Acetic anhydride in the context of Afghan heroin
About the Afghan Opiate Trade Project

The opiates produced in Afghanistan continue to pose a threat to public health, governance and security in the region and beyond at global level. Afghan opiates are likely to widen their reach following the marked increase in cultivation and production in recent years. To address the need for systematic monitoring, comprehensive and consolidated analytical information about the multidimensional threat of the global illicit trade in Afghan opiates, the UNODC Afghan Opiate Trade Project (AOTP) was established in 2008. The project has produced a number of regional and global threat assessment reports and has been collaborating extensively with numerous national and regional policy making bodies and law enforcement agencies to provide the international community with a better understanding of the threat posed by the opiates produced in Afghanistan.

About the AOTP Update

The AOTP Update series is designed to provide brief, regular reporting on emerging patterns and trends of the global situation pertaining to Afghan opiates. Given the speed at which changes in the illicit opiate markets occur, it is important to have a simple sustainable mechanism for regular information sharing.

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AOTP values feedback on this publication. If you have comments or would like to contribute information that could be considered for future publications, please contact:

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Disclaimer

This publication has not been formally edited. The content of this publication does not necessarily reflect the views or policies of UNODC or contributory organizations, nor does it imply any endorsement.
Over the last 15 years, Afghanistan has been the main source for opiates worldwide, primarily supplying markets in neighbouring countries, as well as in Europe, the Middle East and Africa and, to a far lesser extent, North America, South East Asia and the Oceania region. While the processing of Afghan-sourced opium into heroin takes place mainly in Afghanistan, there are indications that heroin manufacture may also take place in other countries, with significant morphine seizures in some of the neighbouring countries pointing to potential heroin manufacture outside Afghanistan.

Despite significant annual fluctuations in the amounts of opium produced in Afghanistan, a number of indicators (heroin seizures and price along the different trafficking routes and level of heroin use in destination markets) suggest that heroin supply to destination markets has remained rather stable over time, with little changes on a year-on-year basis. In order to ensure this smooth and stable supply, heroin may have been manufactured with opium from different harvests, depending on the existence of opium inventories and market strategies.

Size of the illicit market for acetic anhydride

The estimated amount of acetic anhydride (AA) needed for the manufacture of heroin in Afghanistan may vary substantially depending not only on the manufacturing method, the equipment used and the nature of the product (heroin base versus heroin hydrochloride (HCl), but also on the availability and price of AA. The table below reviews the different estimates available.

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2 UNODC and Afghanistan Ministry of Counter Narcotics, Afghanistan Drug Price Monitoring Monthly Reports, August 2017 (and previous years) and UNODC Annual Report Questionnaire.

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*Preliminary seizure data for 2016.
Sources: UNODC and Afghanistan Ministry of Counter Narcotics, Afghanistan Opium Survey 2016: Cultivation and Production, December 2016 (and previous years); UNODC Annual Report Questionnaire.
**Opium to heroin processing**

There are two critical materials required for the manufacture of heroin: opium and acetic anhydride (AA). Opium is the primary raw material used in heroin manufacture, a process that involves a series of sequential operations and several chemicals, some widely available, and others subject to international control measures. Of all the chemicals used, AA is the only one that is not easily replaceable with alternative chemicals. AA is controlled under Table I of the United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988. Although it has many legitimate licit applications around the world, AA is neither produced in Afghanistan nor legally imported into the country.1

Opium and AA account for the bulk of the overall production costs for heroin. A 2010 assessment in the province of Nangarhar in Afghanistan suggested that opium comprised 73 per cent, AA 26 per cent and the other chemicals only 1 per cent of the total cost of the inputs required to manufacture heroin.2 The costs related to AA appears to have decreased in subsequent years, in line with price reductions. Nonetheless, estimates for 2013 suggest that AA still accounts for some 20 per cent of the total heroin manufacturing cost.3

Source: INCB, Precursors and chemicals frequently used in the illicit manufacture of narcotic drugs and psychotropic substances 2016.

