DRUG ENFORCEMENT ADMINISTRATION
**Office of Forensic Sciences**
Special Testing and Research Laboratory

# Fentanyl Profiling Program Report
## CY 2022

**UNCLASSIFIED PRB# 2023-27**

## *Summary*

The United States Drug Enforcement Administration Special Testing and Research Laboratory's Fentanyl Profiling Program (FPP) provides scientific data and intelligence information on illicit fentanyl. Submissions to the FPP are analyzed for purity, adulteration and dilution, and classified to a synthetic route. FPP analyzes exemplars of fentanyl seizures greater than 800 grams submitted to the DEA Laboratory System. FPP findings provide a snapshot of current fentanyl synthesis and trafficking trends; it may not reflect the domestic or global illicit fentanyl supply in its entirety, nor is it representative of total federal fentanyl seizures.

This report summarizes the collective results of wholesale fentanyl samples seized in the United States (U.S.) during CY 2022. Domestic and foreign fentanyl trends observed by the FPP over the last four years are also discussed throughout this report.

## *Key Findings*

- The Gupta-1 method was the primary synthetic route used in the synthesis of fentanyl samples examined by the FPP this reporting period.
- The average fentanyl powder purity for domestic samples was 19.2% with a range of 0.07% to 81.5%. The average tablet contained 2.4 mg of fentanyl with a range of 0.03 to 9.0 mg per tablet.
- Three hundred ninety-three of the tablet exhibits samples examined (65%) contained at least 2 mg of fentanyl.

**Inside this issue:**



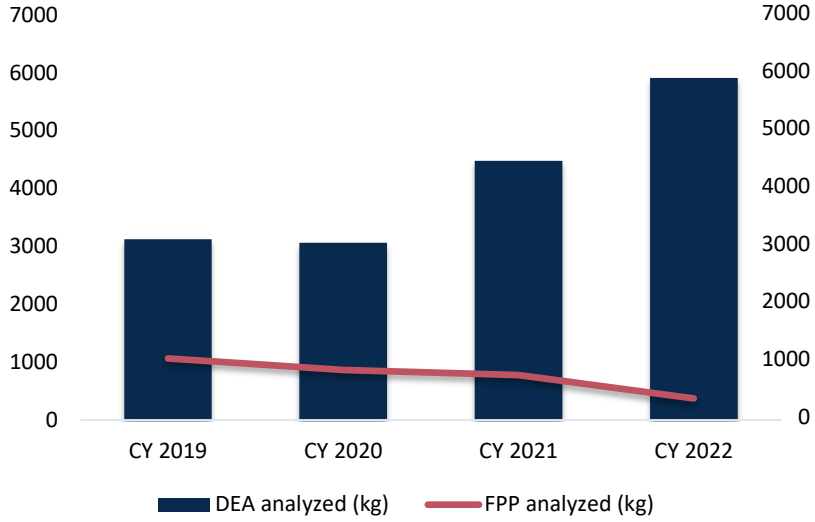
*2 mg fentanyl on pencil tip*

*"Rainbow" fentanyl tablets*

## Domestic Submissions

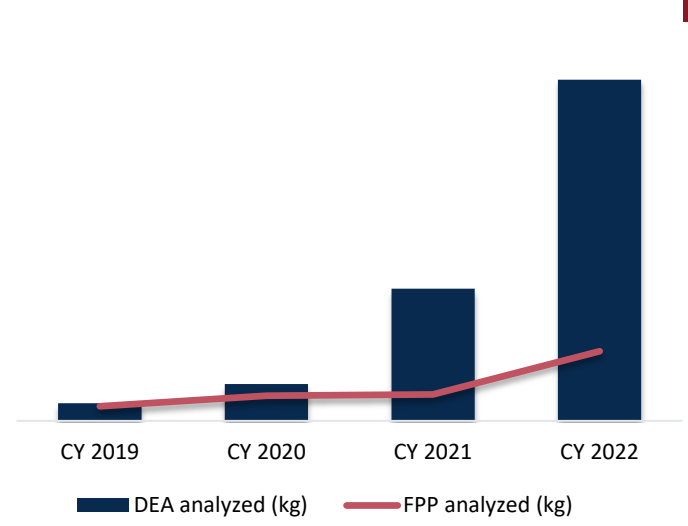
In each of the last three years, FPP analyzed samples from U.S. seizures totaling between 375 – 870 kg for powders and 440 – 1200 kg for tablets. This is 6 – 30% (powders) and 20 – 70% (tablets) of all samples analyzed by the DEA Laboratory System during the same reporting period. Results presented in this report are subject to change as they only account for the information available at the time of extraction from DEA laboratory databases.

