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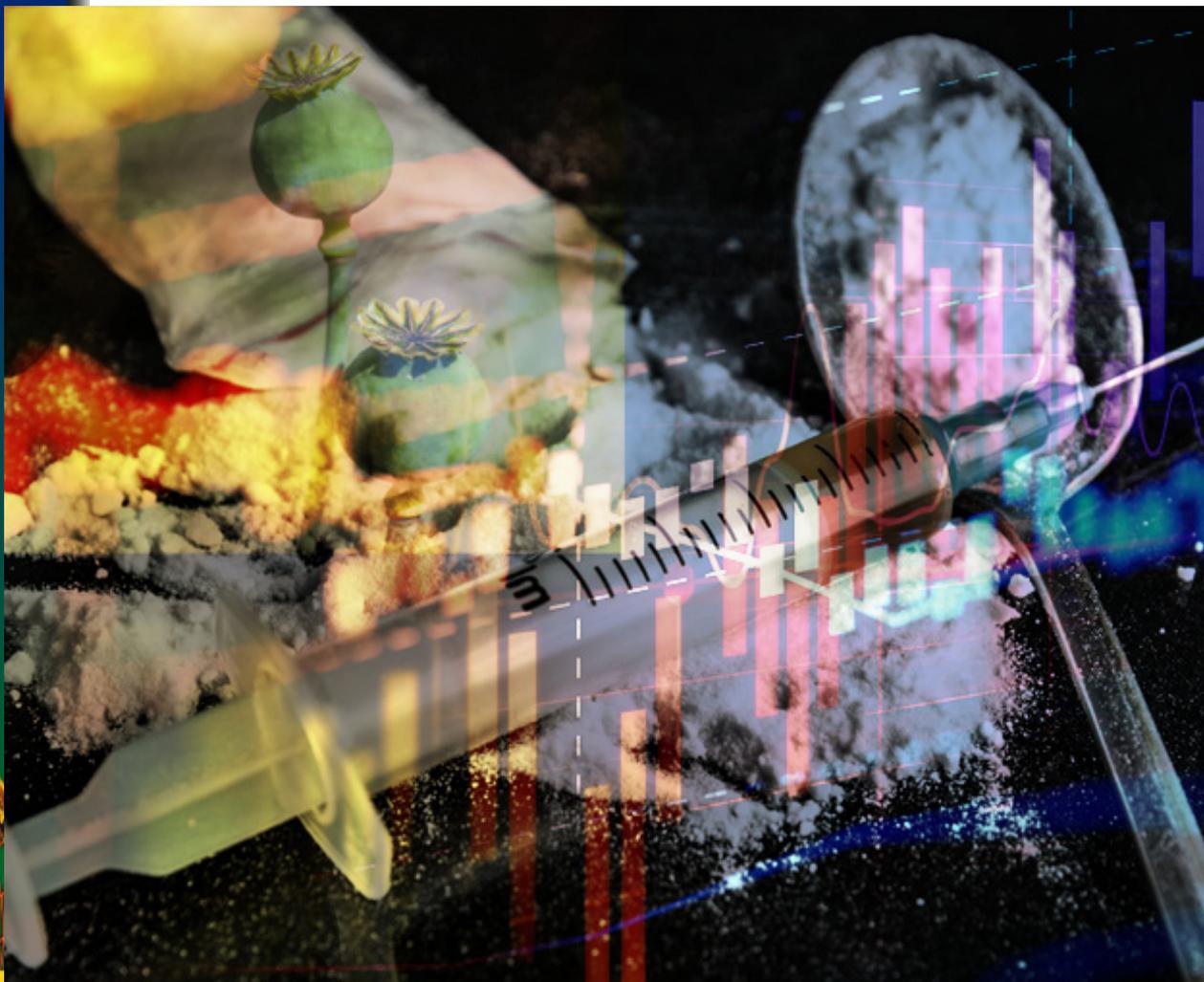
The 2016 Heroin Signature Program Report