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1 INCB, Precursors and chemicals frequently used in the illicit manufacture of narcotic drugs and psychotropic substances 2016.
2 Costs related to labour, equipment, security et cetera are not included in this calculation.
Afghanistan, it is likely that the quantities used in clandestine heroin manufacture are diverted from licit sources abroad. The estimated requirements of AA for heroin manufacture in Afghanistan represent only a marginal proportion of that for the licit sector, accounting for 0.02-0.06 per cent of global production8 and 0.08-0.2 per cent of global imports of licit AA over 2012-2016. Such numbers suggest that a tiny proportion diverted from global production and licit trade flows is sufficient to guarantee the ongoing heroin manufacture in Afghanistan, making it quite challenging to control global licit flows of AA.

### Table 1: Estimated amounts of AA needed for the manufacture of 1 kg of heroin

<table>
<thead>
<tr>
<th>Source</th>
<th>Method</th>
<th>Heroin base</th>
<th>Heroin hydrochloride</th>
<th>Heroin (not specified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEA 2008&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Informants</td>
<td></td>
<td>1.5 to 2.5 litres</td>
<td></td>
</tr>
<tr>
<td>INCB 2012-2016&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Review</td>
<td>1 to 2.5 litres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BKA 2003&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Manufacture of heroin by 2 Afghan 'cooks' from Nangarhar</td>
<td>1 litre</td>
<td>2.1 litres</td>
<td></td>
</tr>
<tr>
<td>UNODC 2010&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Survey among informants in eastern Afghanistan</td>
<td>1.05 litres</td>
<td>1.7 litres</td>
<td>1 to 1.5 litres</td>
</tr>
<tr>
<td>DEA 2017&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Estimate</td>
<td></td>
<td>1 litre</td>
<td></td>
</tr>
</tbody>
</table>

Sources:
6. DEA, 2008a Informants 1.5 to 2.5 litres
7. DEA, 2008b Informants 2.1 litres
8. DEA, 2008c Informants 1.05 litres
9. DEA, 2008d Informants 1 litre
10. DEA, 2008e Informants 0.926 litre
11. DEA, 2008f Informants 0.02% and 0.06%
12. DEA, 2008g Informants 0.02% and 0.06%

8 313,000 litres/1,389,000,000 litres (i.e. 1.5 tons/0.926) = 0.02% and 783,000 litres/1,389,000 litres = 0.06%.
9 313,000 litres/395,119,747 litres (i.e. 426,695,192 kg/0.926) = 0.08% and 783,000 litres/395,119,747 litres = 0.2%.

AA is widely traded worldwide, with many countries engaged in both imports and exports. Out of 127 countries which imported AA over the period 2012-2016, a third also exported the substance. Most of the licit AA trade flows take place across countries in Europe, North America and East Asia. The largest exporters of AA by volume in 2016 were Belgium, followed by Mexico, the USA, India, Switzerland, China and Japan, while the largest importers were Belgium followed by Germany, Switzerland, France, China, the USA and the Republic of Korea.

Such data, not only highlights the size of the AA trade but also the large numbers of players involved in this trade, which makes it difficult to prevent the diversion of small portions of AA into illicit channels. Currently, most diversions of AA take place within national borders rather than through cross-border transactions. The analysis of licit import and export flows of AA shows that the global average import price of AA decreased in the last two years from around US$ 1 per litre in 2014 to US$ 0.8 per litre in 2016.

Whether high prices reflect a risk premium linked to illegal activities - and therefore could be a reliable indicator to identify potential diversions of AA – remains, nonetheless, questionable. The actual quantities traded in “high-price AA countries” would not have been sufficient to meet even a small fraction of the overall AA requirements of the Afghan heroin industry. In fact, the high AA prices in many countries seem to be simply a reflection of the very small volumes of AA traded. The less AA is imported, the higher the price for AA (up to 100 times or more the global average market price). The quantity discount seems to be far more pronounced for AA than for other commodities.
Figure 3: Licit imports and exports of AA, in tons, 2014-2016 (logarithmic scale)

Source: UN Comtrade database.

Figure 4: Licit AA import prices per kilogram and quantities of AA imported in 2015 and 2016 (logarithmic scale)

Source: UNODC elaboration based on amounts imported and value of imports per country, as published in the UN Comtrade database.
Acetic anhydride prices in Afghanistan

AA prices in Afghanistan are much higher than prices in the licit trade because all AA in the country is illicitly sourced. Overall, AA price changes in Afghanistan reflect both the demand for heroin manufacturing and supply in AA, which depends on law enforcement interdiction of illegal shipments of AA in and around Afghanistan.

