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Letter dated 26 October 2017 from the Secretary-General addressed to the President of the Security Council

I have the honour to convey herewith the seventh report of the Organisation for the Prohibition of Chemical Weapons-United Nations Joint Investigative Mechanism.

I should be grateful if the present letter and the report could be brought to the attention of the members of the Security Council.

António Guterres

Letter dated 26 October 2017 from the Leadership Panel

**of the Organisation for the Prohibition of Chemical
Weapons-United Nations Joint Investigative Mechanism
addressed to the Secretary-General**

The Organisation for the Prohibition of Chemical Weapons-United Nations Joint Investigative Mechanism has the honour to transmit its seventh report pursuant to Security Council resolutions 2235 (2015) and 2319 (2016).

Edmond Mulet

Head

Organisation for the Prohibition of Chemical Weapons-

United Nations Joint Investigative Mechanism

Judy Cheng-Hopkins

Leadership Panel

Stefan Mogl

Leadership Panel

Seventh report of the Organisation for the Prohibition of Chemical Weapons-United Nations Joint Investigative Mechanism

• Introduction

1. The present report is the seventh report of the Organisation for the Prohibition of Chemical Weapons (OPCW)-United Nations Joint Investigative Mechanism (“the Mechanism”), submitted pursuant to Security Council resolutions 2235 (2015) and 2319 (2016). It covers the period from 23 June 2017, when the Mechanism’s sixth report (S/2017/552) was submitted to the Security Council, to 25 October 2017.

• Background

- As set forth in Security Council resolutions 2235 (2015) and 2319 (2016), the mandate of the Mechanism is to identify to the greatest extent feasible individuals, entities, groups or Governments who were perpetrators, organizers, sponsors or otherwise involved in the use of chemicals as weapons, including chlorine or any other toxic chemical, in the Syrian Arab Republic where the OPCW Fact-Finding Mission determines or has determined that a specific incident in the Syrian Arab Republic involved or likely involved the use of chemicals as weapons, including chlorine or any other toxic chemical. In accordance with Security Council resolution 2319 (2016), the mandate of the Mechanism ends on 16 November 2017.
- The Joint Investigative Mechanism consists of an independent three-member panel together with a core staff of professionals selected on the basis of their expertise, taking into account geographic diversity and the equal participation of women and men. The Mechanism is headed by an Assistant Secretary-General, Edmond Mulet, with overall responsibility, and two deputies with responsibilities for investigative and political matters respectively. These three positions comprise the Leadership Panel of the Mechanism.
- The Head of the Mechanism has continued to be supported by three components: the Investigative Office, the Political Office, and the Planning and Operations Support Office. The Investigative Office is based in The Hague and is comprised of two units: the Information Collection Unit and the Analysis and Corroboration Unit. The Political Office is based in New York, with a liaison officer in Damascus, and provides, inter alia, political analysis, legal advice, liaison, media and information management support. The Planning and Operations Support Office is based in New York and provides administrative, logistical and planning support to the political and investigative components.

- While the OPCW Fact-Finding Mission in the Syrian Arab Republic works to establish the facts surrounding allegations of the use of toxic chemicals for hostile

purposes in the country, it “is not mandated to reach conclusions about attributing responsibility for chemical weapons use”.¹ Following a determination by the Fact-Finding Mission that a specific incident in the Syrian Arab Republic involved or likely involved the use of chemicals as weapons, the Mechanism conducts an investigation to identify to the greatest extent feasible the perpetrators, organizers, sponsors or those otherwise involved. In conducting its investigation, the Mechanism relies on findings of the Fact-Finding Mission regarding the use of chemicals as weapons in each incident, and pursues a rigorous independent

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- S/2014/533, para. 14, and Security Council resolution 2235 (2015), preambular para. 8.

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examination of the available information surrounding such use so as to identify, to the greatest extent feasible, those responsible.

- As mentioned in the Mechanism’s sixth report, the Leadership Panel’s position remains to be that, if new information is provided regarding the four cases initially referred to in the Mechanism’s third and fourth reports (S/2016/738/Rev.1 and S/2016/888), supplementary investigations may be undertaken. For this report, the Mechanism focused on incidents at Umm Hawsh on 15 and 16 September 2016 and at Khan Shaykhun on 4 April 2017.

