



The Assessment and Cleanup of an Opioid Contaminated Site and Establishment of California's Standards

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USEPA - Voluntary Guidelines for Methamphetamine and Fentanyl Laboratory Cleanup (REVISED EDITION AUGUST 2021)



“...Properties may be contaminated by hazardous chemicals used or produced in the manufacture or packaging of fentanyl where those chemicals remain and where the contamination has not been remediated.”

The Situation and Problem...

- Residual opioid contamination can be left behind following law enforcement and first responder activities.
- Elevated contaminant residues have the potential to be harmful where potentially “lethal dose” levels are found on surfaces that remain (as seen within our case study).
- Awareness of such potential contamination is important and the assessment and decontamination of sites contaminated with opioids and other illicit drug residues is warranted.



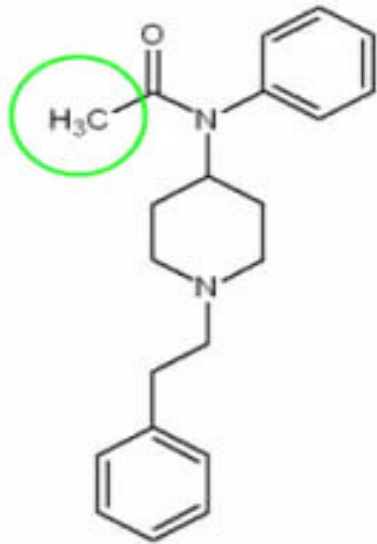
This is a lethal dose of Fentanyl (only 2 – 3 milligrams)



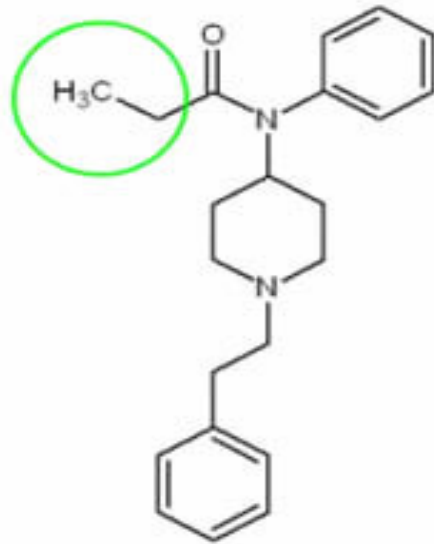
Relative lethal doses of Heroin (50 mg), Fentanyl (2-3 mg), and Carfentanil (0.02 milligrams)



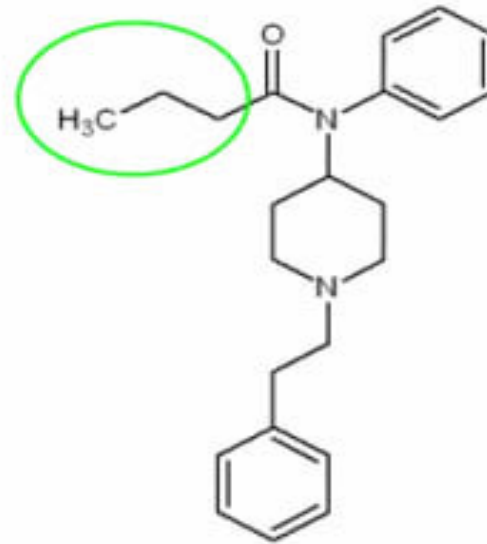
Fentanyl analogs.... (similar structures)



