Synthetic Drug Threats in the United States: 2017 Update

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Special Testing and Research Laboratory
Drug Enforcement Administration
Emerging Trends Program

- Created in October 2011
- Analysis of domestic and foreign seizures
- Monitor past and current trends
- Research and method development
- Track media reports
- Training (foreign and domestic)
- Partner with domestic and foreign law enforcement and drug monitoring entities
DEA Reference Materials Program

- **Primary Responsibilities**
  - Authentication and verification of RM’s
  - Supply orders for RM’s (internal and external customers)

- **Additional Responsibilities**
  - Coordinates Structural Elucidation/Confirmation Process
  - Authors SWGDRUG monographs
Overview of Synthetic Drugs: 

A Review

Synthetic drugs are man-made substances such as:

- Methamphetamine
- MDMA
- PCP
New Psychoactive Substances (NPS)

- Synthetic Cannabinoids
- Synthetic Cathinones
- Phenethylamine Hallucinogems
- Synthetic Opioids
Synthetic Cannabinoids
Packaging
Evolution of Cannabinoids

JWH-018 → UR-144 → AKB48 → PB-22

PX-2 → 5F-AMB → FUB-PB-22 → AB-FUBINACA
EMERGING THREAT REPORT  Fourth Quarter 2016

The Special Testing and Research Laboratory’s Emerging Trends Program compiled the data for this report through a query of archived seizure and analysis information from drug evidence analyzed by the Drug Enforcement Administration’s laboratory system. This data is representative of drug evidence seized and analyzed in the date ranges annotated. This is not a comprehensive list of all new psychoactive substances and is not representative of all evidence analyzed by DEA. This data is a quarterly snapshot of the new psychoactive substance market in the United States.

The term new psychoactive substance (NPS) describes a recently emerged drug that may pose a public health threat. This includes synthetic cannabinoids, substituted cathinones, phenethylamines, opioids, tryptamines, benzodiazepines, and a variety of other chemical classes. Due to the recent increase in seizures, fentanyl is also included in this report.

An identification is made when authenticated reference material is available for comparison. When reference material is not available, the drug evidence is identified as “substance unconfirmed.” A single unit of drug evidence may have multiple sub-units. For the purposes of this document, each unit of drug evidence counts as one identification regardless of the number of sub-units. Some seized drug evidence contains more than one active ingredient; therefore, more than one identification can be made for a single unit.

**SYNTHETIC CANNABINOIDs**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUB-AMB</td>
<td>58</td>
</tr>
<tr>
<td>ADB-FUBINACA</td>
<td>1</td>
</tr>
<tr>
<td>ADB-CHMINACA</td>
<td>1</td>
</tr>
<tr>
<td>AB-CHMINACA</td>
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</tr>
<tr>
<td>AB-FUBINACA</td>
<td>2</td>
</tr>
<tr>
<td>SF-UR-144</td>
<td>2</td>
</tr>
<tr>
<td>3F-MDMB-PINACA</td>
<td>5</td>
</tr>
</tbody>
</table>

MAB-CHMINACA = ADB-CHMINACA

**TRYPTAMINES**

No substituted tryptamines were identified during the reporting period.

**CATHINONES**

There were 30 cathinone identifications in the fourth quarter of CY 2016. N-ethylpentylone accounted for approximately 57% of the identifications. This is the first quarter of 2016 where dibutylone was not the most identified cathinone.

- N-ethylpentylone: 17
- Ethylone: 3
- Butylone: 3
- Dibutylone: 3

**OPIOIDS/ ANALGESICS**

Fentanyl accounted for 50% of the identifications. The next most prominent fentanyl-related substance, furanyl fentanyl, accounted for 24% of the identifications.

- Furanyl fentanyl: 44
- Butyl fentanyl: 7
- Acetylfentanyl: 2
- Benzyl fentanyl: 2
- 4-ANPP: 4
- 4-Cl-fentanyl: 1
- 4-F-fentanyl: 1
- 4-MF: 1
- 4-EC: 2
- Ethylone: 3
- Dibutylone: 3
- N-ethylpentylone: 17

BMC = Bromomethcathinone
CEC = Chloroethcathinone

**HALLUCINOGENS**

No NPS hallucinogens were identified during the reporting period.