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DEA
INTELLIGENCE
REPORT



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Overview

The Drug Enforcement Administration's (DEA) Heroin Signature Program (HSP) analyzes several hundred wholesale-level heroin samples each year to identify the geographic area where the samples were manufactured (Mexico, South America [SA], Southwest Asia [SWA], or Southeast Asia [SEA]). In 2016:

- Heroin from Mexico accounted for 86 percent (by weight) of the samples analyzed through the HSP.
- Heroin under the new formal HSP classification of "Inconclusive Origin-South American" processing method (INC-SA), which is assigned to heroin where either Mexico or South America could be the origin but is produced or refined using South American processing methods, accounted for 10 percent.
- Heroin from South America (SA) accounted for 4 percent.
- Heroin from Southwest Asia (SWA) accounted for less than 1 percent.

There were no Southeast Asian (SEA) heroin samples submitted to the program in 2016. Since the HSP's inception more than 40 years ago, it has proven to be a valuable indicator of changes in the supply of heroin by providing insight into the wholesale-level of heroin trafficking to the United States.

Background

The HSP is one essential component of the DEA Intelligence Program to identify trends in heroin trafficking and distribution in the United States. The objective of the program is to identify and quantify the chemical components of heroin seized at U.S. ports of entry (POEs), all non-POE heroin seizures weighing more than one kilogram, randomly chosen samples, and special requests for analysis. Samples submitted to the HSP undergo in-depth chemical analysis at the DEA Special Testing and Research Laboratory (SFL1). This chemical analysis allows SFL1 to associate the heroin samples with a production process, or "signature," which is indicative of a particular geographic source area and processing method. The proportion of heroin associated with each geographic source area is measured in terms of the net weight of heroin seized and analyzed in the program from each source area that year. Year-to-year fluctuations in HSP data in relation to each source area may reflect shifting law enforcement priorities, changes in trafficking patterns, or exceptionally large seizures that may increase a source area's representation in the HSP. To achieve a comprehensive assessment of heroin importation and trafficking in the United States, HSP chemical analysis data—combined with DEA's retail-level Heroin Domestic Monitor Program, investigative, and other types of reporting—allow for the identification of possible changes in the geographic source and purity of heroin in the United States, as well as changes in trafficking routes and methods. The HSP continually maintains quality assurance by analyzing authentic samples obtained from the primary heroin production regions.

Signature analysis conducted under the HSP is currently the only scientifically based source of information available to determine the geographic origin of wholesale-level quantities of heroin encountered in the U.S. drug market.

2016 Heroin Signature Program Results

In 2016, heroin from Mexico accounted for 86 percent (by weight) of the heroin analyzed by the HSP. Heroin classified as INC-SA accounted for 10 percent; SA heroin accounted for 4 percent; and SWA heroin accounted for less than 1 percent. No SEA heroin samples were submitted to the program in 2016. More than 743 HSP samples, representing approximately 1,631 kilograms of heroin, were analyzed in 2016 by SFL1. Of those 743 samples, 714 (representing approximately 1,592 kilograms) were classified through the HSP (see Figure 1).¹

(U) Figure 1: HSP Geographic Source Area Summary.

Signature	Number of Samples		Weight of Sample (kilograms)		Percentage by Weight	
	2016	2015	2016	2015	2016	2015
Mexican Origin	626	747	1,364	1,771	86%	93%
MEX/T (Black Tar)	319	336	509	672	37%	38%
MEX-SA (White Powder)	294	393	811	1,060	59%	60%
MEX/BP (Brown Powder)	10	14	27	33	2%	2%
MEX	3	4	16	6	1%	0%
INC-SA	58	54	162	63	10%	3%
SA	22	46	59	58	4%	3%
SWA	8	25	7	15	0%	1%
SEA	0	0	0	0	0%	0%
Total	714	872	1,592	1,907	100%	100%