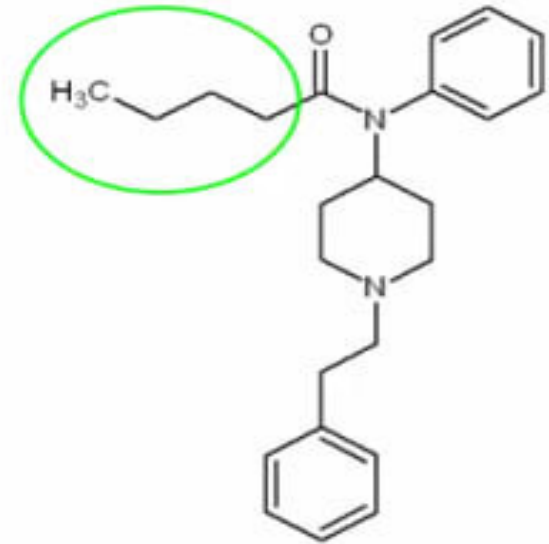
Acetyl fentanyl



Fentanyl



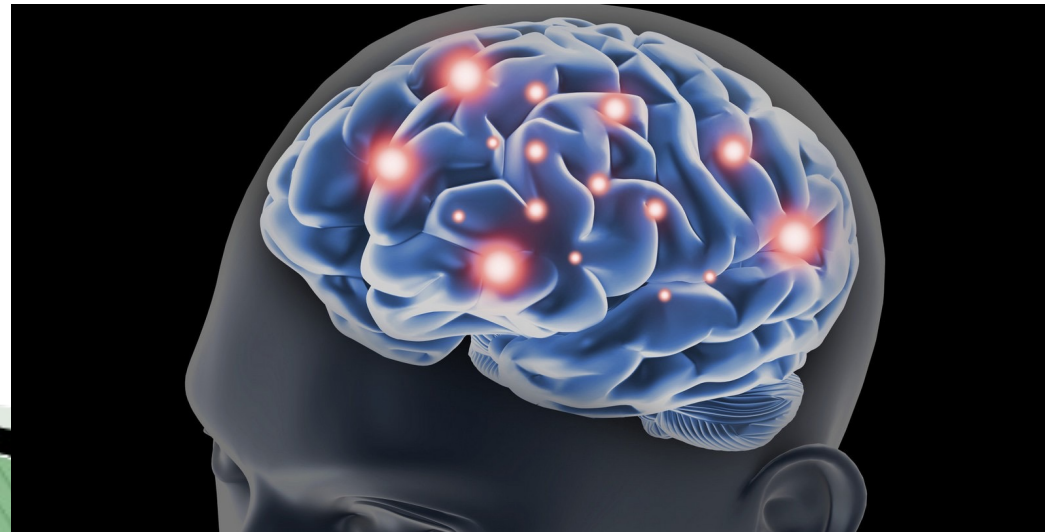
Butyryl fentanyl



Valeryl fentanyl
(Pentanoyl fentanyl)

How Fentanyl affects the brain...

- Like heroin, morphine, and other opiate drugs, fentanyl works by binding to the body's opioid receptors in the brain that control pain, pleasure, and emotions.
- Drives up levels of dopamine in the brain's "reward" centers and produces feelings of euphoria and relaxation



Fentanyl...

- Brand names include Actiq, Duragesic, Subsys, and Sublimaze
- Fentanyl was originally synthesized by Paul Janssen in 1959 and was introduced in 1960 as an analog to pethidine (aka Demerol) ...*which killed Michael Jackson*
- Fast acting (in about 5 minutes) depending on route (oral, inhalation, injection or transdermal patch)
- Wears off quickly (lasting only about an hour)
- Although widely prescribed, however fentanyl was **never intended** for treating chronic pain.



Fentanyl's Legal Uses...

When prescribed by a physician (to treat pain), fentanyl is often administered by:

- Injection and/or IV drip
- Pill or capsule
- Transdermal patch
- Lozenges
- Inhalation...?



Fentanyl Bought and Sold on the Street...

- Fentanyl is typically pre-synthesized and “cut” into heroine, cocaine, and methamphetamine to increase potency, ...and lethality! (see *PBS Special Segment*)
- Added into illicit “fake” pills like Oxycontin, Xanax, in pill presses
- The inclusion (and high potency) of fentanyl greatly increases risk of overdose.
- Fentanyl can be injected, snorted, swallowed, absorbed through mucous membrane (blotter paper), and free-based *



Illicit Uses and Habits are Changing...

2021 study on fentanyl use in the SF Bay Area found drug users were switching from injecting tar heroin to smoking fentanyl, citing benefits such as lower cost and less social stigma by reducing visible “track marks” from injections.



Fentanyl at Higher Doses...

- The high potency increases the risk of overdose (especially if user is unaware)
- Opioid receptors in brain also control breathing rate
- At higher levels... drowsiness, nausea, confusion, respiratory depression, respiratory arrest, unconsciousness, coma, and death!
- “Impairment” dose levels are important and are much lower



The Perfect Storm...

- Over Prescription and Use (>85 % of world's opioids are used in the US)
- Addiction and Abuse ("dependency" versus "recreational" use)
...Creating an Economic Need/Demand
- Illegal Activities and Importation to Supply the Demand



Sobering Facts...

More people have died of synthetic-opioid overdoses than the number of U.S. military personnel killed during the Vietnam, Iraq and Afghanistan wars combined.

Fentanyl is now the [leading cause of death for Americans ages 18 to 49](#), according to a Washington Post analysis of death data since 2021 from the Centers for Disease Control and Prevention (CDC).



The illicit Opioid Trade...

- From October 2020 through September 2021, The U.S. Customs and Border Protection (CBP) seized 11,201 pounds of fentanyl... In 2022 that number topped over 28K pounds (...💀)



Recent Busts in the News...

- Riverside, California Sept 2021: 46 pounds (21 kg) of carfentanil seized. ~ *50 million lethal doses of Carfentanil*

Carfentanil (used as an elephant tranquilizer) is 100 times more lethal than fentanyl.

- San Leandro, California May, 2021: 19 pounds fentanyl (8.6 Kg) seized in pill press operation ~ *4.3 million lethal doses*
- *More...*



The Source of illicit Fentanyl...

- According to current DEA statistics... A complex web of illicit activities exchanging through many hands...
- Illicit fentanyl manufactured in China and India (according to DEA report) is shipped to Mexico mainly via container ships.
- Mexican cartels re-synthesize the drug to produce powders, bricks, and “fake” pills labeled as Oxycontin, Xanax, Adderall, etc. (2022 *PBS Special*).