• **Methods of work**

- The Mechanism is committed to the principles of impartiality, objectivity and independence in conducting its work. The Mechanism continued to implement its mandate in accordance with the methods of work outlined in its previous reports, including in annex I of S/2016/738/Rev.1. There are two main phases of work. During the first phase (information collection and planning for case development), the Mechanism reviews and analyses data, collects relevant information and creates a preliminary investigation plan. Following the decision by the Leadership Panel to conduct an in-depth investigation into a particular incident, the Mechanism requests full access to the information obtained or prepared by the Fact-Finding Mission.
- The second phase (case investigation) commences thereafter, beginning with the preparation of an in-depth investigation plan, which includes consideration of possible scenarios. During this phase the Mechanism conducts detailed analysis of the information obtained by the Fact-Finding Mission, and collects additional information from other sources, including from its field missions. This work continues until the Mechanism is satisfied that it has gathered and assessed all information and evidence that it can reasonably obtain and, on this basis, present its findings to the Security Council.

- As an investigative mechanism without judicial powers, the Mechanism cannot compel the submission of information or documents to it, but relies on the voluntary cooperation of witnesses and those in possession of relevant information. In obtaining information and in conducting analysis and assessment thereof, the Mechanism complied with the terms of reference approved by the Security Council (S/2015/669 and S/2015/697) and conducted its work in an independent and impartial manner. It was at all times guided by the highest professional standards.
- In preparing the investigation plan for each case, the Mechanism outlined a series of possible scenarios, including those put forward by Member States, based on all available information as to how the incidents may have occurred.
- Over the course of conducting its investigations into the incidents at Umm Hawsh and Khan Shaykhun, the Mechanism undertook the following key activities:

(a) obtained and reviewed information and material from the Fact-Finding Mission;

(b) collected information from open sources; (c) submitted requests to Member States, including the Syrian Arab Republic, for information; (d) interviewed witnesses, including during visits to the Syrian Arab Republic, and obtained photographs, videos, documents and other materials; (e) obtained analysis and expert assessments from several forensic institutes; (f) obtained satellite imagery and analysis thereof; (g) obtained expert analysis in respect of medical effects, munitions and their delivery methods, aircraft configuration and capabilities, plume dispersion, and chemistry of toxic agents; (h) obtained information about weather conditions; and (i) attended expert briefings. Upon obtaining the above-mentioned

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information, the Mechanism conducted extensive analysis of the information and material it had obtained.

- In order to identify those responsible, the investigation sought to establish to the greatest extent feasible the circumstances of the use of the chemical weapons, including in respect of the following: (a) the precise date and time of the incident;
 - (b) the impact location; (c) the munition used; (d) the munition delivery method; and (e) the medical effects and response. In collecting and analysing the information in relation to the incidents, the Mechanism prepared a case file for each incident, documenting the information collected, as well as the analysis performed in respect of each scenario.
- Following an invitation by the Syrian Arab Republic to the Head of the Mechanism on 28 July 2017, and the Government's agreement for the Mechanism's liaison officer to take up his duties in Damascus, members of the Mechanism made several visits to the Syrian Arab Republic in support of the investigation. The Head of the Mechanism

went to Damascus from 19 to 21 August, and the Mechanism's technical teams visited Damascus from 7 to 11 September and Al-Shayrat airbase from 8 to 10 October. Throughout its mandate, the Mechanism worked actively to obtain information from Member States, international and non-governmental organizations, individuals and other relevant entities.