AA prices in Afghanistan increased sharply in the first decade of the new millennium, before declining in 2012 and then remained rather stable in subsequent years until 2017, when AA prices markedly increased again. In August 2017, the cost of a litre of ‘best quality’ AA (type A, mostly used in the manufacture of high quality heroin destined for exports to Europe and other developed countries) was more than US$ 700. This is much higher than the average global price of AA in licit trade of around US$ 1 per litre.

The initial upward trend of Afghan AA prices over the period 2006-2011 may be linked to increased international efforts to control the AA supply chain, as well as a rising demand for AA resulting from increasing opium and heroin production in the country over that period.

The subsequent decline, over the period 2011-2015, did not reflect reductions in opium and heroin production in Afghanistan, but rather paralleled a marked decrease in seizures of both opiates and AA. This suggests that between 2011 and 2015 there was a lower risk in AA trafficking. This stemmed from increasing problems for law enforcement to control the territory, prompted inter alia by the withdrawal of international troops, a growing donor fatigue to assist law enforcement and an ever more violent insurgency over larger parts of the country. During that period, Afghan morphine and heroin seizures fell sharply together with AA seizures. The risk of seizure of AA in Afghanistan declined – and so did the risk premium associated with the price.

The situation changed again in 2017 when rising seizures of AA in Afghanistan and neighbouring countries went hand in hand with strong AA price increases, particularly in the price of ‘best quality’ AA (types A and F, primarily used to manufacture heroin for export markets in Europe). In August 2017, the best perceived quality of AA (category A) fetched a record price of US$ 711, three times as high as a year earlier.14

Intelligence reports received by the Counter Narcotics Police of Afghanistan (CNPA) suggest that prices even exceeded US$ 1,000 per litre (US$ 1,000-1,250) for ‘best quality’ AA in the summer of 2017, up from around US$ 250 in 2016.15 In the western and southern regions, AA prices ranged from US$ 1,000 to 1,050 per litre while in the eastern region they fetched even higher prices ranging from US$ 1,050 to 1,250 per litre.16

In contrast, prices for ‘low quality’ AA (used in the manufacture of cheaper, lower-grade heroin, likely for consumption in local and regional markets) remained relatively stable in 2017.17 This suggests that AA used in the manufacture of low quality heroin remains easily available while high quality AA for the manufacture of heroin destined for the more lucrative markets in Western Europe may be more difficult to obtain. This is likely a consequence of some large AA seizures reported by countries in the region in 2016 and 201718 as well as a growing demand for AA due to the increasing opium and heroin production in Afghanistan over the same period.

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13 Caution is required since the grading of AA into quality A to F is based on the assumed countries of origin, which have been associated with different qualities of the product.
15 Data based on CNPA intelligence reports, provided by the Precursors Control Unit of the Counter Narcotics Police of Afghanistan (CNPA).
16 Ibid.
18 Ibid.
**Figure 6: Price developments of various AA qualities in Afghanistan, March 2012 - August 2017**

Sources: UNODC and Afghanistan Ministry of Counter Narcotics, Afghanistan Opium Price Monitoring - Monthly Report, August 2017 and previous months.

**Figure 7: Seizures of AA in and around Afghanistan as reported to UNODC, 2010-2017**

Source: UNODC Drugs Monitoring Platform (DMP) and Individual Drug Seizures (IDS) database.

Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.
Trafficking of acetic anhydride into Afghanistan

Based on data from 2011 to 2014, less than half of all Afghan AA seizures occur at the borders; most are made inland while the chemical is being transported from temporary warehouses to illicit manufacturing sites as well as when clandestine laboratories are being dismantled. Seizures of AA are particularly concentrated in the province of Nangarhar in eastern Afghanistan, in the provinces of Kandahar and Helmand in southern Afghanistan, in the provinces of Farah, Herat and Nimroz in western Afghanistan, and, to a lesser extent, in the provinces of Baghlan and Badakhshan in northern and north-eastern Afghanistan. While such seizures may suggest a stronger presence of law enforcement in these locations, they may also point to places where AA is most likely to be used, i.e. clandestine laboratories.