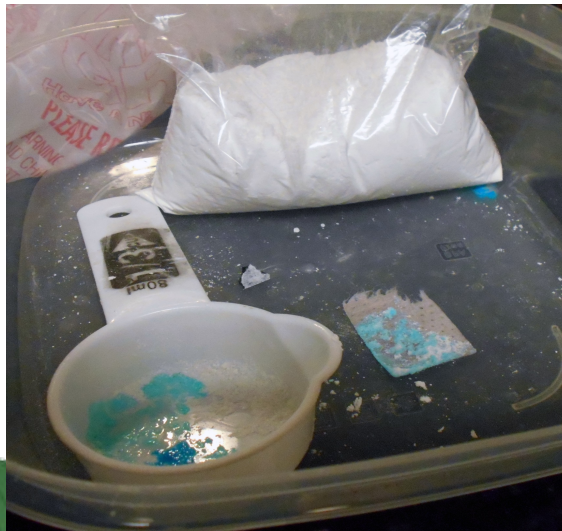


Surface 5

1 2 3 4 5 6 7 8 9 10 11 12

In 2021, the DEA launched a nationwide campaign to increase awareness about the increasing prevalence of criminal drug networks mass-producing fake pills.

Number of DEA-seized counterfeit pills with fentanyl has increased 430% since 2019. DEA reports that 6 of 10 illicit “fake” pills contain potentially lethal amounts of fentanyl (2022).



Unlike heroin, cocaine or marijuana, fentanyl doesn't require farmland, sunshine, rain or field hands and is easily synthesized or converted with few ingredients in a lab... making fentanyl a drug trafficker's dream. (*Janssen method*)

Overdose death rates are similarly increasing exponentially
Illegal profits are staggering...



1 Kilogram (2.2 lbs.) of Pure Fentanyl Can Kill 500,000 People...

1 Kg “brick” of pure fentanyl (cost \$3K-\$5K) produces 1 million (1 mg) pills. Equaling 4-10 million dollars in revenue at \$4-\$10 “street value” per pill...



Fentanyl Overdose...

- Research shows that the potency of fentanyl is more likely to trigger an overdose than other opioids.
- While a heroin overdose can progress to cardiac arrest in 30 minutes, with fentanyl it can happen in a few minutes.



Famous People Who Have Died from Overdose:

- Hank Williams 1953 morphine
- Jimmy Hendrix 1970 barbiturate
- Janis Joplin 1970 heroin
- Jim Morrison 1971 heroin/cocaine
- Elvis Presley 1977 codeine
- John Belushi 1982– heroine and cocaine “speedball” 1982
- Heath Ledger 2008 – opioids (oxycontin, Vicodin, Xanax, and valium)
- Michael Jackson 2009 - Demerol
- Paul Gray (bassist for Slipknot 2010 morphine and fentanyl)
- Prince – 2016 fentanyl
- Tom Petty 2017 fentanyl
- Rapper Mac Miller 2018 fentanyl, cocaine, and ethanol
- 2021 Comedians Fuquan "Fu" Johnson and Enrico Colangeli as well as actors Logan and Michael Williams

Uncontrolled Site Conditions...



