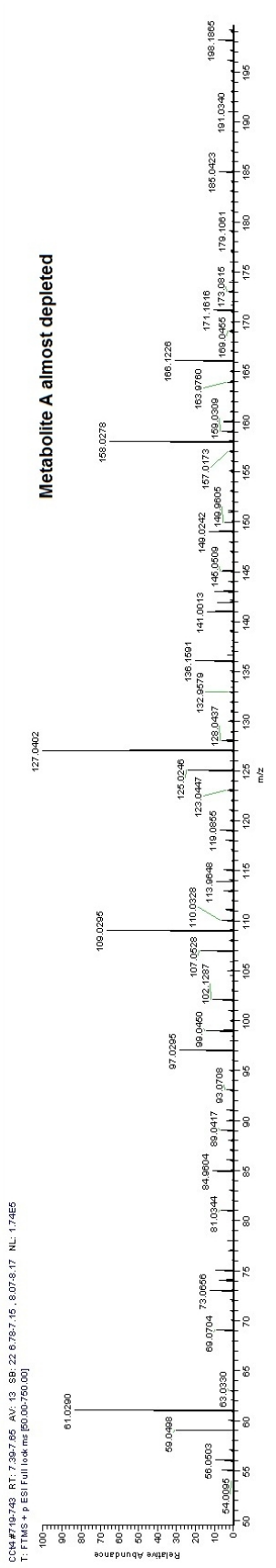
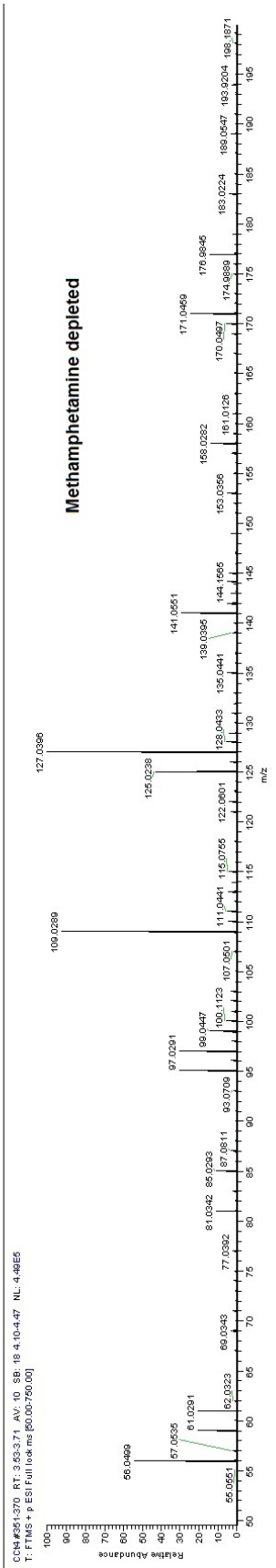
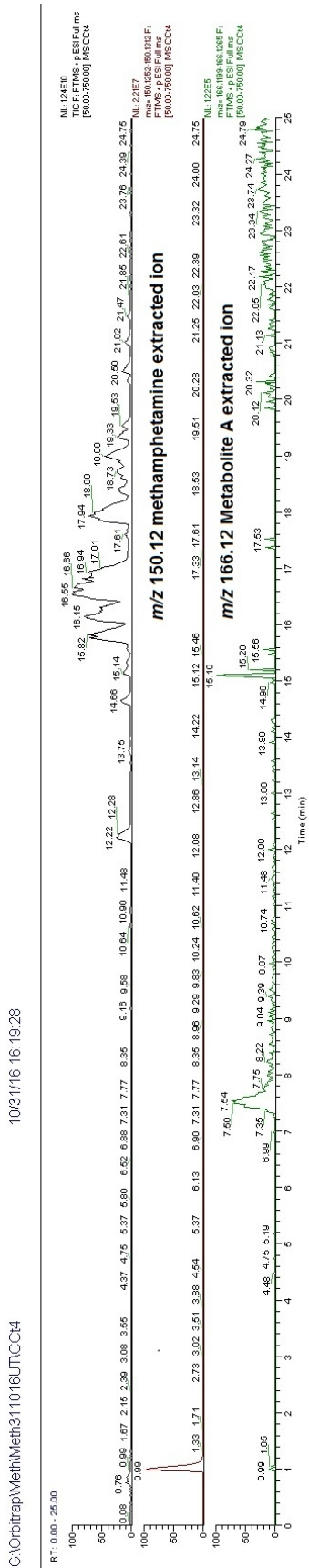
Total Ion Chromatogram for Crystal Clean reaction mixture at t=1. Methamphetamine and Metabolite A extracted [M+H]<sup>+</sup> ions presented as well as respective fragmentation patterns.



Methamphetamine Cleaning Products – Non-Routine ref: 1663973

**Appendix 1.5**

Total Ion Chromatogram for Crystal Clean reaction mixture at t=4. Methamphetamine and Metabolite A extracted [M+H]<sup>+</sup> ions presented as well as fragmentation patterns at respective RT.