- The Mechanism did not visit the scenes of the incidents at Umm Hawsh and Khan Shaykhun. While the Leadership Panel considered that a visit to these sites would have been of value, such value would diminish over time. Further, the Panel was required to weigh the security risks against the possible benefits to the investigation.
- With respect to Khan Shaykhun, the crater from which the sarin emanated was disturbed after the incident and subsequently filled with concrete. As such, the integrity of the scene was devalued. The Leadership Panel considered that the high security risk of a site visit to Khan Shaykhun, which is currently in a situation of armed conflict and under the control of a listed terrorist organization (Nusrah Front), outweighed the benefits to the investigation. The Leadership Panel decided to keep the issue under review. Should conditions improve and it be determined that an on-site investigation would produce valuable new information, a visit could take place in the future. In this context, the Mechanism recently received an updated security advisory noting changes in the extent of control by different groups and additional parties involved, including increased complexity involving indirect artillery fire and recurrent airstrikes.
- In the case of Umm Hawsh, similarly the passage of time between the event occurring in mid-September 2016 and the commencement of the Mechanism's investigation on 25 May 2017, and the fact that the integrity of the scene of the incident had not been preserved, put the value of such a visit in question. Moreover, in light of the extensive information that the Mechanism was able to obtain from witnesses, an on-site visit would have provided little additional value.
- The Mechanism also noted that it would be difficult to visit any of these sites without putting persons who cooperated with it at risk. Notwithstanding the above, the Leadership Panel considered that the Mechanism had gathered sufficient information to come to a conclusion in both cases.
- The Mechanism conducted interviews with over 30 victims and witnesses who were present at Umm Hawsh and Khan Shaykhun at the relevant times, in addition to those interviewed by the Fact-Finding Mission. Regarding Umm Hawsh, these included victims of the attack, journalists present in the immediate period following the attack, doctors who treated victims, and military commanders. Regarding the

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incident at Khan Shaykhun, witnesses included residents, personnel from Al-Shayrat airbase, government officials, doctors who treated victims, rescue personnel and commanders of non-State armed groups.

- The Mechanism obtained information of the physical characteristics of the sites via satellite imagery, taken both before and after the incidents, the analysis of which assisted the Mechanism in determining the timing and precise location of the

events being investigated. Moreover, the Mechanism collected numerous photographs and videos relating to the incidents both directly from witnesses and from other sources, including the Syrian Arab Republic. These videos and images depict impact locations; impact effects, such as plumes and building damage; casualties; and munition remnants. The Mechanism obtained forensic analysis of more than 250 videos and photographs, including to determine their authenticity and the time and place where they were taken.

- Given that a significant amount of the information collected by the Mechanism was available only in Arabic, including a large volume of medical records, interviews, log-books and videos (more than 435 files), the Mechanism employed its own translators and established measures of quality control to translate the materials into English in order to be used by the Mechanism's investigators.
- The Mechanism corroborated information considered important to its investigations and made assessments only on the basis of credible and reliable information. In this connection, identifying circular reporting was important in order to ensure that the corroboration was based on independent sources of information.
- The Mechanism engaged several internationally recognized forensic and specialist defence institutes, as well as OPCW designated laboratories, considered to have established expertise and a record of outstanding performance, to provide forensic and expert support to the investigation. The forensic institutes and OPCW designated laboratories are accredited according to international standards in respect of a broad spectrum of laboratory work (ISO 17025). They were engaged by the Mechanism to authenticate photographs and video footage; to verify the times and places where they were taken; and to provide independent expert assessments and simulations with respect to items depicted, as well as chemical synthesis and analysis. The Mechanism also consulted with several internationally recognized experts in energetic materials and in the medical effects of chemical warfare agents.
- Regarding Umm Hawsh, expert analysis was provided in respect of the impact location, the munition, the trajectory of the munition and its likely delivery method, as well as the medical effects on the victims. Regarding Khan Shaykhun, expert analysis was provided with respect to the nature of the plumes resulting from explosions; the characteristics of the crater and their likely cause; the remnants of the munitions; the dispersion of sarin; the explosives used and their delivery methods; and the medical effects and their treatment. In-depth expert analysis was also provided with respect to the chemistry of sarin.

Leadership Panel's assessment of the cases

- The Leadership Panel reviewed the case files that were prepared regarding the incidents, in which the Mechanism had carefully pieced together all available information to determine the evidence obtained in respect of the essential elements of the cases. The results of the respective investigations were assessed in view of criteria of credibility and reliability.

- The Leadership Panel determined that, in order to identify those responsible for the use of chemical weapons on the dates and times of the two incidents in which the Fact-Finding Mission determined use, a finding must be made in accordance with the standards of evidence as described in the Mechanism’s first report (S/2016/142). In this regard, the Panel also determined that it must be satisfied that the information used as the basis of its findings is of a credible and reliable nature, and that each significant element is corroborated by information from independent sources, including forensic institutes and independent scientific experts.