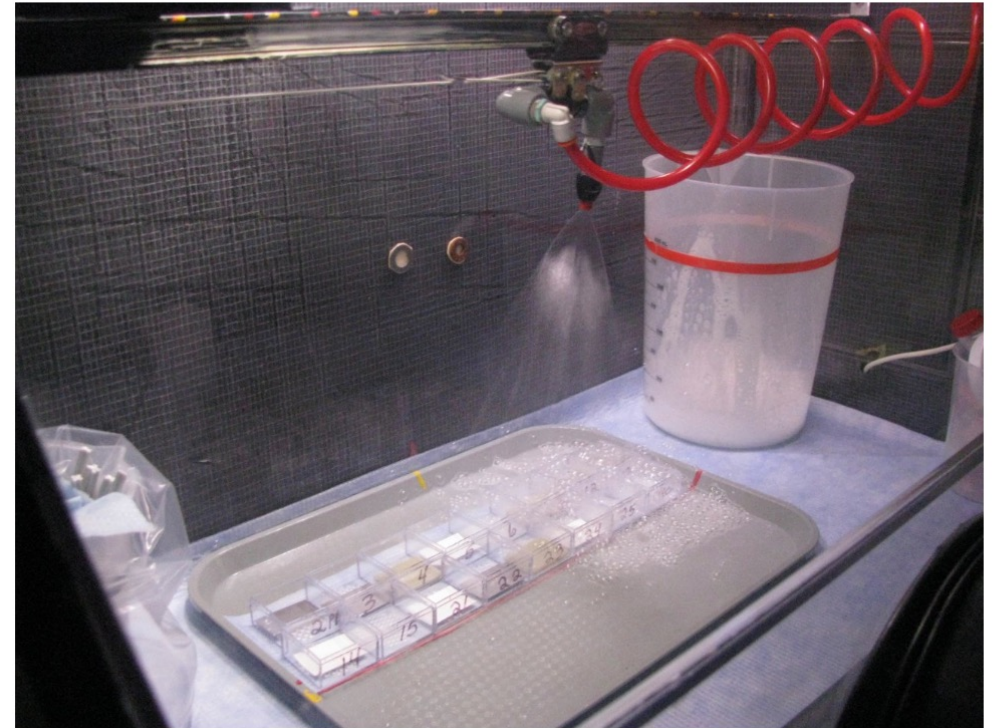


Remediation of Fentanyl Contaminated Indoor Environments

Published November 29, 2022

In March 2016, the Drug and Enforcement Administration (DEA) issued a nationwide alert about fentanyl stating that overdoses were occurring at alarming rates and represent a significant threat to public health and safety. [Recent research has shown](#) the nation's COVID19 pandemic has made the drug overdose epidemic worse. Since a small amount of fentanyl can be deadly, emergency responders, hazmat teams, and law enforcement are concerned about their potential exposure while responding to incidents at mixing houses, pill factories, or in makeshift laboratories that may be found in apartments, hotels, houses, garages, and storage facilities.

The use and production of various fentanyl-containing products can lead to extensive distribution of fentanyl within homes, vehicles, and clandestine drug laboratories. Drug-contaminated structures, homes or buildings pose a threat to human health, threaten community revitalization efforts, and pose challenges for federal, state, local, and Tribal governments and first responders. The lack of information on how to decontaminate structures and determine a safe level for re-occupancy has resulted in condemned properties, and EPA's On-Scene Coordinators (OSCs) across the country are increasingly being asked to provide technical assistance to state and local entities for fentanyl incidents.



Case Study - Subject Property...

- Illegal opioid compound mixing operations discovered by law enforcement (DOJ and DEA) within an apartment
- Bulk Fentanyl and Carfentanil was mixed with other “controlled substances” for distribution and sale
- Paraphernalia associated with manufacturing, mixing, distribution, and use present on site
(Scales, tableting “pill press” machines, packaging, etc.)
- Bulk opioids purchased using “cryptocurrency” and shipped via USPS from China to apartment “community” mailbox



Regulatory Standards and Guidance...

- At the time of incident, NO formal regulatory standards or guidance in California requiring the assessment and/or cleanup of property contaminated with opioids. *(only meth standard existed) ...Now HSC 25400.12-46 is established in California to include fentanyl*
- DEA sent letter to local County Health Department informing that quantities of fentanyl and carfentanil were identified at the scene.
- County contacts BioMax to determine appropriate course of action
- County Health Department “Posts” residence as a precautionary measure and requires a Preliminary Sampling Assessment



Interim DRAFT Fentanyl Protocol...

Protocol based on recent similar opioid contamination case in San Francisco (SFDPH)

Assessment and Cleanup Protocol included...

- Posting of site to preclude access and occupancy
- CIH to perform an inspection and Site Sampling Assessment
- Development of Mitigation Work Plan created by CIH
- Contractor decontamination and cleanup of site (overseen by CIH)
- Post Mitigation "Clearance" assessment verification performed by CIH
- Clearance Criteria Goal set at ≤ 0.10 ug/100cm² for Fentanyl
and ≤ 0.010 for Carfentanil
- Post Mitigation Clearance Report prepared and signed by CIH





DO NOT ENTER UNSAFE DO NOT OCCUPY

WARNING:

This structure has been seriously damaged and is unsafe. Do not enter. Entry may result in death or injury. A Building Permit will be required for all repair work.

Comments:

*Premises
enter. DO NOT
H.*

Building Address: *1304 Whipple Ave. #103*

Date: *8/18/17* Time: *2:00 PM*

Inspector: *M. Hernandez*

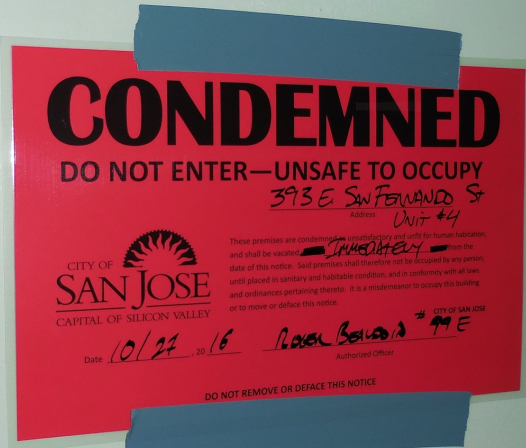
PELIGROSO, NO
Para mas info
llamar: (650) 781-1111

BUILDING & INSPECTION



**DO NOT REMOVE THIS PLACARD
FOR FURTHER INFORMATION TELEPHONE: (650) 781-1111**

Required Postings...



25th California Unified Program
Annual Training Conference
March 20-23, 2023

Preliminary Site Assessment (PSA)...

Inspection and evaluation includes surface residue sampling of representative interior surfaces and materials. (Analysis for fentanyl and carfentanil)



Surface Sampling Methods...