Questions about this data are welcome and may be directed to the DEA Emerging Trends Program at 703-665-3300 or DEA.Emerging_Trends@usdoj.gov.

FOR OFFICIAL USE ONLY
Data Sources

- **DEA Reporting**
  - Laboratory Information Management System (LIMS)
  - Seized: 01/01/2016 – 12/31/2016, Analyzed by 12/31/2016

- **Considerations**
  - Backlogs
  - Availability of reference materials
  - Excludes analyses performed at DEA Special Testing and Research Laboratory
**Synthetic Cannabinoid Identifications**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Count</th>
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</thead>
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<tr>
<td>UR-144</td>
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<tr>
<td>JWH-081</td>
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</tr>
<tr>
<td>FUBIMINA</td>
<td>1</td>
</tr>
<tr>
<td>FDU-PB-22</td>
<td>1</td>
</tr>
<tr>
<td>APP-CHMINACA</td>
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</tr>
<tr>
<td>ADB-PINACA</td>
<td>1</td>
</tr>
<tr>
<td>5F-AKB48</td>
<td>1</td>
</tr>
<tr>
<td>JWH-122</td>
<td>2</td>
</tr>
<tr>
<td>AM2201</td>
<td>2</td>
</tr>
<tr>
<td>JWH-250</td>
<td>3</td>
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<tr>
<td>JWH-019</td>
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<tr>
<td>FUB-144</td>
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<tr>
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<tr>
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<td>PX-2</td>
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<tr>
<td>JWH-073</td>
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<td>FUB-AKB48</td>
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<td>THJ-2201</td>
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<tr>
<td>MAM2201</td>
<td>6</td>
</tr>
<tr>
<td>SDB-005</td>
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<td>5F-PB-22</td>
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<tr>
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<td>10</td>
</tr>
<tr>
<td>5F-AB-PINACA</td>
<td>10</td>
</tr>
<tr>
<td>JWH-018</td>
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<td>MMB-CHMINACA</td>
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<tr>
<td>PB-22</td>
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<tr>
<td>MDMB-FUBINACA</td>
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<tr>
<td>NM2201</td>
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<td>FUB-PB-22</td>
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<tr>
<td>AB-PINACA</td>
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<td>APP-CHMINACA</td>
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<td>AB-FUBINACA</td>
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<tr>
<td>5F-UR-144</td>
<td>222</td>
</tr>
<tr>
<td>FUB-AMB</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.

- 37 synthetic cannabinoids seized and identified
- ~8% of these substances were seized and reported for the first time in 2016
Synthetic Cathinones
Synthetic Cathinones

Three parts of the cathinone molecule can be modified:

- **Aromatic ring**
- **Alkyl group**
- **Amine group**
Cathinone Structures

- **Cathinone**
- **Methylylone**
- **α-PVP**
- **3-Bromomethcathinone**
### Cathinone Identifications

- **24 cathinones seized and identified**
- **~20% were seized and reported for the first time in 2016**

<table>
<thead>
<tr>
<th>Cathinone</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Methoxy-α-pyrrolidinoheptanone</td>
<td>1</td>
</tr>
<tr>
<td>4-F-α-PVP</td>
<td>1</td>
</tr>
<tr>
<td>4-F-α-PHP</td>
<td>1</td>
</tr>
<tr>
<td>4-FMC</td>
<td>1</td>
</tr>
<tr>
<td>4-BMC</td>
<td>1</td>
</tr>
<tr>
<td>3-MEC</td>
<td>1</td>
</tr>
<tr>
<td>PV8</td>
<td>2</td>
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<tr>
<td>4-MEC</td>
<td>2</td>
</tr>
<tr>
<td>3,4-Methylenedioxy-PBP</td>
<td>2</td>
</tr>
<tr>
<td>3,4-MDPV</td>
<td>2</td>
</tr>
<tr>
<td>3-CMC</td>
<td>3</td>
</tr>
<tr>
<td>N-Ethyl-4-methylnorpentedrone</td>
<td>4</td>
</tr>
<tr>
<td>4-CEC</td>
<td>4</td>
</tr>
<tr>
<td>Dimethylnone</td>
<td>6</td>
</tr>
<tr>
<td>4-CMC</td>
<td>6</td>
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<tr>
<td>Methylone</td>
<td>10</td>
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<tr>
<td>4-Cl-α-PPP</td>
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<tr>
<td>4-Cl-α-PVP</td>
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</tr>
<tr>
<td>TH-PVP</td>
<td>16</td>
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<tr>
<td>Pentylnone</td>
<td>18</td>
</tr>
<tr>
<td>α-PVP</td>
<td>44</td>
</tr>
<tr>
<td>N-Ethylpentylnone</td>
<td>57</td>
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<tr>
<td>Ethylone</td>
<td>63</td>
</tr>
<tr>
<td>Dibutylone</td>
<td>78</td>
</tr>
</tbody>
</table>