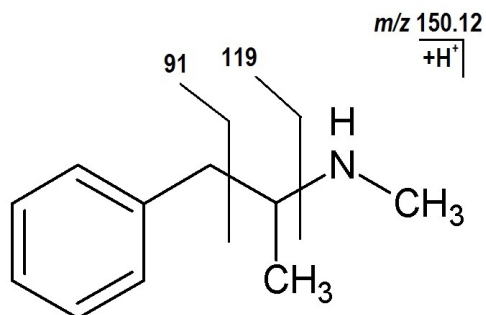


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### Appendix 1.6

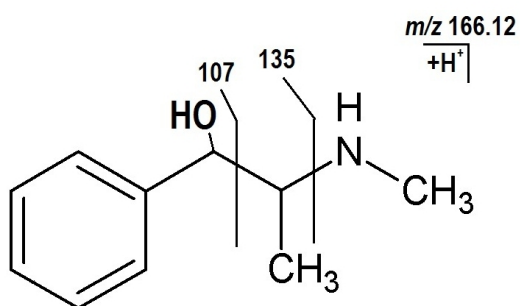
Mass spectral observed and expected fragmentation patterns for A) methamphetamine, and B) ring-hydroxy methamphetamines, ephedrine and pseudoephedrine.

A) Methamphetamine

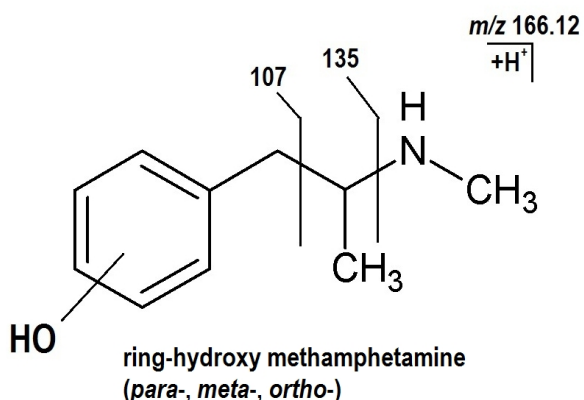


Methamphetamine

B) Ring-hydroxy methamphetamine, ephedrine and pseudoephedrine



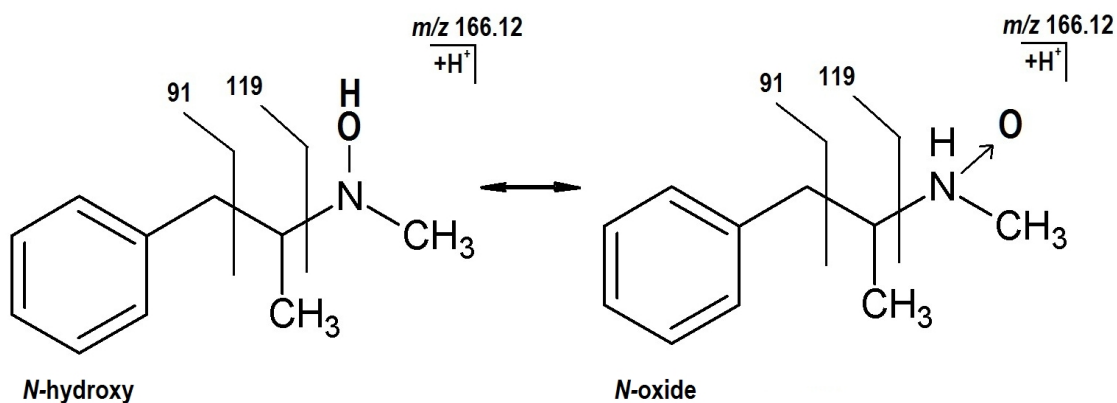
pseudoephedrine/ephedrine



ring-hydroxy methamphetamine  
(*para*-, *meta*-, *ortho*-)

### Appendix 1.7

Mass spectral observed fragmentation of Metabolite A.