- Sterile gauze pads wetted with appx. 3 ml of analytical grade methanol and uniformly wiped over 100 cm² surface. (template)
- Detection and quantification performed by analytical laboratory.



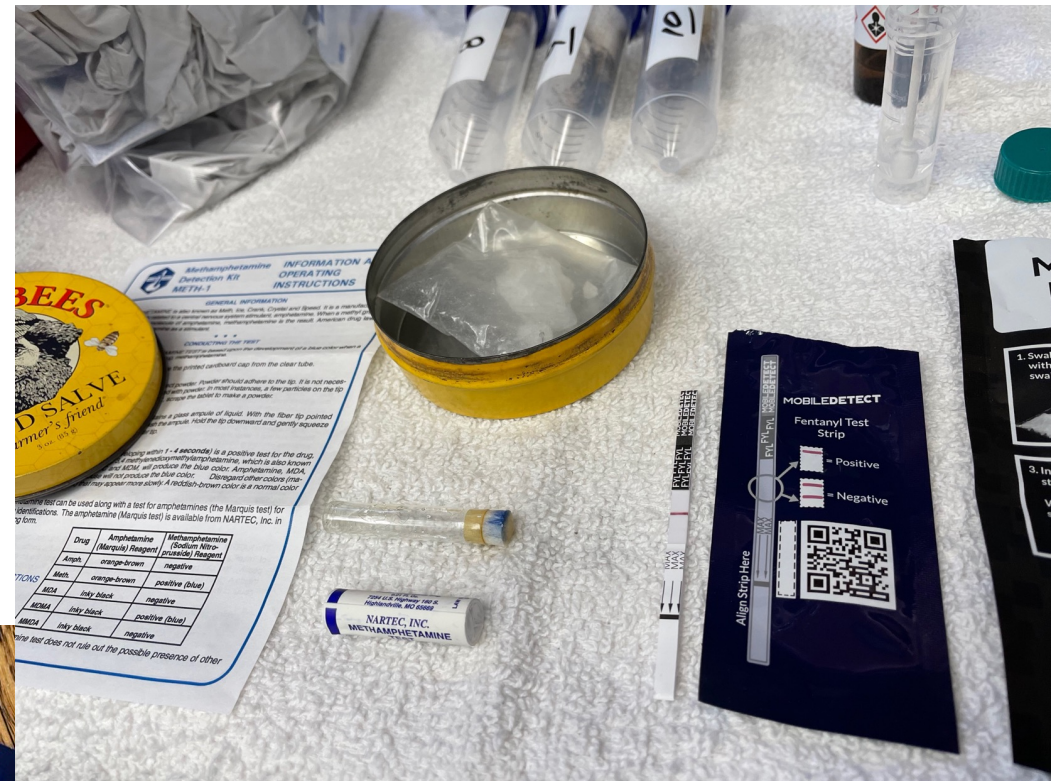
Field Test Kits Available... for detection on site



Rapid Response test kits used for preliminary (+ / -) determination of bulk and “suspect” materials of concern:



Use of Field Test kits...



Surfaces Sampled...

to identify and quantify invisible levels of opioid residues on surfaces:

- Walls, Ceilings, Floors
- Appliances
- Countertops
- Furnishings, clothing, personal items
- HVAC systems/units (supply and return if present)
- Ceiling Fans *