**Fentanyl Powder Samples Analyzed by DEA Laboratory System and FPP (kg)**




*Internal DEA laboratory system data extracted 09/05/23*

**Fentanyl Tablet Samples Analyzed by DEA Laboratory System and FPP (kg)**

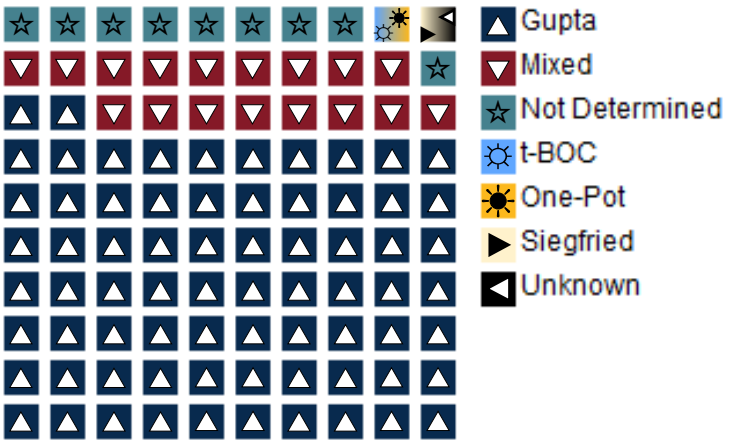



*Internal DEA laboratory system data extracted 09/05/23*

## Domestic Results and Trends

### Synthetic Route Classification – Powders

Three hundred seventy exhibits representing more than 378 kg of fentanyl powder were examined. Approximately 72% of the fentanyl powder samples analyzed by the FPP were synthesized using the Gupta patent method (Gupta) or a modified Gupta method (Gupta-1 or Gupta-2). Of the Gupta-related samples, approximately 70% were classified as using the Gupta-1 method, 28% as the Gupta patent method, and 2% as the Gupta-2 method. Approximately 17% of the fentanyl powder samples analyzed by the FPP were determined to have a mixed route, meaning the samples showed characteristics of more than one synthetic route. For approximately 9% of the fentanyl powder samples analyzed by the FPP, the route could not be determined. This typically occurs when there is insufficient sample for analysis or the sample does not contain sufficient impurities for classification.

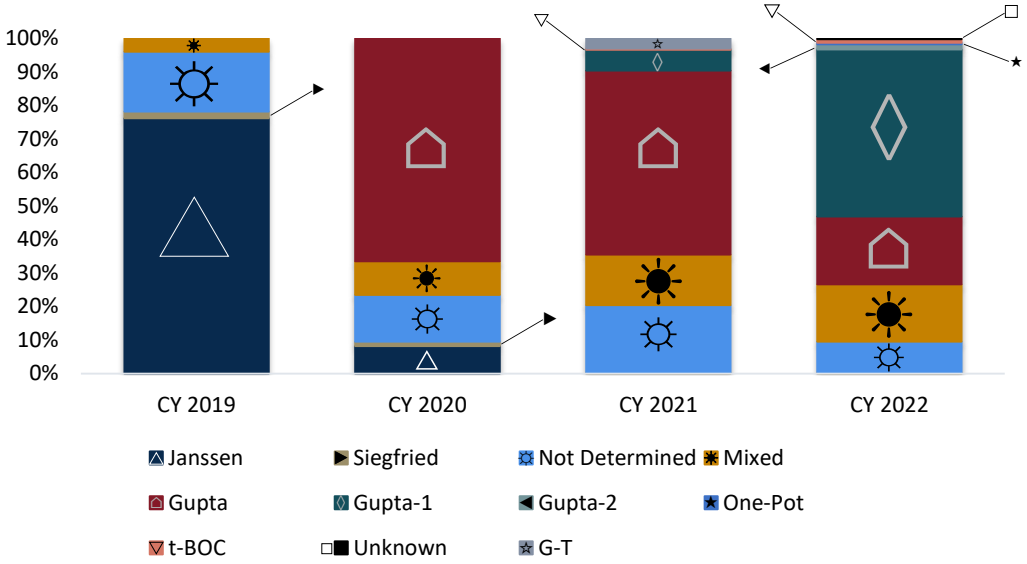



*Precursor chemicals associated with the various routes are included on page 15*

## Synthetic Route Classification – Powders, continued

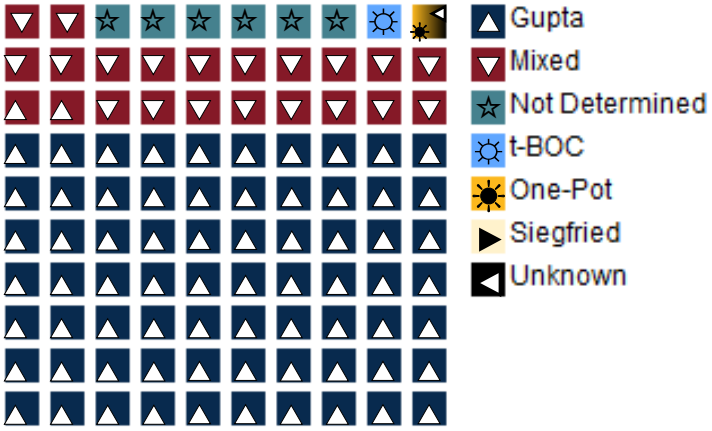
The primary synthetic route employed in the synthesis of illicit fentanyl powder has changed since CY 2019. In CY 2019, the Janssen route was the primary synthetic route identified by the FPP. The following year, the Gupta patent method became the most prevalent synthetic route. Since CY 2021, a modified version of the Gupta method (Gupta-1) has become the predominant method used in the synthesis of illicit fentanyl powder.

**Synthetic Route of Fentanyl Powders: U.S. Seized FPP Samples (CY 2019 – 2022)**




## Synthetic Route Classification – Tablets

Six hundred and ninety tablet exhibits representing approximately 1206 kg were examined. Approximately 70% of the fentanyl tablet samples analyzed by the FPP were synthesized using the Gupta patent method (Gupta) or a modified Gupta method (Gupta-1 or Gupta-2). Of the Gupta-related samples, approximately 59% were classified as using the Gupta-1 method, 11% as the Gupta patent method, and <1% as the Gupta-2 method. Approximately 22% of the fentanyl powder samples analyzed by the FPP were determined to have a mixed route, meaning the samples showed characteristics of more than one synthetic route. For approximately 6% of the fentanyl powder samples analyzed by the FPP, the route could not be determined. This typically occurs when there is insufficient sample for analysis or the sample does not contain sufficient impurities for classification.