N-hydroxy

N-oxide



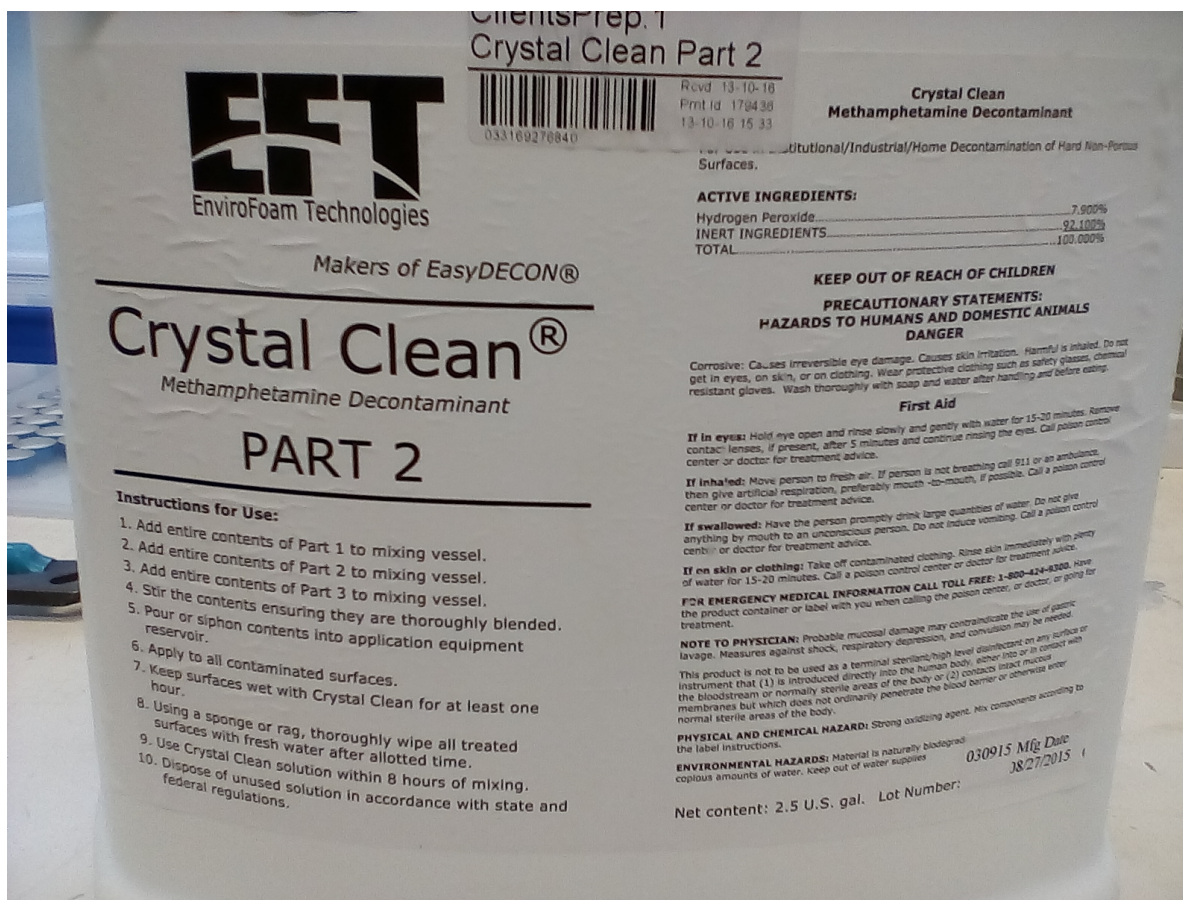
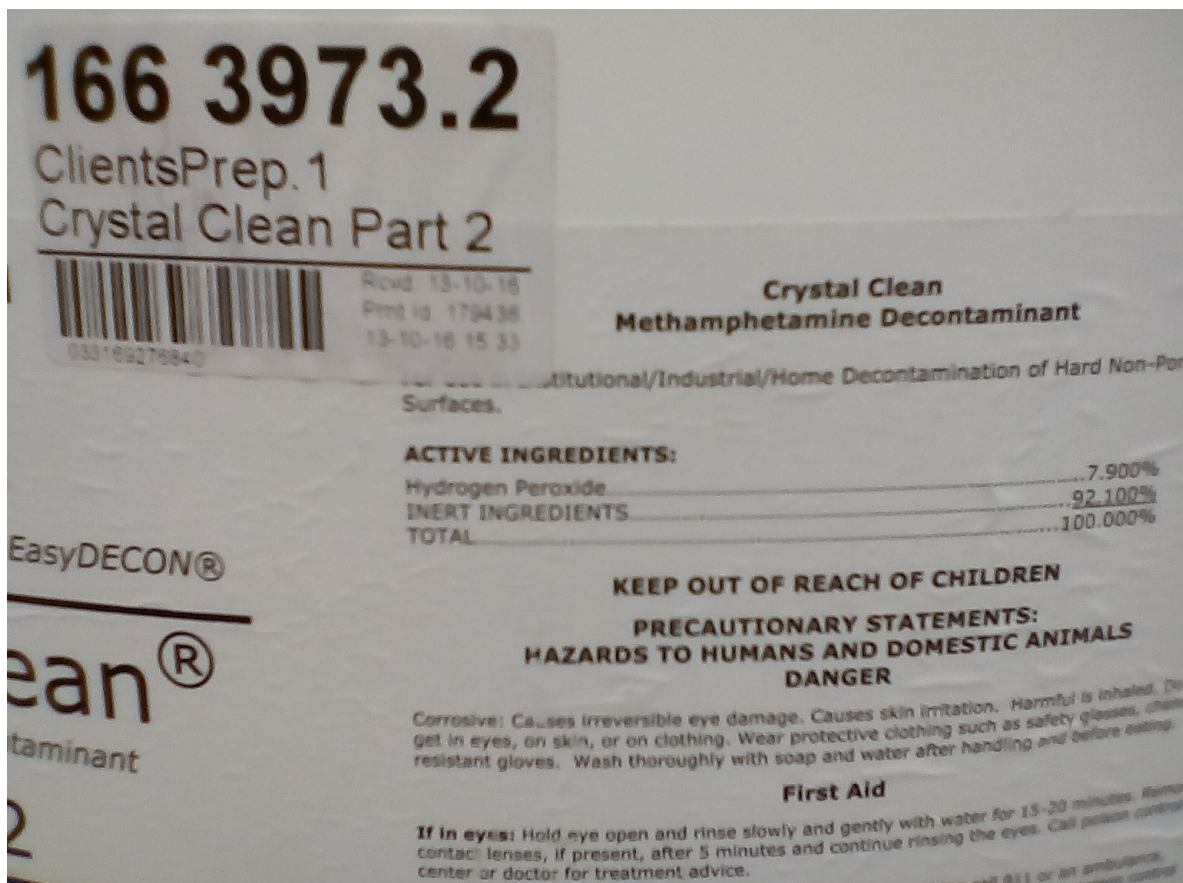
Methamphetamine Cleaning Products – Non-Routine ref: 1663973