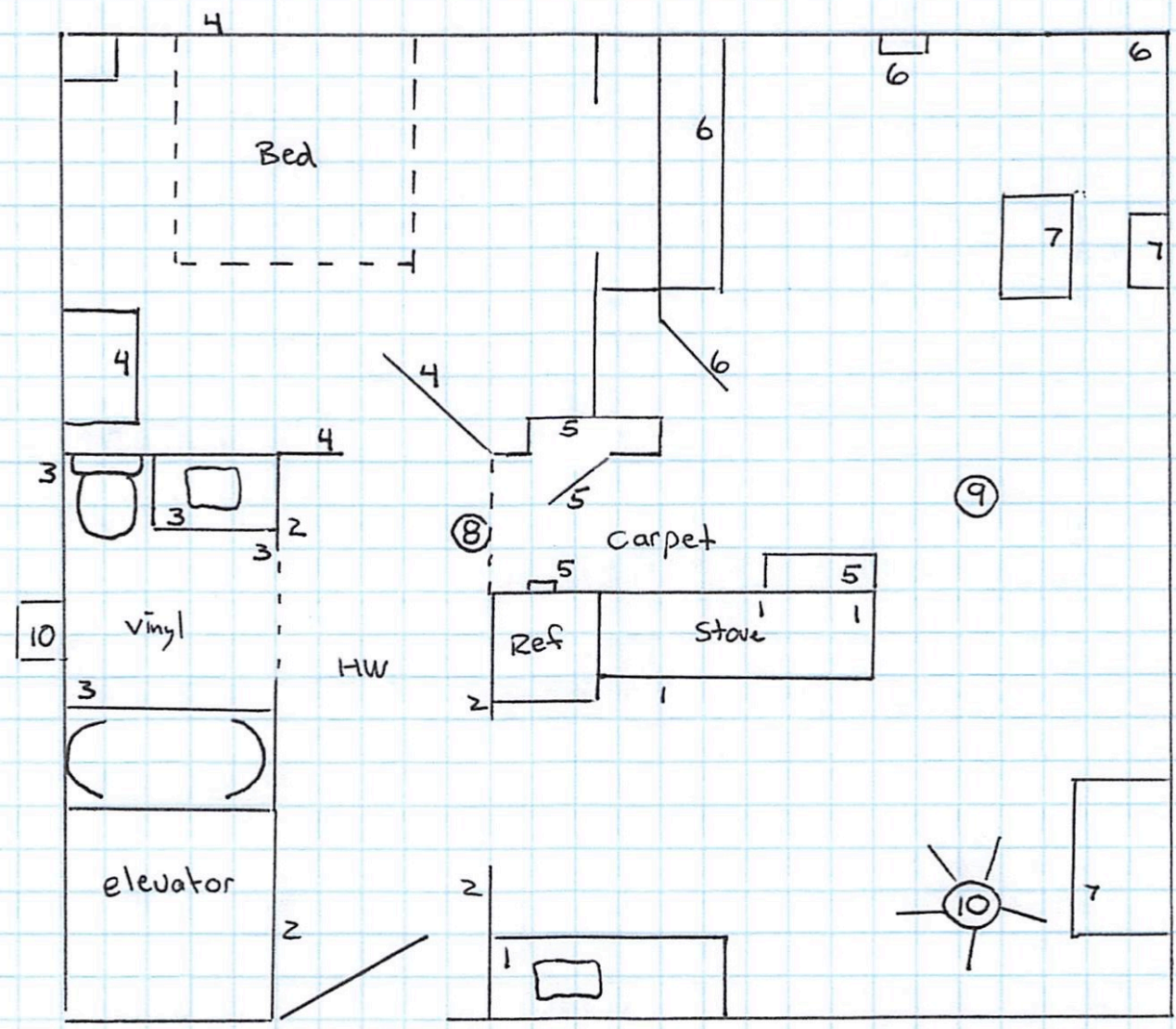
Bulk Material Sampling... e.g. "carpeting"



Air Sampling at Contaminated Sites...

- Current research topic with AIHA Opioid Working Group
- Current Findings during PSA work
 - Presently finding detectable airborne levels at sites (~ 2 - 5 ug/m³)
 - Pharma OELs 8-hr TWA (0.1 - 0.7) and STEL/C (0.2 – 2.0)
- Ongoing Research within AIHA Opioid WG and Pharma
- Relevance for assessment, cleanup workers, and future tenants





⑪ FCB

PSA Findings (*Lethal dose of Carfentanil = 20 ug*)

Sample Number	Sample Location / Description (surface area/volume sampled)	Fentanyl (ug/sample)	Carfentanil (ug/sample)
1	Kitchen surfaces composite	< 0.010 (ND)	0.68
2	Hallway walls and floors	ND	2.7
3	Bathroom surfaces	ND	1.4
4	Bedroom surfaces	ND	10
5	Hallway to Family Room	ND	7.8
6	Family Room 1	ND	7.8
7	Family Room 2	ND	21
8	Hallway carpet bulk sample (1 x 1 inch)	ND	2.5
9	Vacuum cleaner dust/debris (1 x 1 inch)	0.11	220
10	Dining Room ceiling fan top surface	12	1,400
11	Field Method Control Blank (QA/QC)	ND	ND

Cleanup and Decontamination...

The Mitigation Work Plan (MWP) is developed by CIH and cleanup performed by a 40-hour HAZWOPER certified contractor

- Careful planning, preparation, staging, and sequencing
- Aggressive procedures designed to minimize exposures from...
 - dermal contact
 - Inhalation
 - Ingestion
 - Injection and others?



Controls of Hazards...

Engineering Controls, Administrative Controls, Personal Protective Equipment (PPE):

- Negative pressure containments and “critical control barriers”
- Site-specific project hazard controls
- HAZWOPER trained personnel
- PPE... including respiratory and dermal protection
- Worker and equipment decontamination methods
- No use of Alcohol wipes.... Detergent and water only!



Narcan (Naloxone Hydrochloride): Opioid antidote may be administered by injection or by intra-nasal (nose spray)... may require multiple doses.





CIHC Conference 2022





Preliminary Mitigative Cleanup Actions...

- Establish and use negative pressure and critical containment barriers
- #1 Gross debris and furnishing removal using wet methods to reduce generation of airborne particulate hazards
- #2 Structural demolition and physical removal and disposal of all porous and semi-porous materials (including shelving, built-in cabinets, interior doors, baseboards, carpeting, appliances, etc.)
- Utilization of HEPA filtered vacuum equipment and portable air scrubbing units



Negative Pressure Barriers...



Decontamination and Treatment Methods...