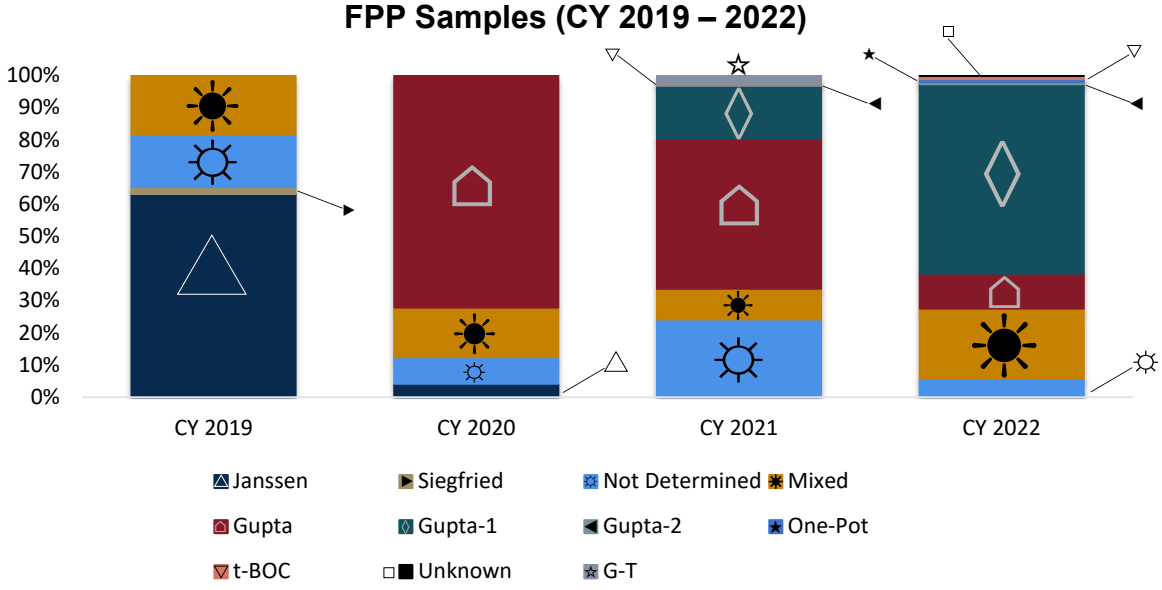



*Precursor chemicals associated with the various routes are included on page 15*

## Synthetic Route Classification – Tablets, continued

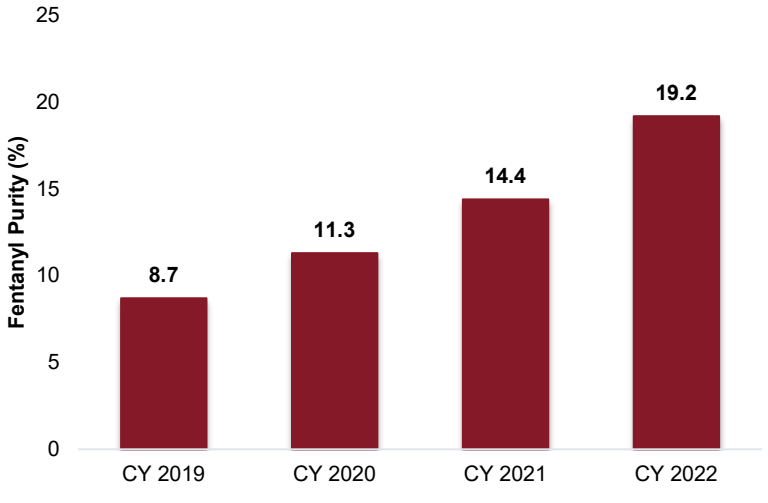
The primary synthetic route employed in the synthesis of illicit fentanyl tablets has changed since CY 2019. In CY 2019, the Janssen route was the primary synthetic route identified by the FPP. The following year, the Gupta patent method became the most prevalent synthetic route. Starting this reporting period, a modified version of the Gupta method (Gupta-1) has become the predominant methods used in the synthesis of illicit fentanyl tablets.

**Synthetic Route of Fentanyl Tablets: U.S. Seized FPP Samples (CY 2019 – 2022)**



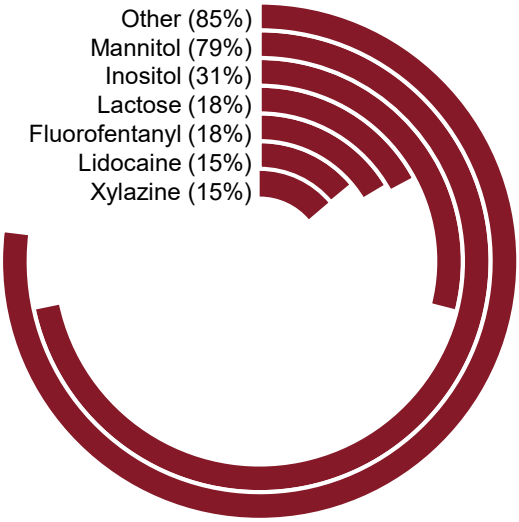

## Purity and Adulterants/Diluents – Powders

The average fentanyl purity was 19.2% with a range of 0.07% to 81.5%. No exhibits had purities exceeding 90%. When determined, all exhibits were fentanyl HCl; no exhibits were the citrate salt form. The salt form could not be determined for five exhibits due to low fentanyl concentration. Fentanyl purity observed in FPP samples has increased consistently since CY 2019.