Trafficking of AA into Afghanistan mainly takes place across two of the country’s international borders. The International Narcotics Control Board, based on data provided by the Government of Afghanistan, estimated that over 85 per cent of cross-border trafficking cases involving AA over the 2011-2014 period took place via Iran (Islamic Republic of) with most of the remainder smuggled into the country via Pakistan.

Several of the individual seizures made in Iran (Islamic Republic of) and Pakistan in recent years suggest that much of the AA intercepted is shipped to the region from China and neighbouring countries. The chemical often enters the region at the ports of Bandar Abbas in Iran (Islamic Republic of) or at the port of Karachi in Pakistan. The AA arriving in Iran (Islamic Republic of) is then often shipped to the province of Khorasan before entering the Afghan province of Herat from where it is then transported to final destinations, typically the locations of clandestine laboratories operating in Afghanistan.

Important AA seizures in Pakistan have taken place in recent years in the province of Baluchistan which borders the Afghan provinces of Kandahar and Helmand (where many clandestine heroin laboratories are located) as well as in the North West Frontier province and the Federally Administered Tribal Areas bordering the Afghan province of Nangarhar, another important centre of Afghan heroin production.

Moreover, AA seizures made in countries along the Balkan route, including in 2017, suggest that some additional shipments of AA from Europe are smuggled via Turkey and Iran (Islamic Republic of) to Afghanistan. Some of the AA in Afghanistan seems to be also of Indian origin.

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20 UNODC Drugs Monitoring Platform (DMP).
22 UNODC Drugs Monitoring Platform (DMP).
23 UNODC Drugs Monitoring Platform (DMP).
24 UNODC, The Global Afghan Opium Trade: A Threat Assessment, July 2011, p. 145. According to the Ministry of Counter Narcotics 64 per cent of all 109 laboratories destroyed over the March 2012 to March 2013 period were located in Helmand province and 8 per cent in Kandahar province (Islamic Republic of Afghanistan, Ministry of Counter Narcotics, 2013 Afghanistan Drug Report, December 2014, p. 85). According to the Counter Narcotics Police of Afghanistan (CNPA) 73 laboratories were dismantled in 2012 of which 48 were located in Helmand and 3 in Kandahar; in 2013 a total of 61 laboratories were dismantled in Afghanistan, including 31 in Helmand and 6 in Kandahar (CNPA, February 2014). According to information from the Afghan Ministry of Counter Narcotics some 70 per cent of clandestine laboratories dismantled in between 2013/14 and 2014/15 in Afghanistan were located in the southern region (68 laboratories in Helmand, 8 laboratories in Kandahar and 3 in Uruzgan). Such laboratories were thus located in the region where most of Afghanistan’s opium production has taken place in recent years (Islamic Republic of Afghanistan, Ministry of Counter Narcotics, 2013 Afghanistan Drug Report, 9 December 2015, p. 92.)
Seizures of AA in Pakistan, originating in China and transiting the United Republic of Tanzania

**JANUARY 2016.** One of the largest seizures of AA took place in Pakistan in 2016. The authorities of Pakistan informed INCB of a seizure of more than 20,000 litres (21.7 tons) of AA. The consignment was declared at customs as a shipment of glacial acetic acid from the United Republic of Tanzania. Subsequent backtracking investigations resulted in the identification of China as the country of origin and the United Republic of Tanzania as the point of diversion where the AA was mislabelled prior to its export to Pakistan.1

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AA seized in western Afghanistan

**APRIL 2016.** 700 barrels, each containing 30 litres of AA (21,000 litres in total), were seized in Afghanistan in Islam Qala, Herat province. The container entered Afghanistan from Iran (Islamic Republic of) through the Dogharon border crossing point.1

**OCTOBER 2016.** Afghan authorities seized 60 litres of AA in Nimroz province at another border crossing with Iran (Islamic Republic of).2

**JANUARY 2017.** Afghan authorities seized a further 1,000 litres of AA in Nimroz province together with 1,940 litres of hydrochloric acid from a container coming from the United Arab Emirates via Iran (Islamic Republic of) to Afghanistan.3

**JULY 2017.** Afghan police seized 15,360 litres of AA on a trailer truck in Herat city, which had transited Iran (Islamic Republic of). The AA had been initially shipped to the Iranian port city of Bandar Abbas and then entered Herat province on a truck at the Islam Qala border crossing. The final destination was intended to be the Bakwa district in neighbouring Farah province4 located south of Herat province. The value of this shipment was estimated at US$ 15 million, at approximately US$ 1,000 per litre.5

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1 Counter-Narcotics Police of Afghanistan (CNPA), reported to UNDOC on 10 September 2017.  
2 Ibid.  
3 Ibid.  
4 Counter-Narcotic Police of Afghanistan (CNPA); incident of 2 July, published on 5 July 2017.  
5 Ibid.