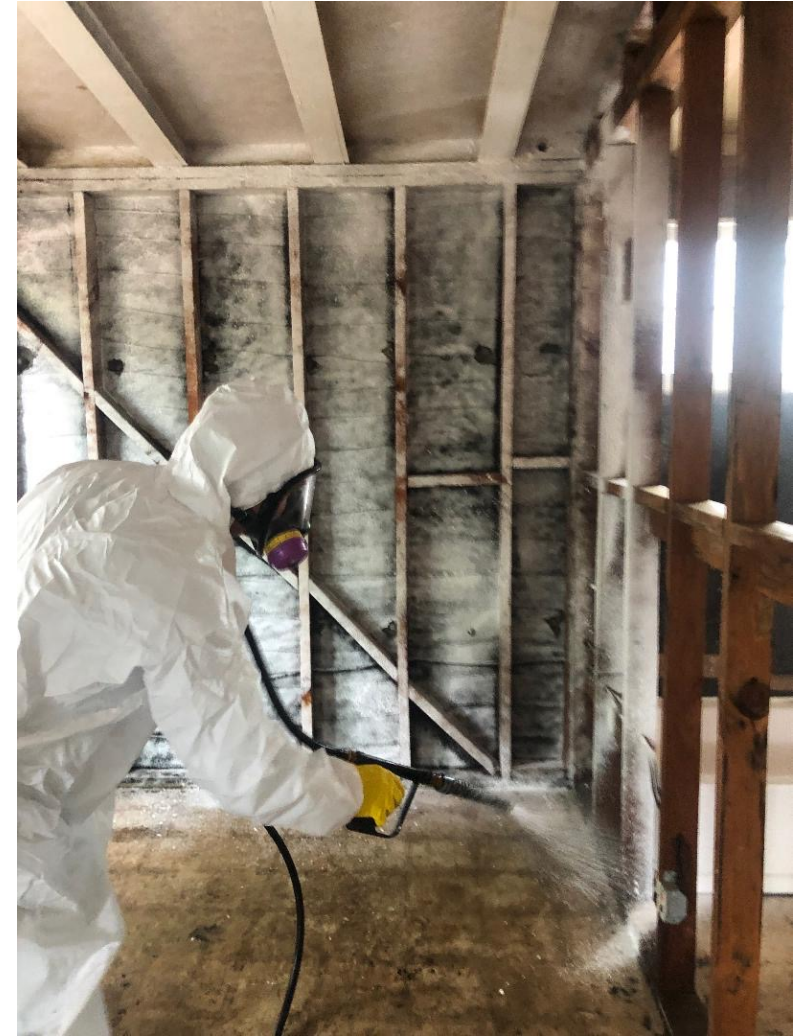
- Interior treatment spray applications using Hydrogen Peroxide (H₂O₂) and Trichloroisocyanuric acid (TCCA) based solutions onto surfaces
- Aggressive wipe (and extraction) removal methods employed using detergent solutions (Formula 409, Simple Green, etc.)



Wet methods with adequate dwell time (> 1 hour) necessary to achieve neutralization...



Foaming agents sometimes used for porous surfaces...





Ongoing Surface Decontamination Research

Dr. Lukas Oudejans (September 2021)



- Decontamination Solutions Listed in order of increasing Efficacy...
- Water
- Percarbonate (OxyClean)
- Hydrogen Peroxide (Meth Remover, ZEP)
- pH Adjusted Bleach Solutions
- Activated Peracetic Acid (EasyDecon DF 200, Dahlgren Decon)



Post Mitigation Clearance Assessment...

Performed to verify the “successful” completion of cleanup including...

- Visual inspection of residence to verify targeted procedures, containments, and removal of selected surfaces has been achieved
- Post-mitigation surface sampling and verification of mitigative cleanup and treatment
- Clearance criteria (as *established for this case*):
 - < 0.10 ug/100cm² (Fentanyl)
 - < 0.010 ug/100cm² (Carfentanil)
- Current California regulatory cleanup standard set at “detection limit”



Post Mitigation Assessment Findings...

Sample Number	Sample Location / Description (surface area sampled = 100 cm ²)	Fentanyl (ug/sample)	Carfentanil (ug/sample)
1	Dining Room window sill	< 0.010 (ND)	0.017 *
2	Family Room wall at closet	ND	ND
3	Hallway wall at floor	ND	ND
4	Bathroom floor	ND	ND
5	Bedroom closet wall	ND	ND
6	Family room subflooring	ND	ND
7	Kitchen wall at baseboard	ND	ND
8	Kitchen ceiling sheetrock	ND	ND
9	Field Control Blank (QA/QC)	ND	ND
10	Covered misc. surfaces (composite)	ND	0.012 *

Community/Apartment Mailbox...





Fentanyl and Carfentanil Contaminants Detected in Apartment Mailboxes...

- Box 103:
(Unit of concern) Fentanyl 0.041 ug
Carfentanil 0.0048 ug
- Box 106:
(Above/Right) Fentanyl 0.031 ug
Carfentanil – ND
- Box 104:
(Below) Fentanyl 0.0082 ug
Carfentanil - ND

Results and Lessons Learned...