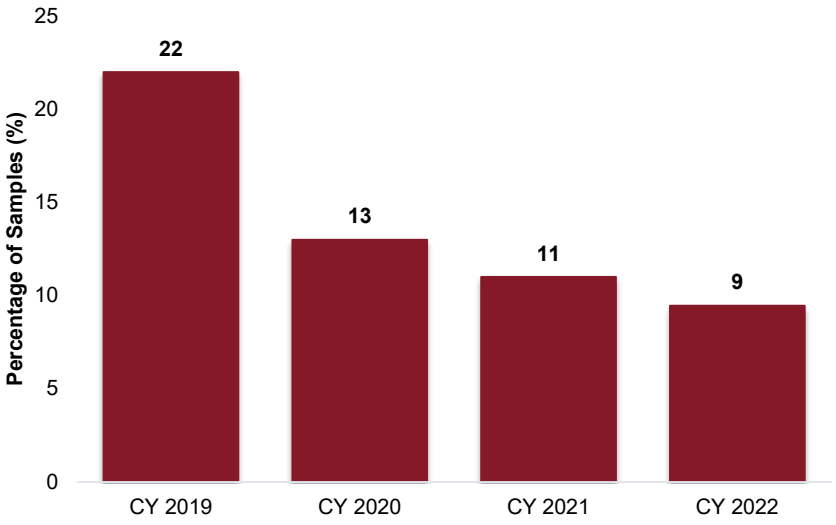
## Purity and Adulterants/Diluents – Powders, continued

The top substances reported with fentanyl in powders are various sugars. The prevalence of sugars has changed slightly since CY 2021 with a decline in the number of inositol and lactose identifications. Fluorofentanyl co-identifications increased from 14% in CY 2021 to 18% in CY 2022. Xylazine identifications remains consistent with CY 2021.




Substances falling into the “other” category include caffeine, tramadol, and heroin, among others.

Since CY 2019, the FPP has seen a significant decrease in the co-identifications of fentanyl and heroin.



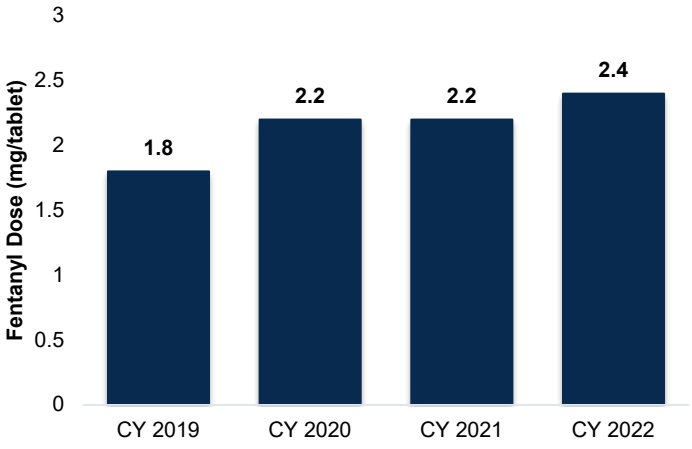

## Purity and Adulterants/Diluents – Tablets

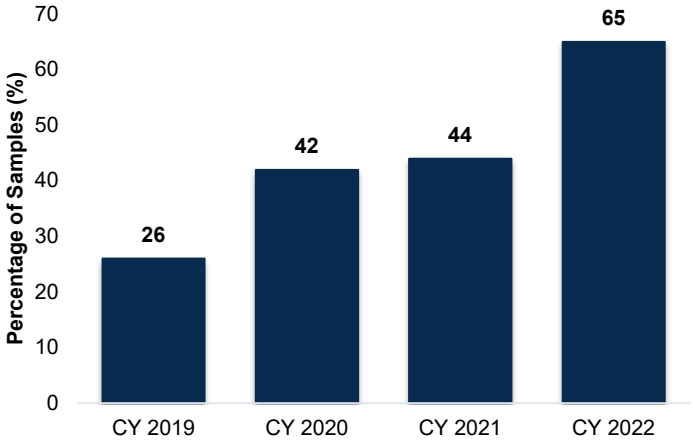
The average tablet contained 2.4 mg of fentanyl with a range of 0.03 to 9.0 mg/tablet. When determined, exhibits were fentanyl HCl. The salt form was not determined in two exhibits due to low fentanyl concentration. The average fentanyl tablet contains more than 0.5 mg more fentanyl per tablet in CY 2022 than it did in CY 2019.

## Purity and Adulterants/Diluents – Tablets, continued

### Tablets Containing at Least 2 mg of Fentanyl

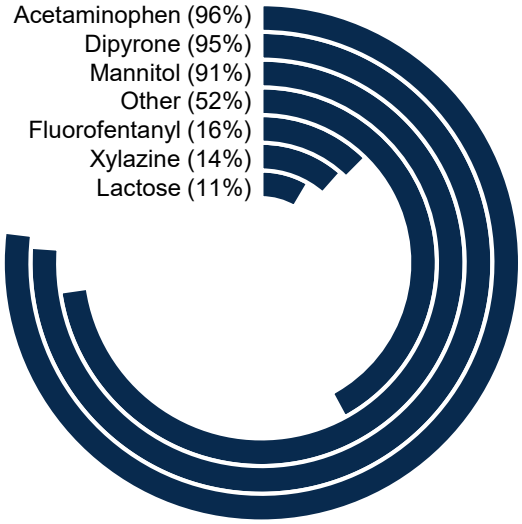
Three hundred ninety-three of the tablet exhibits quantitated (65%) contained at least 2 mg of fentanyl. Since CY 2019, a greater percentage of tablets analyzed by the FPP contain at least 2 mg of fentanyl.




Consistent with previous years, acetaminophen, dipyrone, and mannitol are the most common adulterants and diluents observed in fentanyl tablets analyzed by the FPP.

Substances falling into the “other” category include lidocaine, inositol, and dimethyl sulfone, among others.