### Notes:
1. This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.
Hallucinogen Identifications

2015¹
- 25I-NBOMe (20)
- 25C-NBOMe (8)
- 2C-B (8)
- 2C-I (1)
- DOC (1)

2016²
- 25I-NBOMe (3)
- 25C-NBOMe (1)
- 2C-B (1)

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2015 through 12/31/2015 that were analyzed by 12/31/2015.
2) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016.
3) This data is subject to change as the laboratory system obtains reference materials and analyzes exhibits in the backlog.
Tryptamine Identifications

2015¹

• 5-MeO-DALT (4)
• 5-MeO-DiPT (3)
• 5-MeO-MiPT (2)

2016²

• 5-MeO-DiPT (3)
• 5-MeO-MiPT (1)

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2015 through 12/31/2015 that were analyzed by 12/31/2015.
2) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016.
3) This data is subject to change as the laboratory system obtains reference materials and analyzes exhibits in the backlog.
2016 Annual – Other

- Substance Unconfirmed (43)
- Mitragynine (9)
- Deschloroketamine (8)
- 3-Fluorophenmetrazine (3)*
- 4-Fluoroamphetamine (3)
- MDMA methylene homolog (2)
- 5-EAPB (6)*

- Methoxetamine (2)
- W-18 (2)
- Ethylphenidate (1)
- MDPT (tBuONE) (1)*
- N-Ethyl-N-methyl-1,2-diphenylethan-1-amine (1)*

*Seized and reported for the 1st time in 2016

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.
SYNTHETIC OPIOIDS
Synthetic Opioids Seized in 2015

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2015 through 12/31/2015 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.
Fentanyl-type substances

- Acetyl fentanyl
- Fentanyl
- Butyryl fentanyl
- Valeryl fentanyl (Pentanoyl fentanyl)
Opioid & “Fentanyl-like” Identifications

- 15 different substances seized and identified in 2016
- ~60% of these substances were seized and reported for the first time in 2016

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.
Fentanyl-type substances

- Fentanyl
- 3-Methylnfentanyl
- 4-Fluroiso-butyrfentanyl
- β-Hydroxythiofentanyl
- Carfentanil
Fentanyl and related mixtures

Only Controlled Substance
- 46% of Fentanyl exhibits
- 36% of Furanyl fentanyl exhibits
- 24% of Acetylfentanyl exhibits

With Heroin
- 42% of Fentanyl exhibits
- 46% of Furanyl fentanyl exhibits
- 44% of Acetylfentanyl Exhibits

With Other
- 12% of Fentanyl exhibits
- 18% of Furanyl Fentanyl Exhibits
- 32% of Acetylfentanyl exhibits
Synthetic Opioids

- Furanyl fentanyl
- Acetylfentanyl
- Valeryl fentanyl
- Fentanyl
Estimated Fatal Dose

- 2 milligrams* of fentanyl hydrochloride

Carfentanil

- Used as a tranquilizing agent for elephants and other large animals
- Schedule II Substance under the Controlled Substances Act
- Approximately 100 times more potent than fentanyl and 10,000 times more potent than morphine
- First reported in Ohio in summer of 2016
- Typically seen as powder or capsules, some tablets

DEA Officer Safety Alert, Carfentanil: A Dangerous New Factor in the U.S. Opioid Crisis, September 2016.
Carfentanil in the U.S.