- The handling, mixing, packaging, and distribution of opioid compounds within this residence resulted in significant surface contamination at potentially lethal levels
- Decontamination and cleanup methods employed were successful in reaching current regulatory cleanup goals
- Importance of Assessment, Decontamination, and Clearance by trained and certified personnel
- Implementation of current regulatory standards and protocols are important...

Assessment → Decontamination → Clearance



This regulatory requirement is codified in California under Chapter 6.9.1 Section 25400.10 of Division 20 of Health and Safety Code enacted January 1, 2020.

“The Methamphetamine or Fentanyl Contaminated Property Cleanup Act”



Key Requirements of Regulation...

- Recognizes potential for residual contamination from manufacturing
- Posting of Property and engages LHO involvement and CIH review and oversight
- Expands applicability of standard to including meth, fentanyl, fentanyl analogs and related “controlled substances”
- Expands definition of “Laboratory Activity”
- Establishes Clearance Cleanup Criteria (below detection level)



“Fentanyl Laboratory Activity” ...

Section 25400.11 (i) “Fentanyl laboratory activity” means the illegal manufacturing or storage of fentanyl. This shall include manufacturing, compounding, converting, producing, deriving, processing, or preparing, either directly or indirectly by chemical extraction, pill pressing, distribution, cutting, diluting, synthesis, or other activity that has the potential to contaminate the property with fentanyl or any of its precursors.



“Clearance” Cleanup Criteria ...

Property contaminated by fentanyl laboratory activity is determined safe for human occupancy ...only if the level of fentanyl on an indoor surface is **below the (analytical) detection level.** HSC Section 25400.10 (d)

... (d) shall become inoperative when a health-based target remediation standard for fentanyl as adopted.



Potential Exposures...

- First Responders, EMTs, and Law Enforcement
- Secondary Exposures to...
 - Property owners and maintenance staff
 - Site assessment and inspector personnel
 - Forensic Laboratory and Evidence Storage sites
 - Contracted Mitigation Cleanup Personnel
- Tenants and Occupants... Is the property “Safe and Habitable”???
- Ongoing Research... Potential for airborne exposures exists at sites







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P: 3 GRAY
TRAN-6234
1204 1204 2828 2828 0520
1:339
1800

85893
1244Y462424242424
Order #

FOR MEDICAL FACILITY
USE ONLY.
NOT FOR RETAIL SALE
BD
Insulin Syringes
1mL U-100 Insulin Syringe
29G x 1/2 (0.39mm x 12.7mm)
Not made with natural rubber latex.
Permanently Attached Needle

FOR MEDICAL FACILITY
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Take Away Summary...

- This case study (and others like it) demonstrates that assessment and cleanup is needed in cases where opioids are manufactured, handled, stored or distributed.



Communication Requirements...

A Law Enforcement Officer or Investigator... “Shall notify Department, CUPA, or Administrating Agency at sites where an illegal controlled substance is or was manufactured ...

HSC 25354.5 (a)



CUPA Requirements...

- HSC 25400.17** Laboratory "Activity" = Assumed Contamination is Present
- HSC 25400.18** Notice Posted within 48 hours
- HSC 25400.19** Inspection Performed within 5 days
- HSC 25400.20** Determination of Contamination is Made



What's Next on the Street...

- Xylazine (known as "Tranq") Veterinary tranquilizer (Non opioid - Naloxone "resistant")
- Isonitazine (known as "Iso") new and very potent synthetic opioid
- Air B&B Case in Florida...
- Rainbow fentanyl...




Additional Sources of Information...

- US Drug Enforcement Agency Media Library:
[www.dea.gov/media/videos/Chasing the Dragon.mp4](http://www.dea.gov/media/videos/Chasing%20the%20Dragon.mp4)
- US Center for Disease Control:
www.cdc.gov/drugoverdose/opioids/fentanyl.html
- www.emergency.cdc.gov/han/han00384.asp
- National Institute of Drug Abuse:
www.drugabuse.gov/publications/drugfacts/fentanyl
- BioMax Environmental Inc. web site: www.biomaxenvironmental.com



Cleanup and Decontamination Research

Related Publications:

1. Oudejans, L., D. See, C. Dodds, M. Corlew, AND M. Magnuson. Decontamination Options for Indoor Surfaces Contaminated with Realistic Fentanyl Preparations. JOURNAL OF ENVIRONMENTAL MANAGEMENT. Elsevier Science Ltd, New York, NY, 297:113327, (2021). <https://doi.org/10.1016/j.jenvman.2021.113327> 
2. Oudejans, L. Remediation Options for Fentanyl Contaminated Indoor Environments. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-21/105, 2021. [EPA report]
3. EPA Technical Summary (cleared but not formatted yet): Decontamination Strategies, Methods, and Related Technical Challenges for Remediation of a Fentanyl-Contaminated Site; EPA Publication Number EPA/600/S-22/154



Thank You

Acknowledgements...



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