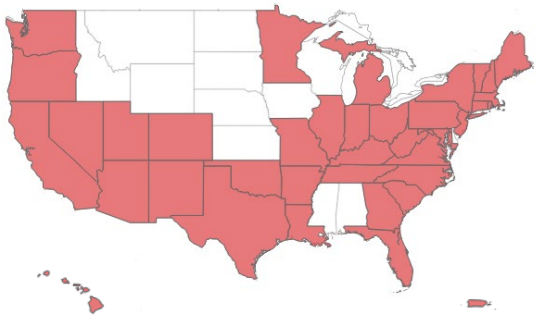


## CONUS Seizures – Powders

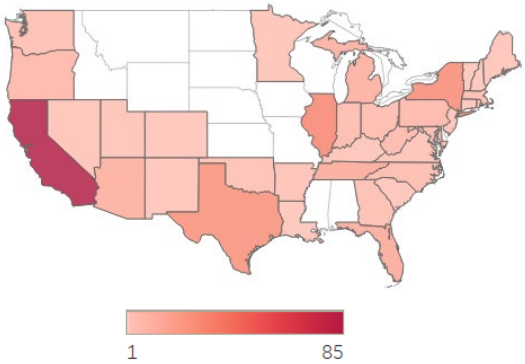
The following table and map summarize the number of powder samples, total kg seized, and purity by state. Please note that these graphics describe samples analyzed by the FPP. For information on FPP sampling, see page 15.

| State | Total Samples | Total Seized (kg) | Average Fentanyl Purity (%) | Min. Fentanyl Purity (%) | Max. Fentanyl Purity (%) |
|---|---|---|---|---|---|
| AR | 4 | 32.6 | 34.6 | 34.5 | 34.7 |
| AZ | 13 | 14.5 | 29.0 | 8.7 | 49.6 |
| CA | 85 | 103.9 | 23.0 | 0.2 | 81.5 |
| CO | 2 | 0.5 | 1.5 | - | - |
| CT | 1 | 0.2 | 0.3 | - | - |
| DC | 1 | 0.1 | - | - | - |
| FL | 15 | 5.7 | 9.2 | 0.0 | 1.1 |
| GA | 5 | 1.8 | 19.8 | 17.1 | 21.2 |
| HI | 2 | 0.5 | 4.6 | 4.5 | 4.7 |
| IL | 32 | 34.3 | 19.4 | 0.2 | 34.0 |
| IN | 7 | 8.0 | 18.7 | 1.3 | 24.6 |
| KY | 2 | 1.2 | 6.6 | 2.1 | 11.1 |
| LA | 10 | 4.4 | 9.1 | 4.3 | 18.5 |
| MA | 5 | 4.8 | 16.7 | 9.7 | 22.9 |
| MD | 7 | 12.1 | - | - | - |
| ME | 2 | 0.0 | 12.8 | 2.8 | 22.8 |
| MI | 13 | 11.8 | 16.8 | 0.3 | 64.8 |
| MN | 3 | 3.2 | 19.4 | 12.6 | 31.2 |
| MO | 16 | 8.9 | 24.5 | 7.0 | 54.8 |
| NC | 7 | 2.3 | 10.2 | 0.7 | 43.1 |
| NH | 1 | 0.2 | 13.0 | - | - |
| NJ | 3 | 2.1 | 8.5 | - | - |
| NM | 2 | 1.6 | 19.8 | 10.0 | 29.7 |
| NV | 3 | 13.0 | 43.0 | 42.6 | 43.3 |
| NY | 29 | 27.3 | 18.0 | 0.5 | 55.9 |
| OH | 7 | 2.2 | 5.3 | 1.7 | 11.7 |
| OK | 4 | 4.8 | 17.1 | 1.6 | 32.9 |
| OR | 9 | 2.3 | 11.2 | 9.2 | 12.3 |
| PA | 9 | 4.6 | 16.8 | 2.6 | 30.5 |
| PR | 3 | 3.0 | 22.9 | 21.7 | 23.5 |
| RI | 4 | 1.9 | 2.0 | 2.0 | 2.0 |
| SC | 2 | 1.0 | 17.6 | 17.4 | 17.8 |
| TN | 15 | 8.8 | 20.7 | 1.1 | 58.1 |
| TX | 27 | 39.1 | 17.6 | 0.4 | 77.7 |
| UT | 3 | 10.0 | 19.7 | 18.0 | 21.3 |
| VA | 3 | 2.5 | 25.3 | 20.4 | 30.2 |
| VT | 1 | 0.2 | 2.9 | - | - |
| WA | 5 | 1.3 | 22.5 | 2.8 | 37.9 |
| WV | 8 | 2.1 | 10.0 | 2.9 | 21.7 |

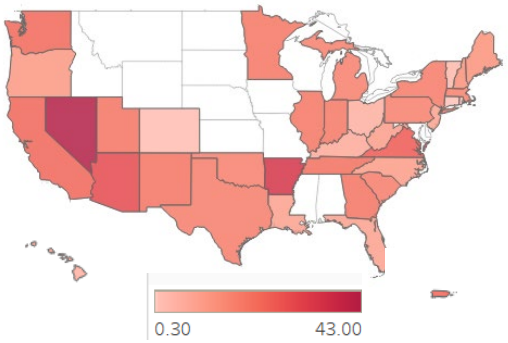
**States With Fentanyl Powder Seizures—CY 2022**