Source: DEA

In 2016, approximately one percent of the heroin samples submitted for analysis through the HSP were classified as “unknown” (UNK), meaning the signature profiles of the samples were not consistent with the signature profiles of authentic heroin samples collected from any of the four geographic source regions. Since heroin is manufactured through a series of chemical processing steps, signature analysis is expected to result in a small number of samples whose signature is UNK or undetermined. In May 2015, SFL1 introduced new forensic protocols that allowed chemists to better differentiate and isolate the origin of heroin samples previously classified as UNK to either Mexico or South America. These protocols have resulted in a decrease in the overall number of heroin samples classified as UNK. It should be noted that heroin samples classified as UNK are not included in the HSP Geographic Source Area Summary.

Heroin classified as SA had the highest purity average in 2016 at 71 percent, followed closely by MEX-SA heroin (new formal signature for Mexican white powder heroin) at 70 percent (see Figure 2).

¹ Since not all heroin seized in the United States is submitted for analysis through the HSP, the source area proportions reported through the HSP should not be characterized as market share. As previously stated, fluctuations from year-to-year in source area proportions may reflect shifting law enforcement priorities, changes in trafficking patterns, or exceptionally large seizures that could increase the HSP representation of a particular source area. To achieve a comprehensive assessment of heroin smuggled into and trafficked in the United States, HSP data must be used in conjunction with investigative reporting, drug production estimates, and seizure statistics.

(U) Figure 2: HSP Average Heroin Purity.

Signature	Average Purity	
	2016	2015
SA	71	63
MEX-SA	70	70
MEX	47	41
MEX/BP	44	43
SWA/C	43	54
MEX/T	37	41
INC-SA	36	51
SWA/B	26	66
SWA/A	N/A	36
SEA	N/A	N/A

Source: DEA

Mexico

Analysis of 2016 HSP data identified Mexico as the primary source of origin for heroin transported to the United States for the fourth consecutive year. Mexico was identified as the geographic origin of 86 percent (by weight) of samples classified under the HSP during 2016. Of these samples, 59 percent were classified as Mexican-South American (MEX-SA); 37 percent as Mexican-Black Tar (MEX/T); and 2 percent as Mexican Brown Powder (MEX/BP). Less than 1 percent was classified as MEX, which is the classification assigned to refined or crudely manufactured heroin from Mexico. This classification is assigned when MEX/T, MEX/BP, or MEX-SA are not applicable. In 2016, the percentage (by weight) of Mexican-origin heroin analyzed through the HSP decreased 7 percentage points, from 93 percent in 2015 to 86 percent. The weight of Mexican-origin heroin samples submitted to the HSP also decreased, from approximately 1,771 kilograms (747 samples) in 2015, to 1,364 kilograms (626 samples) in 2016.

(U) Figure 3: Mexican and South American Heroin Seized at Southwest Border Ports of Entry by State.

SWB State	Mexican-Origin Heroin (Number of Exhibits)		SA Heroin (Number of Exhibits)	
	2016	2015	2016	2015
Arizona	54	50	2	2
California	142	211	2	3
New Mexico	0	0	0	0
Texas	9	13	0	0
Total	205	274	4	5

Source: DEA

The average overall purity of Mexican-origin heroin analyzed through the HSP in 2016 decreased 4 percentage points, from 56 percent in 2015 to 52 percent in 2016. Within Mexican signatures, MEX-SA heroin remained highly refined with a purity level at 70 percent, followed by MEX at 47 percent; MEX/BP at 44 percent; and MEX/T at 37 percent. In 2016, 23 percent of MEX-SA heroin was