**Appendix 1.8**

A) Crystal Clean SDS – Chemical Composition Information

EFT Holdings, Inc.	MATERIAL SAFETY DATA SHEET	EFFECTIVE DATE: January 22, 2007
CREATION DATE: 1/19/07	NAME OF FINISHED SOLUTION: Crystal Clean 200-3313	REVISION DATE: 03/22/13
TRADE NAMES/SYNONYMS: Crystal Clean® Methamphetamine Decontaminant		
EMERGENCY TELEPHONE NUMBER: 24 Hour Emergency Assistance: ChemTrec: 800-424-9300; 703-527-3887		
MANUFACTURER'S NAME & ADDRESS: General MSDS Assistance: Intelagard, Inc. 1275 Rook Creek Circle Lafayette, CO 80026 - (303) 309 - 6309		
SECTION I: MATERIAL IDENTIFICATION		
Name & Part Number of Individual Component	Part One 3000	Part Three- 0010
<b>SECTION II: COMPOSITION &amp; INFORMATION ON INGREDIENTS</b>		
EXPOSURE LIMITS: COMPONENT/CASE#/QUANTITY %		
OSHA PEL-ppm mg/m3, AGH TLVppm/mg/m3	Quaternary Ammonium Compounds, Benzyl-C12-C16 Alkyl Dimethyl Chlorides: CAS : 68424-85-1 5.5-8.5%	Liquid Hydrogen Peroxide, CAS: 7722-84-1 <math>4-8.0\%</math>
COMPONENT/CASE#/QUANTITY %	1 - OSHA PEL-ppm , 1 - AGH TLVppm Quaternary Ammonium Compounds: N,N,N',N' - Pentamethyl-N Talow Alkyl- trimethylbenzyl Chlorides, CAS: 68807-29-4 1.5-2.5%	1 - OSHA PEL-ppm , 1 - AGH TLVppm
OSHA PEL-ppm mg/m3, AGH TLVppm/mg/m3	1 - OSHA PEL-ppm , 1 - AGH TLVppm	
<b>SECTION III: PHYSICAL DATA</b>		
BOILING POINT:	200F	
FREEZING POINT:	26F	
SPECIFIC GRAVITY (H2O=1):	1.09 g/cc; 9.255 Lb/gal; (Finished Blend 1.075 g/cc, 8.971 Lb/gal)	
EVAPORATION RATE:	NA	1.18 g/cc; 9.875 Lb/gal
SOLUBILITY IN WATER:	Complete	NA
PH:	10.5-10.7; (Finished Blend, 9.6-9.9)	Miscible
APPEARANCE:	Clear, pale yellow liquid	Neutral
ODOR:	Sweet, soapy	Colorless liquid
VAPOR PRESSURE (mmHg):		Solvent odor
VAPOR DENSITY (air=1):		<math>< 1 \text{ mm @ } 20\text{C}</math>
Haz Rate: Health, Fire, React, Personal Protection	1, 0, 0, 0	
<b>SECTION IV: FIRE &amp; EXPLOSION DATA</b>		
FIRE AND EXPLOSION HAZARDS:	Low fire hazard. In a fire, overheated sealed containers may explode from overpressure.	Emits carbon monoxide and dioxide
EXTINGUISHING MEDIA:	None, by cleveand open cup	Water, CO2, dry chemical, alcohol or polymer foam
FLASH POINT:	None	141C (Open Cup), 146C COC
FIRE FIGHTING:	Move container from fire area if it can be done without risk. Cool well after the fire is out. Reduce vapors with water spray. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.	If excessive smoke, or fumes are encountered, wear self-contained breathing apparatus and protective clothing. Material decomposes at 250-280C.
<b>SECTION V: HEALTH HAZARD DATA</b>		
EYE:	Contact with eyes may cause irritation; prolonged eye contact may cause permanent damage.	Material causes irritation.
SKIN:	Prolonged contact with skin may cause irritation	Material causes skin irritation. May be harmful by skin absorption
INGESTION:	Can cause damage to mucous membranes. Strong emetic, may cause vomiting and nausea for 24hrs	May be harmful by ingestion.
INHALATION:	No known effects. Aspiration of liquid into respiratory passages may cause damage to mucous membranes.	May cause respiratory tract irritation
CARCINOGENICITY:	This product or (components of its mixture) is not listed in IARC Monograph, the NTP Sixth Annual Report or the current ACGIH TLV's as a carcinogen or potential carcinogen.	
<b>EMERGENCY AND FIRST AID PROCEDURES:</b>		
EYE CONTACT:	Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.	Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Then get immediate medical attention.
SKIN CONTACT:	Flush with cool running water. If irritation develops get medical attention.	Immediately wash skin with soap and copious amounts of water while removing contaminated clothing and shoes. Wash contaminated clothing before reuse. If irritation develops get medical attention.

B) Crystal Clean Part 2 – Label photographs of ingredients



# TECH CONSULTING



*Wide acceptance of an idea is not proof of its validity*

## Summary of the report supplied to Extreme Cleaning Solutions Ltd Auckland NZ November 2016.

### Scope

Investigate chemical removal and subsequent degradation products of methamphetamine by client supplied cleaning products. The three cleaning products supplied were:

1. Crystal Clean (3 part component US product)
2. Green Kleen 420-4 (Single component US product)
3. Strike Force (Single component NZ product)

Tests were conducted using solutions of each product according to the manufacturer's label instructions.