**Count of Fentanyl Powder Seizures by State—CY 2022**




**Average Fentanyl Powder Purity by State—CY 2022**

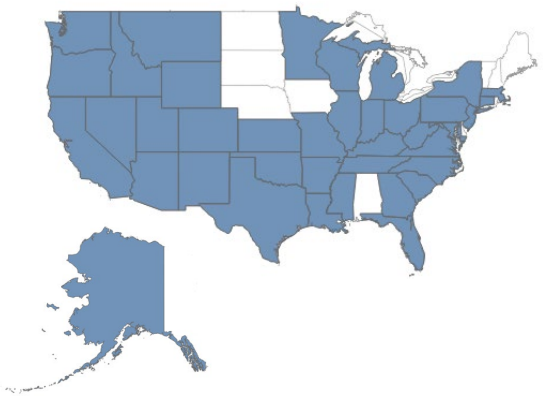


## CONUS Seizures – Tablets

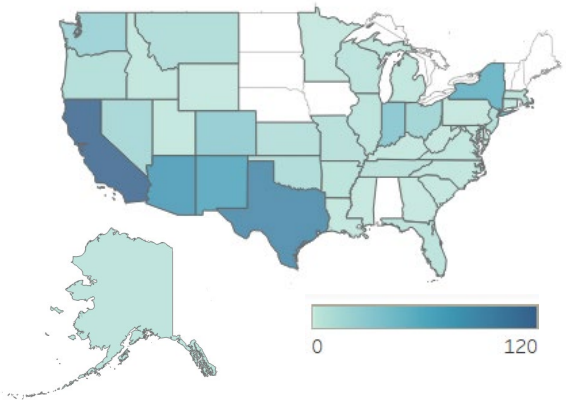
The following table and map summarize the number of tablet samples, total kg seized, and purity by state. Please note that these graphics describe samples analyzed by the FPP. For information on FPP sampling, see page 15.

| State | Total Seizures | Total Seized (kg) | Average Fentanyl Purity (%) | Min. Fentanyl Purity (%) | Max. Fentanyl Purity (%) |
|---|---|---|---|---|---|
| AK | 5 | 2.2 | 2.9 | 1.5 | 3.5 |
| AR | 7 | 26.6 | 3.9 | 2.5 | 4.5 |
| AZ | 76 | 236.8 | 2.5 | 0.2 | 5.0 |
| CA | 120 | 294.1 | 2.7 | 0.0 | 5.4 |
| CO | 30 | 35.4 | 1.9 | 0.2 | 5.1 |
| CT | 2 | 0.2 | 0.5 | - | - |
| FL | 6 | 3.0 | 2.5 | 0.8 | 4.2 |
| GA | 1 | 0.0 | - | - | - |
| ID | 3 | 3.1 | 1.6 | 1.0 | 2.0 |
| IL | 6 | 3.1 | 3.5 | 1.9 | 4.1 |
| IN | 36 | 4.0 | 3.4 | 1.8 | 4.2 |
| KS | 10 | 2.0 | 3.4 | 1.3 | 5.0 |
| KY | 2 | 4.5 | 1.5 | 1.2 | 1.8 |
| LA | 2 | 0.4 | 1.5 | - | - |
| MA | 6 | 3.5 | 2.1 | 1.1 | 2.7 |
| MD | 2 | 1.5 | 3.2 | - | - |
| MI | 3 | 3.0 | 2.4 | 2.3 | 2.5 |
| MN | 1 | 0.2 | - | - | - |
| MO | 9 | 2.1 | 2.1 | 1.7 | 2.7 |
| MS | 1 | 0.1 | 1.7 | - | - |
| MT | 13 | 2.7 | 1.7 | 0.8 | 3.0 |
| NC | 3 | 2.5 | 2.7 | 2.2 | 3.2 |
| NJ | 11 | 2.3 | 1.9 | 1.1 | 2.5 |
| NM | 65 | 110.7 | 2.0 | 0.5 | 3.2 |
| NV | 18 | 6.2 | 1.8 | 1.1 | 3.4 |
| NY | 55 | 67.2 | 2.8 | 1.4 | 6.8 |
| OH | 21 | 3.0 | 2.2 | 1.9 | 2.6 |
| OK | 14 | 21.8 | 2.0 | 0.2 | 5.4 |
| OR | 11 | 23.7 | 2.1 | 1.1 | 2.7 |
| PA | 1 | 2.0 | - | - | - |
| SC | 2 | 2.3 | 1.6 | 0.7 | 2.5 |
| TN | 8 | 3.5 | 2.4 | 1.6 | 3.1 |
| TX | 92 | 258.3 | 2.1 | 0.3 | 5.5 |
| UT | 2 | 4.1 | 1.8 | 1.6 | 2.0 |
| VA | 3 | 1.4 | 1.5 | 1.3 | 1.7 |
| WA | 25 | 38.8 | 2.3 | 0.5 | 6.3 |
| WI | 6 | 6.4 | 2.0 | 1.7 | 2.1 |
| WV | 1 | 0.1 | 2.3 | - | - |
| WY | 1 | 1.1 | 2.6 | - | - |

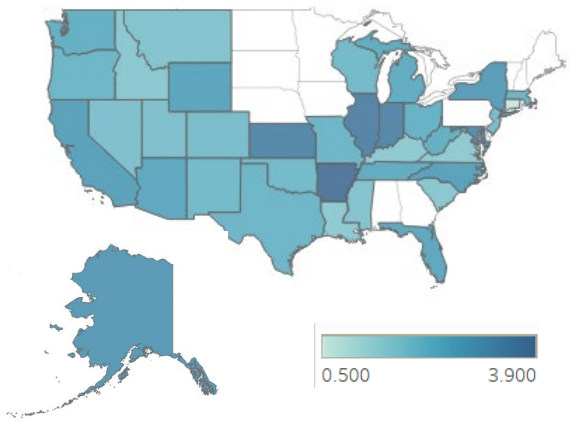
**States With Fentanyl Tablet Seizures—CY 2022**