adulterated, with caffeine being the primary adulterant followed by quinine.² Six MEX-SA samples were found to contain fentanyl hydrochloride (HCl). Of these six samples, four were obtained in Connecticut, one was obtained in Kentucky, and one in Michigan. In 2016, mannitol, inositol, and lactose were the primary diluents found in MEX-SA heroin samples.³ Forensic analysis of 2016 HSP heroin samples also revealed previously detected cutting patterns for MEX-SA shipments continue, in that the heroin becomes heavily adulterated with additional caffeine and other adulterants once the heroin crosses the U.S. Southwest Border (SWB). MEX-SA heroin is also further diluted inside the United States with the same previously detected diluents—mannitol, inositol, and lactose. The majority of MEX/T and MEX/BP samples analyzed under the HSP in 2016 were unadulterated; however, of the adulterated samples, lidocaine was the most detected, with diacetamide as the most common diluent, followed by lactose, sucrose, inositol, and dextrose.

The number of Mexican-origin heroin samples seized at Arizona POEs and submitted to the HSP for analysis increased from 50 in 2015 to 54 in 2016, while Mexican-origin heroin samples seized at POEs in Texas and submitted to the HSP for analysis decreased from 13 in 2015 to 9 in 2016. Heroin samples seized at POEs in California and submitted to the HSP for analysis also decreased, from 211 in 2015 to 142 in 2016 (see Figure 3). Almost

(U) Figure 4: Characteristics of Mexican Heroin Seized at U.S. Ports of Entry and Analyzed through the DEA Heroin Signature Program.

Calendar Year	Number of Exhibits	Average Purity
2016	3 (MEX/BP)	52.7%
	74 (MEX-SA)	81.2%
	132 (MEX/T)	43.6%
2015	10 (MEX/BP)	44.1%
	101 (MEX-SA)	72.0%
	163 (MEX/T)	42.2%
2014	12 (MEX/BP)	54.0%
	63 (MEX-SA)	82.0%
	125 (MEX/T)	43.0%
2013	165	46.9%
2012	146	42.3%
2011	145	40.4%
2010	88	38.1%
2009	55	39.6%
2008	61	44.0%
2007	49	38.6%
2006	32	44.6%
2005	40	49.4%
2004	24	41.5%
2003	20	37.9%
2002	26	32.8%
2001	34	31.0%

Source: DEA

- ² Adulterants are pharmacologically active substances that are added to heroin to enhance or mimic the effect of heroin. An example of an adulterant is acetaminophen, an analgesic compound often found with heroin. However, many current heroin adulterants do not meet this criterion, as they may have an adverse effect, or possibly no effect, to the heroin. Adulterants can be added to heroin shipments immediately after production, in transit, or prior to distribution. Although dextromethorphan for Southwest Asian heroin and diltiazem for South American heroin are examples of adulterants that are added immediately after production, xylazine for Puerto Rico and quinine for Washington, DC-Baltimore are examples of city-specific adulteration prior to distribution.
- ³ Diluents are inert ingredients (pharmacologically inactive compounds) used to increase the bulk of a finished product. Typical diluents include sugars, starches, and inorganic salts.

half of the 142 Mexican-origin heroin samples seized at California POEs in 2016 and submitted to the HSP for analysis were obtained at the San Ysidro POE.

Figure 4 summarizes the number and purity of Mexican-origin heroin samples seized at U.S. POEs and analyzed through the HSP from 2001 to 2016. As noted in Figure 4, MEX-SA heroin exhibits seized at U.S. POEs in 2016 and analyzed through the HSP were highly refined, with an average purity of 81 percent. Furthermore, according to SFL1 forensic analysis, most Mexican-origin heroin border seizures (both powder and tar) remained fentanyl-free, which demonstrates that fentanyl cutting or lacing at the wholesale level was minimal. Although the availability of Mexican-origin heroin, especially MEX/T and MEX/BP, remains strong in markets west of the Mississippi River, 2016 HSP data indicates that Mexican-origin heroin, particularly Mexican white powder heroin, continues to move into Eastern and Midwestern U.S. markets. In 2016, the HSP obtained a total of 124 Mexican-origin heroin samples from the following areas that have traditionally been considered white heroin markets:

- Connecticut (8 samples – 7 classified as MEX-SA)
- Florida (11 samples – all classified as MEX-SA)
- Illinois (24 samples – all 24 classified as MEX-SA)
- Michigan (15 samples – 13 classified as MEX-SA)
- New York (30 samples – 28 classified as MEX-SA)
- North Carolina (6 samples – 5 classified as MEX-SA)
- Ohio (11 samples – 7 classified as MEX-SA)
- Pennsylvania (10 samples – all classified as MEX-SA)
- Rhode Island (2 samples – all classified as MEX-SA)
- Virginia (7 samples – 6 classified as MEX-SA)

Of the 124 Mexican-origin heroin samples noted above, 113 (91 percent) were classified as MEX-SA. Of particular importance is that all of the Mexican-origin HSP heroin samples obtained from Florida, Illinois, Pennsylvania, and Rhode Island in 2016 were classified as MEX-SA. This is a strong indicator that Mexican drug trafficking organizations are actively producing white heroin for distribution in the Eastern United States in order to gain a larger share of these lucrative heroin markets.

South America

South America (SA) was identified as the geographic source area of 4 percent (by weight) of heroin samples classified under the HSP during 2016. This represents a slight increase from 2015, when SA heroin accounted for 3 percent (by weight) of the heroin analyzed. The weight of SA heroin samples submitted to the HSP also increased slightly, from 58 kilograms in 2015 to 60 kilograms in 2016. From 1995 to 2013, South America (primarily Colombia) accounted for the majority of the heroin analyzed through the HSP; however, HSP results since 2013, along with investigative and other information, indicate that South America is now the second most common source of the heroin analyzed under the HSP.

In 2016, the average purity of SA heroin increased to 71 percent from 63 percent in 2015. According to SFL1 forensic analysis, approximately 13 percent of SA heroin samples were found to be adulterated. Caffeine continued to be the most common adulterant for SA heroin, followed by diltiazem. Inositol was the only identified diluent used for SA heroin in 2016.

Although SA heroin continues to be smuggled into the United States by couriers on commercial flights and over land from Mexico, 2016 HSP data continues to show a significant decline in the number of SA heroin samples seized at U.S. POEs in comparison to 2015. In 2016, only nine SA heroin samples obtained from seizures at U.S. POEs (both air and land) were analyzed under the HSP (compared to 17 samples in 2015). Of the nine POE SA heroin samples obtained in 2016, five were airport seizures in New York—a primary arrival point for SA heroin couriers. The remaining four SA heroin samples were obtained from land seizures at SWB POEs in Arizona and California. Non-POE SA heroin samples were obtained in New York (seven), Florida (four), Arizona, California, and Illinois (one each). The number of SA heroin samples seized at U.S. POEs and analyzed through the HSP

since 2001 has steadily decreased, while the purity has remained relatively stable during the same time frame. The decline in the amount of SA heroin seized at U.S. POEs is consistent with reports of significant decreases in Colombian poppy cultivation in recent years. The reduction in SA heroin production, coupled with increasing levels of heroin production in Mexico and transportation activities across the SWB, has had a noticeable impact on SA heroin availability in the United States. Figure 5 summarizes the number and purity of SA heroin samples seized and analyzed through the HSP at U.S. POEs from 2001 through 2016.

(U) Figure 5: Characteristics of South American Heroin Seized at U.S. Ports of Entry and Analyzed through the DEA Heroin Signature Program.