For each cleaning product was subjected to the following testing scheme,

1. Methamphetamine was added to working solutions of each cleaning product to create a 1000 µg/L (parts per billion or ppb) solution of methamphetamine.
2. Solutions were stood at room temperature with sub-samples removed for analysis after 4 and 24 hour time periods. These sub-samples were diluted 100 fold prior to analysis
3. Control solutions of methamphetamine were subjected to the same protocol.
4. Samples underwent 'targeted' analysis for the presence of methamphetamine and quantitated against standard calibration curves.
5. Samples then underwent 'untargeted' analysis in order to identify any methamphetamine reaction products.
6. To assist in identifying any methamphetamine reaction products, deuterium labelled methamphetamine (methamphetamine-d9) was used to prepare identical experimental solutions as outlined above, and subjected to the same processes as outlined above. (Deuterium labelled methamphetamine does not occur naturally.)

### Analysis and Identification

An Ultra-High Performance Liquid Chromatography (UPLC) system was used to separate the different compounds. This system was coupled to a High Resolution Accurate Mass Spectrometer instrument) which identifies and quantitates the compounds. Analytes were detected in full-scan mode. Quantification of methamphetamine and methamphetamine-d9 were performed against authentic analytical pure standards.

The recognised metabolic pathways for the degradation of methamphetamine have been published in peer reviewed literature. The metabolites of methamphetamine identified for this work are listed below.

#### List of Metabolites from the Metabolic Pathway

	Name	CAS#	Mono-isotopic Mass
1	Methamphetamine	537-46-2	149.12045
2	Amphetamine	300-62-9	135.1048
3	4-hydroxymethamphetamine	370-14-9	165.11536
4	3,4-hydroxymethamphetamine	-	181.1103
5	4-hydroxyamphetamine	1518-86-1	151.0997
6	phenylacetone	103-79-7	134.0732
7	4-hydroxyphenylacetone	770-39-8	150.0681

The selected degradation compounds (metabolites) were extracted from their respective untargeted analyses via the protonated molecular ion ([M+H]<sup>+</sup>) and individually presented as a relative percent abundance.

**Results:** The results for the 3 products supplied are each reported below for methamphetamine and degradation metabolites separately.

**[A] Crystal Clean Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Crystal Clean are presented in Table 1

**Table 1: Methamphetamine levels in standard controls and after treatment with Crystal Clean.**

Reference	Description	Meth conc.[µg/L]	Meth-d9 conc.[µg/L]
<b>Control Standards</b>			
	Standard Controls 4h	9.7	9.9
	Standard Controls 24h	10.2	10.2
<b>Crystal Clean</b>			
	CC blank 4h	0	0
	CC treatment 4h	0	0
	CC blank 24h	0	0
	CC treatment 24h	0	0

These results indicate complete degradation or irreversible binding of parent methamphetamine and the methamphetamine-d9 after 4 hours and 24 hours.

**[B] Crystal Clean Metabolites**

Relative % levels of methamphetamine metabolites from the untargeted Crystal Clean analysis are presented in Table 2. Metabolites were extracted based on their protonated molecular ion masses. No methamphetamine or requested metabolites were present.

**Table 2: Relative levels in of requested metabolites present in Crystal Clean treatments.**

Name	CAS#	[M+H] <sup>+</sup> extracted ion	% Found
Methamphetamine	537-46-2	150.1283	0%
Amphetamine	300-62-9	136.1126	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%
3,4-hydroxymethamphetamine	-	182.1181	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%
phenylacetone	103-79-7	135.0810	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%

**[C] Green Kleen 420-4 Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Green Kleen 420-4 are presented in Table 3.

**Table 3: Methamphetamine levels in standard controls and after treatment with Green Kleen 420-4.**

Reference	Description	Meth conc. [µg/L]	Meth-d9 conc.[µg/L]
<b>Standard Controls</b>			
	Standard controls 4h	10.3	10.1
	Standard controls 24h	10.4	10.2
<b>Green Kleen 420-4</b>			
	GK blank 4h	0	0
	GK treatment 4h	10.0	10.3
	GK blank 24h	0	0
	GK treatment 24h	10.1	10.3

Results indicate no significant degradation or irreversible binding of parent methamphetamine or methamphetamine-d9 after 4 hours and 24 hours.

**[D] Green Kleen 420-4 Metabolites**

Relative % levels of requested methamphetamine metabolites from the untargeted Green Kleen 420-4 analysis are presented in Table 4. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.



**Table 4: Relative levels in of requested metabolites present in Green Kleen 420-4 treatments.**

Name	CAS#	[M+H] <sup>+</sup> ion	% Found 4 hr treatment	% Found 24 h treatment
Methamphetamine	537-46-2	150.1283	100%	100%
Amphetamine	300-62-9	136.1126	0%	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%	0%
3,4-hydroxymethamphetamine	-	182.1181	0%	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%	0%
phenylacetone	103-79-7	135.0810	0%	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%	0%

#### [E] Strike Force Absolute Levels

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Strike Force are presented in Table 5.

**Table 5: Methamphetamine levels in standard controls and after treatment with Strike Force.**

- No change in the amount of methamphetamine present after 4 and 24 hours contact results same as for Green - Kleen

#### [F] Strike Force Metabolites

Relative % levels of requested methamphetamine metabolites from the untargeted Strike Force analysis are presented in Table 6. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present

**Table 6: Relative levels in of requested metabolites present in Strike Force treatments.**

Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.