• RMP supplied a carfentanil reference material to 22 laboratories between July-October 2016
• Questionnaire results:
  - How many identifications were made?
  - What is the form?
  - What other substances were identified?
• As of November 2016, SFL1 has received confirmation of 451 carfentanil identifications throughout the United States.
  - 83% were in Ohio

This data is representative of drug evidence that was seized and analyzed containing carfentanil. It is not inclusive of all carfentanil identifications made in the United States during this time period since the data is dependent upon the accuracy and completeness of the responses provided. We thank our colleagues and their laboratories for responding to our questionnaire, providing information regarding carfentanil seizures, and for submitting samples for testing.
Reported carfentanil identifications
July–October 2016

Provided data

<table>
<thead>
<tr>
<th>Substance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powder</td>
<td>280</td>
</tr>
<tr>
<td>Capsule</td>
<td></td>
</tr>
<tr>
<td>Residue</td>
<td></td>
</tr>
<tr>
<td>Blood</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>Tablet</td>
<td></td>
</tr>
</tbody>
</table>

- Heroin/Fentanyl: 1
- Heroin/Furanyl Fentanyl/Fentanyl: 4
- Fentanyl: 5
- Heroin/Fentanyl: 13
- Other Controlled Substance: 15
- Furanyl Fentanyl: 16
- Heroin: 27
- Only Controlled Substance: 90
- No Reporting: 280
# DEA Carfentanil Identifications

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>as the only controlled substance</td>
<td>Caffeine, diphenhydramine, quinine, procaine, lidocaine, benzocaine, dipyrone</td>
</tr>
<tr>
<td>29%</td>
<td>in combination with heroin</td>
<td>Heroin/fentanyl, Heroin/fentanyl/cocaine, Heroin/fentanyl/acetylfentanyl</td>
</tr>
<tr>
<td>47%</td>
<td>with a controlled substance other than heroin</td>
<td>Furanyl fentanyl, Fentanyl/furanyl fentanyl, Cocaine/alprazolam, Tramadol/methamphetamine</td>
</tr>
</tbody>
</table>
Challenges

Field testing for law enforcement
• More accurate with pure samples
• Presumptive/non-specific
• Handling of fentanyl-type substances by officers

Forensic Analysis
• Low purity and complex mixtures
• Increased availability for neat materials
• Limited comparable data for verification
Structural Confirmation

- Verification of structure when no literature exists for comparison
- NMR Experimentation (1D & 2D)
  - Proton NMR (HNMR)
  - Carbon NMR (CNMR)
  - Correlation Spectroscopy (COSY)
  - Heteronuclear Single Quantum Coherence (HSQC)
  - Heteronuclear Multiple Bond Correlation (HMBC)
Structural Elucidation

- Not from a reputable source and no comparable data:
- NMR Experimentation (1D & 2D)
  - Proton NMR (HNMR)
  - Carbon NMR (CNMR)
  - Correlation Spectroscopy (COSY)
  - Heteronuclear Single Quantum Coherence (HSQC)
  - Heteronuclear Multiple Bond Correlation (HMBC)
- MS Interpretation
  - EI - Fragmentation
  - Accu-TOF DART – Exact mass and fragmentation
- Salt Form Determination
Structural Elucidation of: 4-chloroethcathinone
Structural Elucidation of: valeryl fentanyl
General Information
• IUPAC Name
• Synonyms

Chemical and Physical Data

Qualitative Data
• NMR
• GC/MS
• FTIR
  ✓ Sample preparation
  ✓ Instrument parameters

Additional Resources
• Links to other resources
• Article citations
2016 Top 5 NPS Identifications by Laboratory

Notes:
1) This data was compiled from analytical results from the DEA laboratory system. It encompasses exhibits seized 01/01/2016 through 12/31/2016 that were analyzed by 12/31/2016. The data was retrieved on 01/04/2017.
2) 2 = Northeast Laboratory; 3 = Mid-Atlantic Laboratory; 4 = Southeast Laboratory; 5 = North Central Laboratory; 6 = South Central Laboratory; 7 = Western Laboratory; 8 = Southwest Laboratory
3) Due to the recent increase in seizures, fentanyl is included.
Acknowledgements

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