Calendar Year	Number of Exhibits	Average Purity
2016	9	67.1%
2015	17	70.0%
2014	32	77.4%
2013	76	71.8%
2012	138	68.2%
2011	150	61.8%
2010	128	54.5%
2009	134	61.9%
2008	141	64.7%
2007	126	64.3%
2006	138	62.0%
2005	185	68.0%
2004	237	72.5%
2003	350	77.1%
2002	376	76.9%
2001	412	81.2%

Source: DEA

Heroin Classified as Inconclusive - South America (INC-SA)

The new HSP signature classification of INC-SA, which was established in 2015 by SFL1, is a classification assigned when heroin is produced or refined using South American processing methods with an “inconclusive” origin component where either Mexico or South America could be the geographic origin. Heroin classified as INC-SA accounted for 10 percent (by weight) of the heroin analyzed through the HSP in 2016, which is an increase from 3 percent in 2015. The weight of INC-SA heroin samples analyzed through the HSP increased from 63 kilograms (54 samples) in 2015 to 162 kilograms (58 samples) in 2016. The average purity of INC-SA heroin decreased significantly, from 51 percent in 2015 to 36 percent in 2016. INC-SA heroin samples submitted to the HSP in 2016 were obtained from 19 states, with the largest number of samples obtained in New York (21 samples) (See Figure 6).

SFL1 forensic analysis of 2016 HSP samples classified as INC-SA indicated that the numerous adulterants present in these samples hindered the origin analysis, or the analytical results fell into an inconclusive range, including a 47 kilogram seizure in Queens, New York, which may have been a mix of MEX-SA and SA heroin.

(U) Figure 6: Heroin Classified as Inconclusive - South America (INC-SA) Seized by State.

INC-SA Samples	2016	2015
AZ	4	3
CA	1	7
CO	1	0
CT	2	3
DC	1	0
DE	0	1
FL	3	3
IL	4	2
MA	0	1
MD	5	5
MI	2	2
MO	1	2
NC	0	1
NJ	2	0
NY	21	12
OH	1	1
PA	1	4
PR	0	2
TX	1	1
VA	3	2
VT	2	0
WI	1	1
WV	2	1
Total	58	54

Source: DEA

Southwest Asia

Despite increased levels of heroin production in Afghanistan, 2016 HSP results, along with investigative and other information, indicate that the presence and availability of SWA heroin in U.S. markets is minimal. Southwest Asian (SWA) heroin accounted for less than 1 percent of the heroin analyzed (by weight) under the HSP in 2016, compared to 1 percent in 2015. The average purity of the SWA heroin analyzed under the HSP decreased from 54 percent in 2015 to 41 percent in 2016. The primary adulterants identified in SWA heroin samples analyzed under the HSP in 2016 were

caffeine, methorphan, and acetaminophen; and diluents included lactose, sucrose, and dextrose. According to DEA's SFL1, SWA heroin is easily distinguished from Mexican and South American heroin based on the signature analysis employed by SFL1. Due to distinct signature differences, it is not possible to misclassify SWA heroin as either South American or Mexican origin. Based on DEA investigative reporting and seizure data, SWA heroin is not shipped to the United States in the bulk (wholesale) quantities needed to sufficiently challenge or supplant well-entrenched Mexican heroin distribution networks. As noted in Figure 1, the total weight of SWA heroin samples submitted to the HSP in 2016 decreased from 15 kilograms (25 samples) in 2015 to only 7 kilograms (eight samples) in 2016, though the percentage by weight remained constant at approximately 1 percent for both years. Until SWA trafficking networks can ensure a consistent flow of high-purity, competitively priced heroin while simultaneously expanding their U.S. distribution networks, it is unlikely that SWA heroin will significantly increase its presence in the United States in the near term.