### Summary

- Of the three cleaning products supplied, only Crystal Clean was successful in removal of parent methamphetamine, presumably through peroxide initiated oxidative degradation or irreversible binding to components contained within Crystal Clean. Total removal of methamphetamine was observed within 4 hours.
- Green Kleen 420-4 and Strike Force showed no evidence of parent methamphetamine degradation or irreversible binding after 24 hours.
- No methamphetamine metabolites have so far been identified from any of the three cleaning products used in this work.

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Ref: 161101/1

Date:(initial release) 03 November 2016 Date of Summary: 20 February 2017



# TECH CONSULTING

*Wide acceptance of an idea is not proof of its validity*

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## Report for Extreme Cleaning Solutions Ltd, Auckland NZ. February 2017

Report date: 20 February 2017

Version 1.0

**Background:** In an earlier report by Tech Consulting to Extreme Cleaning Solutions Ltd in Nov 2016 Crystal Clean was shown to remove methamphetamine in solution and not to generate any methamphetamine related degradation products. A second study was undertaken to ensure a similar outcome when Crystal Clean used in the remediation of a known contaminated building. A summary of the Nov 2016 report is included in this report as appendix-1.

For this work a single storey dwelling in the Waikato area of New Zealand that was known to be contaminated with methamphetamine was identified. Fresh Living using the 'Crystal Clean' product decontaminated and cleaned the dwelling. Tech Consulting took swabs to validate the absence of methamphetamine after cleaning and further to determine if any methamphetamine related degradation products could be detected within the dwelling.

**Contents:** Tech Consulting took swabs as set out by NIOSH 911. These swabs were delivered on the same day to the Hill Laboratories, Clyde Street, Hamilton. The laboratory's IANZ accreditation includes the testing of this sample type in the laboratory scope. Hill Laboratory tested the swabs using a procedure based upon Liquid Chromatography with Tandem Mass Spectroscopy. The technique identifies and quantifies 4 compounds (methamphetamine, amphetamine, ephedrine & pseudo-ephedrine with a low reporting level of 0.02µg/swab. Earlier work undertaken for Tech Consulting by Hill Laboratory showed that methamphetamine related degradation products could be detected using a modified version of the same analytical method. The two swabs found to contain the highest trace of methamphetamine were selected for the degradation product testing.

The swabbing was carried out on pm Thursday 09 February 2017.

**Observations:** On site notes

- Keys to the property located as described by John Campbell - & returned to same location on exit
- The dwelling interior was dry and dust free
- Carpet had been removed and some wallpaper removed
- Cooking hob and ventilation removed

**Data:** [1] The initial test results on the dwelling were provided to Tech Consulting by John Campbell CEO Fresh Living -the relevant part of this data is reproduced below in Table-1. The analysis for Living Fresh was undertaken by the Analytica Laboratory based in Hamilton NZ. The IANZ registration number for this laboratory is 1099 . The scope of the registration includes the appropriate Environmental Monitoring class 2.58 (d)

## Results Summary

### Drugs of Abuse

Laboratory ID	Sample ID	Methamphetamine mAMP	Amphetamine AMP	Ephedrine EPH	Pseudoephedrine pEPH
Units Reporting Limit		µg/sample 0.02	µg/sample 0.02	µg/sample 0.02	µg/sample 0.02
16-18344-1	J011325-1; Kitchen; KMS	20.44	0.38	0.03	0.03
16-18344-2	J011325-2; Lounge; KMS	32.58	0.56	0.10	0.09
16-18344-3	J011325-3; Kitchen; KMS	3.00	0.09	<0.02	<0.02
16-18344-4	J011325-4; Lounge; KMS	0.10	<0.02	<0.02	<0.02
16-18344-5	J011325-5; Lounge; KMS	1.77	0.07	<0.02	<0.02
16-18344-6	J011325-6; Hallway; KMS	3.92	0.06	<0.02	<0.02
16-18344-7	J011325-7; Bedroom 1; KMS	8.17	0.18	0.05	0.08
16-18344-8	J011325-8; Bedroom 1; KMS	5.62	0.13	<0.02	<0.02
16-18344-9	J011325-9; Bedroom 2; KMS	7.41	0.22	0.04	0.03
16-18344-10	J011325-10; Bedroom 2; KMS	1.43	0.03	<0.02	<0.02
16-18344-11	J011325-11; Bedroom 3; KMS	1.55	0.04	<0.02	<0.02
16-18344-12	J011325-12; Bedroom 3; KMS	0.36	<0.02	<0.02	<0.02
16-18344-13	J011325-13; Bathroom; KMS	25.45	0.48	0.07	0.07
16-18344-14	J011325-14; Bathroom; KMS	0.83	0.05	<0.02	<0.02
16-18344-15	J011325-15; Toilet; KMS	9.98	0.12	0.02	0.02
16-18344-16	J011325-16; Laundry; KMS	1.34	0.02	<0.02	<0.02
16-18344-17	J011325-17; Laundry; KMS	12.30	0.26	<0.02	<0.02
16-18344-18	J011325-18; Garage; KMS	0.04	<0.02	<0.02	<0.02
16-18344-19	J011325-19; Blank; KMS	<0.02	<0.02	<0.02	<0.02

### Method Summary

#### Meth

Wipes are extracted with 0.1M sulfuric acid followed by centrifugation and dilution. Analysis by LC-MS/MS. (NIOSH 9111 - Modified).