**Count of Fentanyl Tablet Seizures by State—CY 2022**




**Average Fentanyl Dose by State—CY 2022**



## Other Forms

### Tars & Pastes

| Primary Fentanyl | Purity (%) | Description | Route |
|---|---|---|---|
| Fentanyl | —— | Brown rock-like tar | Gupta |
| Fentanyl | 11.4 | Purple paste | Gupta-1 |
| Fentanyl | 13.4 | Green paste | Gupta-1 |
| Fentanyl | 0.6 | Black tar | Not Determined |
| p-Fluorofentanyl | 0.4 | Red-brown rock-like tar | Gupta |
| Fentanyl | 5.1 | Brown tar | Gupta-1 |
| Fentanyl | 1.3 | Purple resin | Gupta |
| Fentanyl | 1.4 | Purple resin | Gupta |
| p-Fluorofentanyl | 0.2 | Black rock-like tar | Gupta |
| Fentanyl | 6.6 | Black tar | Gupta-1 |

These samples were seized in the following states: AZ (1), CA (1), CO (1), OH (1), OR (2), SC (2), TX (2). Heroin was also identified in three samples. Other common diluents include mannitol, sucrose, lactose, and inositol.

## Fentanyl-Related Compound Submissions

Forty eight exhibits containing fentanyl-related compounds as the primary fentanyl were examined. The following table summarizes data obtained from the analyses.

| Fentanyl-Related Compound | # Exhibits | Purity (%) | Description |
|---|---|---|---|
| Fluorofentanyl | 46 | 0.8 - 28.5 | Powder = 33<br>Tablets = 13 |
| t-BOC-4-Fluoro-AP | 2 | >99% | White powder |

## Southwest Border Seizures

Eleven powder samples and 32 tablet samples seized at Ports of Entry (POE) along the United States/Mexico border were analyzed during this reporting period. A drug quality breakdown by POE are summarized as follows:

| Form | State | Number of Samples | Purity Range (% or mg/tab) | Average Purity (% or mg/tab) | Synthetic Route | Adulterants/Diluents |
|---|---|---|---|---|---|---|
| Powder | AZ | 3 | 20.2-49.5 | 36.4 | Gupta-1 (2)<br>Mixed (1) | Mannitol (3) |
| | CA | 2 | 26.5-43.9 | 35.2 | Gupta-1 (1)<br>Mixed (1) | Mannitol (3) |
| | NM | 0 | —— | —— | —— | —— |
| | TX | 6 | 15.7-77.7 | 32.4 | Gupta-1 (4)<br>Gupta (1)<br>Mixed (1) | Inositol (3), Mannitol (2) |
| Tablets | AZ | 6 | 1.3-4.1 | 2.1 | Gupta-1 (2)<br>Gupta (1)<br>t-BOC (G-T) (1)<br>Mixed (1)<br>ND (1) | Dipyrone (6), Acetaminophen (6), Mannitol (5), Lactose (1), Fluorofentanyl (1), Procaine (1) |
| | CA | 8 | 1.8-3.2 | 2.5 | Gupta-1 (5)<br>Mixed (2)<br>ND (1) | Acetaminophen (8), Mannitol (8), Dipyrone (8), Inositol (1), Xylazine (1), Lidocaine (1), Fluorofentanyl (1) |
| | NM | 0 | —— | —— | —— | —— |
| | TX | 18 | 0.8-4.2 | 2.1 | Gupta-1 (10)<br>Gupta (5)<br>Mixed (2)<br>ND (1) | Acetaminophen (18), Mannitol (16), Dipyrone (18), Lactose (4), Inositol (2), Lidocaine (3), Fluorofentanyl (9), Xylazine (3), Tramadol (2), Caffeine (2), Methamphetamine (1) |

# FPP Laboratory Analysis Summary by POE

## Arizona Port of Entry (POE) Seizures

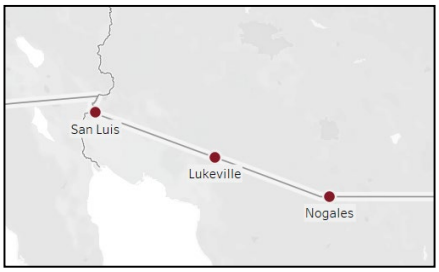
**Powders**

**Lukeville**

1 seizure
Total seizure weight: 0.9 kg
Synthetic Route: Gupta-1 (1)
Purity: 20.2%

**Nogales**

2 seizures
Total seizure weight: 2.9 kg
Synthetic Route: Gupta-1 (1), Mixed (1)
Purity: 39.4-49.5%




**Tablets**

**Lukeville**

2 seizures
Total seizure weight: 2.5 kg
Synthetic route: Gupta (1), ND (1)
Dosage: 1.5-4.1 mg/tab

**Nogales**

4 seizures
Total seizure weight: 32.8 kg
Synthetic route: Gupta-1 (2), G-T (1), Mixed (1)
Dosage: 1.3-2.4 mg/tab

## California Port of Entry (POE) Seizures

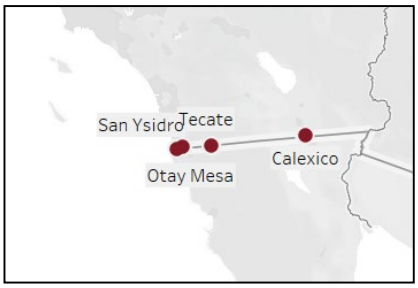
**Powders**

**Calexico**

1 seizure
Total seizure weight: 20.7 kg
Synthetic Route: Gupta-1 (1)
Purity: 43.9%