Southeast Asia

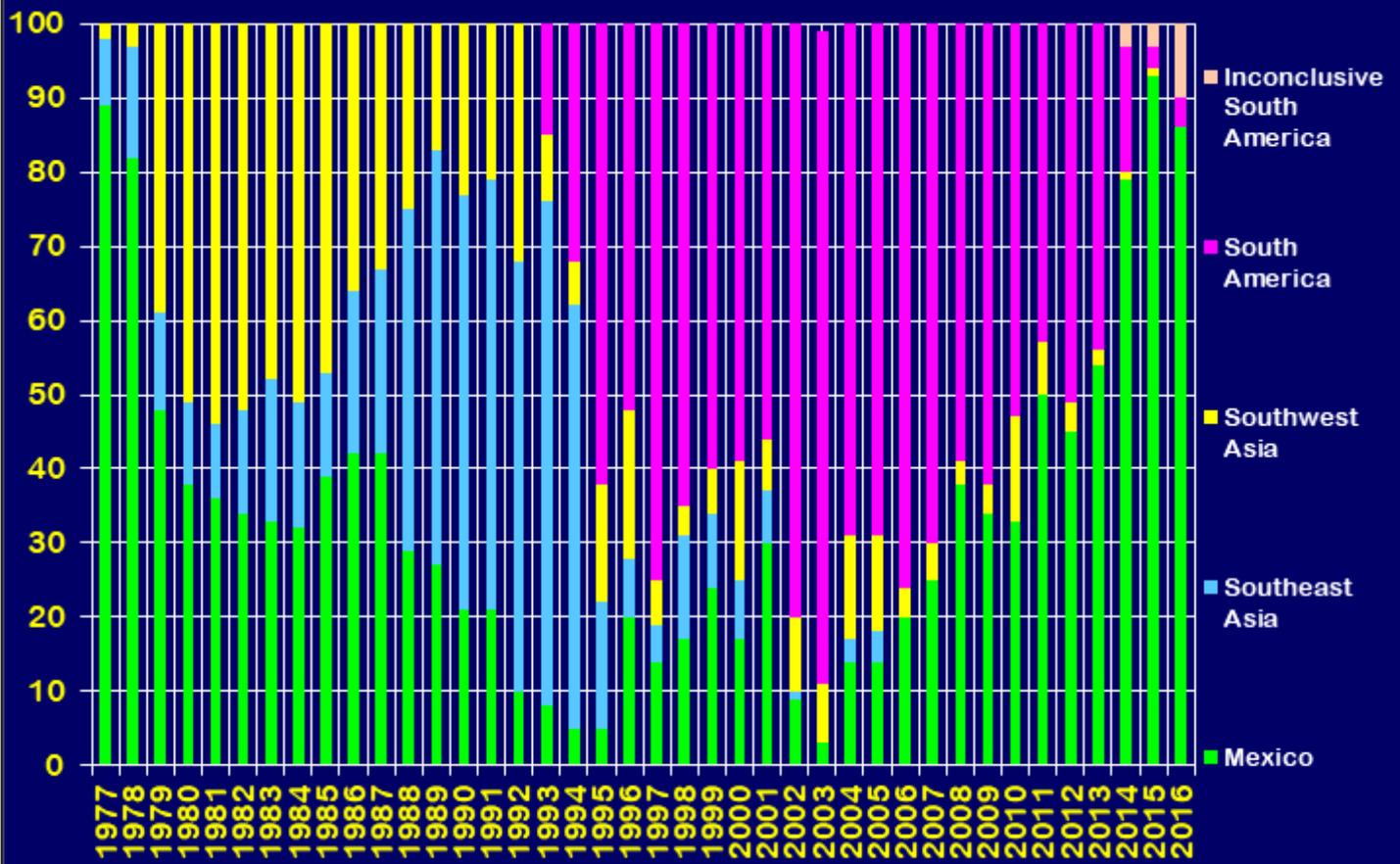
For the eighth consecutive year, there were no SEA heroin samples analyzed through the HSP. U.S. Government estimates indicate that opium and heroin production in Southeast Asia has declined and there has also been a conscious shift towards synthetic drugs in regional drug markets.