**Table- 1 Initial Methamphetamine Results**

[2] The methamphetamine test results relating to Tech Consulting samples are presented in Table-2. The analysis was undertaken by Hill Laboratory based in Hamilton NZ. The IANZ registration number for this laboratory is 365. The scope of the laboratory registration includes the appropriate Environmental Monitoring class 2.58 (d)

### Tech Consulting results from Hill Laboratory Report 1721072

ug/100cm<sup>2</sup>

Hill Lab Id	TC Lab No	TC Location	Precise Location	meth	amph	ephed	pseudo
1721077.1	TC-101	bed-1	bed-3	0.17	<0.02	<0.02	<0.02
1721077.2	TC-102	bed-1	bed-3	0.09	<0.02	<0.02	<0.02
1721077.3	TC-103	bed-2	bed-2	<0.02	<0.02	<0.02	<0.02
1721077.4	TC-104	bed-2	bed-2	<0.02	<0.02	<0.02	<0.02
1721077.5	TC-105	bed-3	bed-1	0.02	<0.02	<0.02	<0.02
1721077.6	TC-106	bed-3	bed-1	0.03	<0.02	<0.02	<0.02
1721077.7	TC-107	kitchen	kitchen	<0.02	<0.02	<0.02	<0.02
1721077.8	TC-108	kitchen	kitchen	<0.02	<0.02	<0.02	<0.02
1721077.9	TC-109	lounge	lounge	0.02	<0.02	<0.02	<0.02
1721077.10	TC-110	lounge	lounge	<0.02	<0.02	<0.02	<0.02

# Note location identities for Tech Consulting & Precise sampling locations

**Table-2 Post Remediation Methamphetamine Results**

[3] Related degradation products testing The analysis was also undertaken by Hill Laboratory based in Hamilton NZ. The IANZ registration number for this laboratory is 365. The scope of the registration includes the appropriate Environmental Monitoring class 2.58 (d) together with the Instrumental Techniques class 2.70. In 2016 the Hill Laboratory examined test solutions that had been exposed to Crystal Clean (the same product used for the remediation of this dwelling) to identify and quantify the oxidative degradation products of methamphetamine that may be generated during the remediation process. In that study a number compounds were found using High Performance Liquid Chromatography to separate the compounds and High Resolution Mass Spectroscopy for the identification. A similar technique was used for this section of the work having previously found which compounds may be present. Tandem Mass Spectroscopy replaced High Resolution Mass Spectroscopy.

The degradation product work was carried out on 2 of the 10 samples selected by Tech Consulting. The selected samples were TC-101 and TC-102 which correspond with the areas tested by Precise (John Campbell) as samples 7 and 8

**Results: Remediation.** Table-3 below shows the numerical values that the cleaning with Crystal Clean delivered at this dwelling. Only low level traces of methamphetamine were detected. The percent removal based on the initial testing was in the range of 97 to 100%. No amphetamine, ephedrine or pseudo-ephedrine was detected at  $> 0.02\mu\text{g}/100\text{cm}^{-2}$

Precise Location	% Reduction			
	meth	amph	ephed	pseudo
bed-1	97.4	100.0	NA	NA
bed-2	100.0	100.0	100.0	100.0
bed-3	98.1	100.0	100.0	100.0
kitchen	100.0	100.0	100.0	100.0
lounge	100.0	100.0	100.0	100.0

NA = not applicable as not found in initial testing

Table-3 Percent removal of methamphetamine & related products

**Results: Degradation by-products.** No degradation by-products were detected in the samples tested. Previous work undertaken at the same suitably qualified laboratory has shown that the degradation by-product compounds would have been detected if present at a concentration of approximately  $>0.02\mu\text{g}/100\text{cm}^{-2}$

A summary version of the degradation study of November 2016 is attached to this report as appendix-1

**Summary:** [1] The testing on this dwelling shows that Crystal Clean is an effective agent for the removal of methamphetamine and similar related compounds to well below the required level at domestic dwellings

[2] No methamphetamine related degradation products were detected in this test. This indicated that no stable methamphetamine related degradation products are an issue for the remediation or related clean-up and disposal.

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## Appendix.

### Appendix-1 Summary Report - issued to ECS by Tech Consulting November 2016

#### Summary of the report supplied to Extreme Cleaning Solutions Ltd Auckland NZ November 2016.

#### Scope

Investigate chemical removal and subsequent degradation products of methamphetamine by client supplied cleaning products. The three cleaning products supplied were:

1. Crystal Clean (3 part component US product)
2. Green Kleen 420-4 (Single component US product)
3. Strike Force (Single component NZ product)

Tests were conducted using solutions of each product according to the manufacturer's label instructions.

For each cleaning product was subjected to the following testing scheme,

1. Methamphetamine was added to working solutions of each cleaning product to create a 1000 µg/L (parts per billion or ppb) solution of methamphetamine.
2. Solutions were stood at room temperature with sub-samples removed for analysis after 4 and 24

hour

- time periods. These sub-samples were diluted 100 fold prior to analysis
3. Control solutions of methamphetamine were subjected to the same protocol.
4. Samples underwent 'targeted' analysis for the presence of methamphetamine and quantitated against standard calibration curves.
5. Samples then underwent 'untargeted' analysis in order to identify any methamphetamine reaction products.

6. To assist in identifying any methamphetamine reaction products, deuterium labelled methamphetamine (methamphetamine-d9) was used to prepare identical experimental solutions as outlined above, and subjected to the same processes as outlined above. (Deuterium labelled methamphetamine does not occur naturally.)