IV. Assessment, findings and conclusion

• Cases under investigation

- *Umm Hawsh.* On 4 May 2017, the Secretary-General transmitted to the President of the Security Council the report entitled “Report of the OPCW Fact-Finding Mission in Syria regarding the incident of 16 September 2016, as reported in the note verbale of the Syrian Arab Republic, number 113, dated 29 November 2016” (S/2017/400, enclosure). In the conclusion of that report, the Fact-Finding Mission confirmed that “the two female casualties reported to have been involved in the incident in Um-Housh, Aleppo, of 16 September 2016 were exposed to sulfur mustard”.
- *Khan Shaykhun.* Further to a status update of the Fact-Finding Mission regarding a reported incident in Khan Shaykhun on 4 April 2017 (S/2017/440, enclosure), on 30 June 2017 the Secretary-General transmitted to the President of the Security Council the document entitled “Report of the OPCW Fact-Finding Mission in Syria regarding an alleged incident in Khan Shaykhun, Syrian Arab Republic, April 2017” (S/2017/567, enclosure). Based on its work, the Fact-Finding Mission concluded that “a large number of people, some of whom died, were exposed to sarin or a sarin-like substance” and concluded that “such a release can only be determined as the use of sarin, as a chemical weapon”.

• The Leadership Panel’s assessments and findings

- The following summarizes the work of the Mechanism and the assessment and findings of the Leadership Panel.
- Full descriptions of the Mechanism’s investigations into the incidents at Umm Hawsh and Khan Shaykhun are in annexes I and II, respectively.

Umm Hawsh

- In conducting its comprehensive investigation into the case, the Mechanism used the information and materials collected and prepared by the Fact-Finding Mission as a starting point. It interviewed 10 witnesses in addition to those questioned by the Fact-Finding Mission and reinterviewed the two victims. It also collected and reviewed significant amounts of additional material, including videos, photographs, satellite imagery and medical records. Furthermore, the Mechanism obtained independent expert assessments and analysis regarding the munitions used and their trajectory, as well as the medical effects to the victims and their treatment.

- The Mechanism determined that the incident affecting the two victims had occurred on 15 September 2016 at around 1500 to 1600 hours. The Mechanism made this finding based on the following: medical records indicating that the

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victims had been admitted to Afrin Hospital on 16 September 2016, approximately 23 hours after exposure to the chemical agent; witness interviews; and the assessment of medical experts that the victims' blisters would have been at least 12 hours old at the time of initial hospitalization.

- Based on further witness statements, satellite imagery and verified footage from the above-mentioned news crew, the Mechanism found that a second incident involving the use of chemical weapons occurred on the following day, 16 September 2016, when a mortar shell was lodged into the pavement between 1315 and 1500 hours.
- Based on witness interviews, the Mechanism determined that a number of other people, aside from the two victims interviewed by the Fact-Finding Mission, may have been affected by sulfur mustard and in need of medical attention. Their symptoms ranged from slight to severe, with the two victims still suffering from the consequences to date. The Mechanism only identified and interviewed the two victims.
- Regarding the make and origin of the mortar shells, forensic analysis determined that the mortar shell recovered from the pavement was of an improvised or makeshift origin. Based on witness descriptions and comparative analysis of photographs of the mortar shells, experts assessed the munition from the house to be of the same type as the one found in the pavement.
- The range of the mortar shells was assessed by forensic institutes and individual experts as being from 1 to 2 km. The delivery trajectory for the mortar shell found in the pavement was assessed as being from the east to the south-east. It was difficult to arrive at a precise assessment of the trajectory of the mortar shell that hit the house. However, based on the assessed trajectory of the mortar shell which damaged the wall of the house combined with that of the munition found in the pavement, forensic analysis indicated that the most likely launch point was from the east to the south-east.
- With respect to identifying those responsible, the Leadership Panel has determined that there is sufficient credible and reliable evidence of the following:
 - The trajectory of the mortar shell found in the pavement was determined to be from an eastward or south eastward direction of the impact location. The damage to the victim's house indicated that the trajectory of the mortar shell that caused it was coming from the south-east;
 - ISIL was fighting against the SDF from the outskirts of Umm Hawsh on
 - and 16 September 2016;