AA seized in Karachi, Pakistan

**FEBRUARY 2016.** Pakistani authorities seized 16.2 tons of AA in a container at the port of Karachi, shipped from Hong Kong, China to Pakistan according to the Pakistan Anti-Narcotics Force (ANF). The chemical was packed in 600 cans in a container en-route from Hong Kong, China to Afghanistan.1 The port of Karachi has also served in the past as the main entry point of overseas shipments of AA into Pakistan.2

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1 Anti Narcotics Force of Pakistan (PK, 2016-02-17), quoted in UNODC Drugs Monitoring Platform (DMP).  

AA seized in clandestine laboratories in western and southern Afghanistan

**OCTOBER 2016.** Afghan authorities conducted an operation in Bakwa district of Farah province, located in western Afghanistan, and dismantled 7 heroin laboratories and seized 8,490 litres of AA. In addition, 16,310 kg of solid chemicals, 129 kg of heroin, 12,500 kg of morphine, 6,534 kg of opium and 12 kg of hashish were seized.1

**MAY 2017.** 180 litres of AA were seized while dismantling a clandestine heroin laboratory in the Nadi Ali district of Helmand province. In the process, Afghan counter-narcotic units seized and destroyed about US$ 19 million worth of narcotics and drug production equipment, along with vehicles, weapons and communications equipment. The operation also “yielded” 220 kilograms of heroin, 7 tons of morphine base, 80 litres of ammonium hydroxide and 275 kilograms of soda ash.2

...  
1 Counter-Narcotic Police of Afghanistan (CNPA) (AF, 2016-10-17), quoted in UNODC Drugs Monitoring Platform (DMP).  
AA seized in Baluchistan, Pakistan

DECEMBER 2016. 100 cans, containing 3,660 litres of AA, were seized by the ANF in Quetta.\(^1\)

JUNE 2017. The ANF of Quetta seized a further 120 litres of AA at an uninhabited residential home in Chagi district, province of Baluchistan, in addition to 135 kg of opium. The substances were allegedly in temporary storage before transfer to another organized crime group.\(^2\)

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AA seized in the Islamic Republic of Iran

2015. The Iranian customs authorities seized two large consignments of 9.3 tons and 17.6 tons of AA destined to Afghanistan.\(^1\)

FEBRUARY 2016. INCB was made aware of 11.5 tons of AA seized by the Iranian customs authorities in February 2016, shipped via Taiwan Province of China to Iran (Islamic Republic of) with a final destination in Afghanistan.\(^2\)

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\(^1\) Anti Narcotics Force of Pakistan (PK, 2016-12-23), quoted in UNODC Drugs Monitoring Platform (DMP).

\(^2\) Anti Narcotics Force of Pakistan (PK, 2017-06-08), quoted in UNODC Drugs Monitoring Platform (DMP).
In this issue

Processing of Afghan-produced opium into heroin takes place mainly in Afghanistan. Acetic anhydride (AA) is a crucial precursor required for conversion of opium into heroin. Over the period 2012 - 2016, it is estimated that between 313,000 and 780,000 liters of AA were required annually for manufacturing heroin in Afghanistan. This first issue of the AOTP Update is dedicated to the illicit market of AA in Afghanistan and reviews recent developments in AA trafficking routes, seizures, market size and prices up to 2017.

Recent AOTP publications

![Image of publication covers]

The Afghan Opiate Trade Project aims at addressing the need for systematic, comprehensive and consolidated analytical information on trends in the global illicit Afghan opiate trade in order to support the international responses to that issue. In addition, the project also aims at enhancing the drug research capacity of those countries most affected by Afghan opiates, and increasing the awareness of the data and information needs to support research on opiate trafficking. Established in 2008, the Afghan Opiate Trade Project has produced a number of research reports relating to several aspects of the illicit trade in Afghan opiates, and has also supported a number of countries in producing their own reports.

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