**Otay Mesa**

1 seizure
Total seizure weight: 0.99 kg
Synthetic Route: Mixed (1)
Purity: 26.5%




**Tablets**

**Calexico**

3 seizures
Total seizure weight: 26.4 kg
Synthetic route: Gupta-1 (1), Mixed (1), ND (1)
Dosage: 1.8-3.2 mg/tab

**San Ysidro**

5 seizures
Total seizure weight: 9.3 kg
Synthetic route: Gupta-1 (3), Mixed (1), ND (1)
Dosage: 2.4-3.0 mg/tab

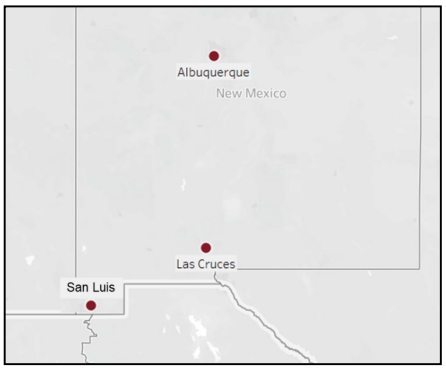
## New Mexico Port of Entry (POE) Seizures

### Powders

None

### Tablets

None




## Texas Port of Entry (POE) Seizures

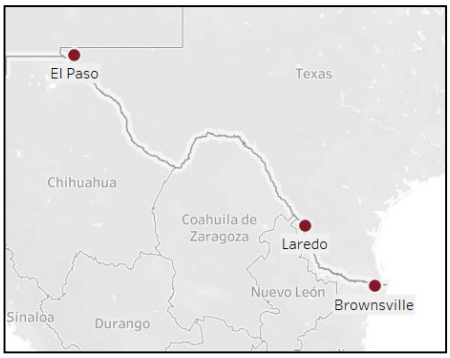
### Powders

**Brownsville**

3 seizures
Total seizure weight: 1.7 kg
Synthetic Route: Gupta-1 (3)
Purity: 17.2-28.2%

**El Paso**

3 seizures
Total seizure weight: 6.2 kg
Synthetic Route: Gupta (1), Gupta-1 (1), Mixed (1)
Purity: 15.7-77.7%




### Tablets

**Brownsville**

1 seizure
Total seizure weight: 2.0 kg
Synthetic route: Mixed (1)
Dosage: 2.7 mg/tab

**El Paso**

16 seizures
Total seizure weight: 13.9 kg
Synthetic route: Gupta-1 (10), Gupta (4), Mixed (1), ND (1)
Dosage: 0.8-3.7 mg/tab

**Laredo**

1 seizure
Total seizure weight: 1.4 kg
Synthetic route: Gupta (1)
Dosage: 4.2 mg/tab

## *Foreign Results*

### Country #1

Seven fentanyl HCl samples were analyzed. A summary of these results can be found in the table below. Another sample consisted of a pink-purple rock-like powder which contained not fentanyl, but was found to contain carfentanil (1.2%), sildenafil, and mannitol. The synthetic route was not determined.

| Substances Identified | Synthetic Route | Description |
|---|---|---|
| Fentanyl (3.9%), dimethyl sulfone (42.6%), mannitol (51.4%), caffeine (0.7%) | Mixed | Blue rock-like powder |
| Fentanyl (26.6%), inositol (1.7%), caffeine (29.4%), dextrose (5.9%), mannitol (8.4%) | Gupta | Black rock-like powder |
| Fentanyl (2.1%), acetaminophen (14.8%), methamphetamine (0.3%), dimethyl sulfone (46.3%), heroin, lactose (10.5%), caffeine (4.0%), diazepam | t-BOC | Yellow compressed powder |
| Fentanyl (18.4%), caffeine (13.8%), cocaine, flubromazepam | Gupta | Off-white chunky powder |
| Fentanyl (18.4%), caffeine (14.8%), carfentanil | Gupta | Blue-green chunky powder |
| Fentanyl (7.2%), caffeine (15.1%), carfentanil, flubromazepam | Gupta | White chunky powder |
| Fentanyl (18.7%), caffeine (13.6%), flubromazepam | Gupta | Purple rock-like powder with grape odor |

### Country #2

One sample consisting of blue M 30 tablets was submitted for analysis. The sample was found to contain fentanyl (2.1%), acetaminophen (44.2%), mannitol (28.7%), and dipyrone (5.7%). It was found to have a mixed synthetic route with indications of both Gupta-1 and Gupta-2 routes.

## *Background Information*

### Sampling Plan

At its inception in October 2017, FPP received fentanyl samples weighing greater than 100 g from the DEA laboratory system. FPP also received submissions of any fentanyl related substances, regardless of weight. In October 2021, that sampling plan was limited for the DEA's laboratories in New York and San Diego, due to the overwhelming number of samples submitted by those laboratories. Targeted sampling of "rainbow fentanyl" tablets occurred between August 2022 and March 2023. In January 2023, FPP focused efforts on seized samples weighing greater than 800 g. In July 2023, new sampling guidance was released to the DEA laboratory system advising the submission of samples containing fentanyl, fentanyl-related compounds, and precursor chemicals when the net weight is greater than or equal to 800 g. Glassine baggies are not accepted and liquid fentanyl samples are considered on a case-by-case basis.

### Synthetic Route Classifications

Synthetic route classifications are listed below. Synthetic route classification results from an analysis of the impurities in the fentanyl sample. Synthetic routes have been reproduced at the Special Testing and Research Laboratory.

Janssen

Siegfried/Valdez

One-Pot

Gupta

Gupta-1

Gupta-2

t-BOC-Norfentanyl