- ISIL was positioned along three sides of Umm Hawsh, specifically to the east of the village (the assessed origin of the chemical mortar shells);
- Owing to the limited range (1 to 2 km) of the mortar shells, only ISIL and SDF were within distance of the impact locations;
- As SDF and ISIL were in active combat and witness statements and forensic analysis support the conclusion that the mortar shell came from the direction of ISIL-held areas, it is very unlikely that the SDF is responsible for the incident; and
- Unlike ISIL, which was found by the Mechanism to have used sulfur mustard in Marea in August 2015 (S/2016/738), there is no evidence that the SDF have used sulfur mustard in the past.

Based on the foregoing, the Leadership Panel is confident that ISIL is responsible for the use of sulfur mustard at Umm Hawsh on 15 and 16 September 2016. The

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findings of the Leadership Panel regarding the evidence in this case are based on the information set forth in detail in annex I.

Khan Shaykhun

- Taking the findings of the Fact-Finding Mission as a starting point, the Mechanism conducted a comprehensive investigation into the release of sarin at Khan Shaykhun on 4 April 2017. The Mechanism interviewed 17 witnesses in addition to those interviewed by the Fact-Finding Mission, and collected and reviewed material not obtained by the Fact-Finding Mission. The Mechanism obtained substantial information on activities of the Syrian Arab Air Force (SAAF) on 4 April 2017.
- The Mechanism examined eight possible scenarios as to how the incident occurred. Based on the information obtained, the following two scenarios were further investigated: (a) sarin was released via an aerial bomb; or (b) sarin was released via the explosion of an improvised explosive device (IED) placed on the ground. A third scenario with two alternatives was also investigated, neither of which was found to be linked to the release of sarin.
- The Mechanism determined that sarin was released from the location of a crater in the northern part of Khan Shaykhun between 0630 and 0700 hours on 4 April 2017.
- Based on their review of photographs, videos and satellite images, the forensic institutes and individual experts engaged by the Mechanism assessed that the crater was most probably caused by a heavy object travelling at a high velocity, such as an aerial bomb with a small explosive charge. Examining the munition remnants observed inside the crater, the forensic institutes and individual experts concluded that the remnants were pieces of a thin-walled munition of 300 to 500 mm in diameter and were likely from an aerial bomb.
- The Mechanism also examined whether an IED could have caused the crater. While this possibility could not be completely ruled out, the experts assessed that that scenario was less likely, on the basis that an IED would have caused more damage to the

surroundings than had been observed at the scene. Furthermore, no witnesses reported the placement or explosion of an IED from the ground.

- The Mechanism received information as to the operation of SAAF aircraft in the area of Khan Shaykhun indicating that SAAF aircraft may have been in a position to launch aerial bombs in the vicinity. At the same time, however, SAAF flight records and other records provided by the Syrian Arab Republic make no mention of Khan Shaykhun on 4 April 2017. Furthermore, a representative of the SAAF stated to the Mechanism that no SAAF aircraft had attacked Khan Shaykhun on 4 April 2017.
- The Mechanism received conflicting information about aircraft deployment in Khan Shaykhun that morning. On 6 and 13 April 2017, the Government of the Syrian Arab Republic made public statements that the SAAF bombed Khan Shaykhun with conventional bombs at around 1130 to 1200 hours. Furthermore, the Mechanism obtained original video footage from two separate witnesses that showed four plumes caused by explosives across Khan Shaykhun. The footage was confirmed by forensic analysis to be authentic and to have been filmed in Khan Shaykhun between 0642 and 0652 hours on 4 April 2017.
- The Mechanism examined the nature of the rescue and health-care operations following the mass-casualty situation caused by the release of sarin in Khan Shaykhun. At present, the Mechanism cannot verify the total number of persons who either died or were injured as a result of the attack, but concludes, based on its

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interviews with victims and medical personnel, review of medical records and consultations with medical experts engaged by the Mechanism, that the response to the incident largely correlated to the reported number of casualties and victims.