#### Analysis and Identification

An Ultra-High Performance Liquid Chromatography (UPLC) system was used to separate the different compounds. This system was coupled to a High Resolution Accurate Mass Spectrometer instrument) which identifies and quantitates the compounds. Analytes were detected in full-scan mode. Quantification of methamphetamine and methamphetamine-d9 were performed against authentic analytical pure standards.

The recognised metabolic pathways for the degradation of methamphetamine have been published in peer reviewed literature. The metabolites of methamphetamine identified for this work are listed below.

#### List of Metabolites from the Metabolic Pathway

	Name	CAS#	Mono-isotopic Mass
1	Methamphetamine	537-46-2	149.12045
2	Amphetamine	300-62-9	135.1048
3	4-hydroxymethamphetamine	370-14-9	165.11536
4	3,4-hydroxymethamphetamine	-	181.1103
5	4-hydroxyamphetamine	1518-86-1	151.0997
6	phenylacetone	103-79-7	134.0732
7	4-hydroxyphenylacetone	770-39-8	150.0681

The selected degradation compounds (metabolites) were extracted from their respective untargeted analyses via the protonated molecular ion ([M+H]<sup>+</sup>) and individually presented as a relative percent abundance.

**Results:** The results for the 3 products supplied are each reported below for methamphetamine and degradation metabolites separately.

**[A] Crystal Clean Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Crystal Clean are presented in Table 1

**Table 1: Methamphetamine levels in standard controls and after treatment with Crystal Clean.**

Reference	Description	Meth conc.[µg/L]	Meth-d9 conc.[µg/L]
Control Standards	Standard Controls 4h	9.7	9.9
	Standard Controls 24h	10.2	10.2
Crystal Clean	CC blank 4h	0	0
	CC treatment 4h	0	0
	CC blank 24h	0	0
	CC treatment 24h	0	0

These results indicate complete degradation or irreversible binding of parent methamphetamine and the methamphetamine-d9 after 4 hours and 24 hours.

**[B] Crystal Clean Metabolites**

Relative % levels of methamphetamine metabolites from the untargeted Crystal Clean analysis are presented in Table 2. Metabolites were extracted based on their protonated molecular ion masses. No methamphetamine or requested metabolites were present.

**Table 2: Relative levels in of requested metabolites present in Crystal Clean treatments.**

Name	CAS#	[M+H] <sup>+</sup> extracted ion	% Found
Methamphetamine	537-46-2	150.1283	0%
Amphetamine	300-62-9	136.1126	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%
3,4-hydroxymethamphetamine	-	182.1181	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%
phenylacetone	103-79-7	135.0810	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%

**[C] Green Kleen 420-4 Absolute Levels**

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Green Kleen 420-4 are presented in Table 3.

**Table 3: Methamphetamine levels in standard controls and after treatment with Green Kleen 420-4.**

Reference conc.[µg/L]	Description	Meth conc. [µg/L]	Meth-d9
Standard Controls	Standard controls 4h	10.3	10.1
	Standard controls 24h	10.4	10.2
Green Kleen 420-4	GK blank 4h	0	0
	GK treatment 4h	10.0	10.3
	GK blank 24h	0	0
	GK treatment 24h	10.1	10.3

Results indicate no significant degradation or irreversible binding of parent methamphetamine or methamphetamine-d9 after 4 hours and 24 hours.

#### [D] Green Kleen 420-4 Metabolites

Relative % levels of requested methamphetamine metabolites from the untargeted Green Kleen 420-4 analysis are presented in Table 4. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.

**Table 4: Relative levels in of requested metabolites present in Green Kleen 420-4 treatments.**

Name treatment	CAS#	[M+H] <sup>+</sup> ion	% Found 4 hr treatment	% Found 24 h
Methamphetamine	537-46-2	150.1283	100%	
Amphetamine	300-62-9	136.1126	0%	0%
4-hydroxymethamphetamine	370-14-9	166.1232	0%	0%
3,4-hydroxymethamphetamine	-	182.1181	0%	0%
4-hydroxyamphetamine	1518-86-1	152.1075	0%	0%
phenylacetone	103-79-7	135.0810	0%	0%
4-hydroxyphenylacetone	770-39-8	151.0759	0%	0%

#### [E] Strike Force Absolute Levels

Levels of methamphetamine and methamphetamine-d9 after 4 hour and 24 hour treatment periods with Strike Force are presented in Table 5.

**Table 5: Methamphetamine levels in standard controls and after treatment with Strike Force.**

- No change in the amount of methamphetamine present after 4 and 24 hours contact results same as for Green -Kleen

#### [F] Strike Force Metabolites

Relative % levels of requested methamphetamine metabolites from the untargeted Strike Force analysis are presented in Table 6. Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present

**Table 6: Relative levels in of requested metabolites present in Strike Force treatments.**

Metabolites were extracted based on their protonated molecular ion masses. Methamphetamine was the only analyte identified. No requested metabolites were present.

#### Summary

- Of the three cleaning products supplied, only Crystal Clean was successful in removal of parent methamphetamine, presumably through peroxide initiated oxidative degradation or irreversible binding to components contained within Crystal Clean. Total removal of methamphetamine was observed within 4 hours.
- Green Kleen 420-4 and Strike Force showed no evidence of parent methamphetamine degradation or irreversible binding after 24 hours.
- No methamphetamine metabolites have so far been identified from any of the three cleaning products used in this work.

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