Outlook

Mexico is the primary geographic source of the heroin samples submitted to the HSP for the fourth consecutive year, and will likely remain the primary source in the near term. Mexican transnational criminal organizations/drug trafficking organizations (TCOs/DTOs), through their extensive infrastructure in Mexico and the United States, control the heroin pipeline from manufacture in Mexico to at least mid-level wholesale in the United States. Mexican TCOs/DTOs, often leveraging their established cocaine distribution networks, first entered lucrative U.S. East Coast white heroin markets with the transportation and wholesale distribution of SA heroin into markets historically supplied by Colombian traffickers since the mid-1990s. Once Mexican TCOs/DTOs began producing white powder heroin, they eliminated the need to purchase this type of heroin from outside sources—whether from South America, Afghanistan, Africa, or Canada—to meet demand in the United States. By producing their own high-quality white powder heroin, Mexican TCOs/DTOs have ensured that they will continue to dominate the U.S. illicit heroin market in the near- to mid-term. Although SA heroin remains available in the United States, HSP results for both 2015 and 2016 indicate South America remains a secondary source of heroin for the U.S. market. Diminished levels of SA heroin in the United States are consistent with the decreased level of opium poppy production in Colombia and steadily increasing levels of heroin production in Mexico and subsequent transportation activities. SEA heroin has virtually no impact on the U.S. market. U.S. Government estimates indicate that opium cultivation in Southeast Asia has declined over the last 2 years. It is important to note that not all Asian opium is converted into heroin and the majority of SEA opium that is produced remains in Asia to meet the demand for opiates in local and regional markets.

(U) APPENDICES

(U) APPENDIX A: Heroin Source Area Distribution - Percentage By Weight 1977-2016.



Source: DEA

(U) APPENDIX B: 1977-2016 Heroin Signature Program Results

Geographic Source Area Distribution (in percent)
Based on Net Weight of Heroin Seized and Analyzed*

Year	Mexico	Southeast Asia	Southwest Asia	South America	Inconclusive South America
2016	86	0	<1	4	10
2015	93	0	1	3	3
2014	79	0	1	17	3
2013	54	0	2	44	N/A
2012	45	0	4	51	N/A
2011	50	0	7	43	N/A
2010	33	0	14	53	N/A
2009	34	0	4	62	N/A
2008	38	<1	3	59	N/A
2007	25	<1	5	70	N/A
2006	20	0	4	76	N/A
2005	14	4	13	69	N/A
2004	14	3	14	69	N/A
2003	3	<1	8	88	N/A
2002	9	1	10	80	N/A
2001	30	7	7	56	N/A
2000	17	8	16	59	N/A
1999	24	10	6	60	N/A
1998	17	14	4	65	N/A
1997	14	5	6	75	N/A
1996	20	8	20	52	N/A
1995	5	17	16	62	N/A
1994	5	57	6	32	N/A
1993	8	68	9	15**	N/A
1992	10	58	32	---	N/A
1991	21	58	21	---	N/A
1990	21	56	23	---	N/A
1989	27	56	17	---	N/A
1988	29	46	25	---	N/A
1987	42	25	33	---	N/A
1986	42	22	36	---	N/A
1985	39	14	47	---	N/A

(U) APPENDIX B: 1977-2016 Heroin Signature Program Results

Geographic Source Area Distribution (in percent)
Based on Net Weight of Heroin Seized and Analyzed*

Year	Mexico	Southeast Asia	Southwest Asia	South America	Inconclusive South America
1984	32	17	51	---	N/A
1983	33	19	48	---	N/A
1982	34	14	52	---	N/A
1981	36	10	54	---	N/A
1980	38	11	51	---	N/A
1979	48	13	39	---	N/A
1978	82	15	3	---	N/A
1977	89	9	2	---	N/A

* Percentage based on samples for which a signature was identified. From 1977 through 1991, percentages were based on the number of samples tested. Since 1992, percentages have been based on the net weight of the heroin seized and analyzed.

** The signature for heroin from South America was developed in July 1993; therefore, this figure represents only partial-year data. DEA reporting indicates that heroin from South America first was noted in the United States in 1991 and that its availability increased during the latter half of 1992 as well as in early 1993.

Source: DEA

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(U) This product was prepared by the DEA Indicator Programs Section. Comments and questions may be addressed to the Chief, Analysis and Production Section at DEA.IntelligenceProducts@usdoj.gov.