- The Mechanism commissioned an in-depth laboratory study of the origin of the precursor chemical DF used to produce the binary sarin released in Khan Shaykhun. This study revealed that the sarin released in Khan Shaykhun had most likely been made with the precursor DF from the original stock from the Syrian Arab Republic. An initial screening of reports concerning previous incidents of the release of sarin in the Syrian Arab Republic showed that some “marker chemicals” appear to be present in environmental samples. This would warrant further study. This finding relates only to the origin of the DF used as precursor and not to the those responsible for the dissemination of sarin.
- With respect to identifying those responsible, the Leadership Panel has determined that the information it has obtained constitutes sufficient credible and reliable evidence of the following:
 - Aircraft dropped munitions over Khan Shaykhun between 0630 and 0700 hours on 4 April 2017;
 - Aircraft of the Syrian Arab Republic was in the immediate vicinity of Khan Shaykhun between 0630 and 0700 hours on 4 April 2017;
 - The crater from which the sarin emanated was created on the morning of 4 April 2017;

- The crater was caused by the impact of an aerial bomb travelling at high velocity;
- A large number of people were affected by sarin between 0630 and 0700 hours on the morning of 4 April 2017;
- The number of persons affected by the release of sarin on 4 April 2017 and that sarin reportedly continued to be present at the site of the crater 10 days after the incident indicate that a large amount of sarin was likely released, which is consistent with it being dispersed via a chemical aerial bomb;
- The symptoms of victims and their medical treatment, as well as the scale of the incident are consistent with a large-scale intoxication of sarin; and
- The sarin identified in the samples taken from Khan Shaykhun was found to have most likely been made with a precursor (DF) from the original stockpile of the Syrian Arab Republic; and
- The irregularities described in annex II are not of such a nature as to call into question the aforementioned findings.

Based on the foregoing, the Leadership Panel is confident that the Syrian Arab Republic is responsible for the release of sarin at Khan Shaykhun on 4 April 2017. The findings of the Leadership Panel regarding the evidence in this case are based on the information set forth in detail in annex II.

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• **Other activities**

• **Interaction with Member States and the Organisation for the Prohibition of Chemical Weapons**

Syrian Arab Republic

- In accordance with Security Council resolution 2235 (2015), the Syrian Arab Republic, and all parties in Syria, are to fully cooperate with the Mechanism, including by providing full access to all locations, individuals and materials in the Syrian Arab Republic that are deemed relevant by the Mechanism to its investigation. The Syrian Arab Republic engaged constructively with the Mechanism and demonstrated its commitment to cooperate and facilitate the Mechanism's requests for access to information and witnesses. The Mechanism maintained regular contact with the relevant authorities of the Syrian Arab Republic.

- The Mechanism engaged with the Syrian Arab Republic for planning purposes, including in requesting for a liaison officer to be based in Damascus. The Mechanism received a positive response on 11 July 2017 to this request and thereafter commenced planning to visit the Syrian Arab Republic.
- In letters dated 5 and 19 July 2017, the Head of the Mechanism requested the Government of the Syrian Arab Republic to provide official records regarding arrangements and movements at Al-Shayrat airbase with respect to 4 April 2017.
- During the first visit to Damascus, from 19 to 21 August 2017, by members of the Leadership Panel, the Government of the Syrian Arab Republic provided all materials requested by the Mechanism. During this mission, the Head of the Mechanism met with representatives of the Government of the Syrian Arab Republic, including the Deputy Minister for Foreign Affairs and Expatriates and members of the armed forces.
- During the second visit to Damascus, from 7 to 11 September 2017, a technical team of the Mechanism conducted witness interviews, collected information and met with representatives of the Government of the Syrian Arab Republic, including officials from the Syrian Scientific Studies and Research Centre.
- During the third visit, from 8 to 10 October 2017, the Mechanism went to Al-Shayrat airbase. After having received information provided by the Syrian Arab Republic during the first and second visits to Damascus, the Mechanism considered that such a visit would be of value to its investigation into the incident at Khan Shaykhun. The technical visit had the following objectives: (a) to verify the authenticity of the log-books and flight operation records of 4 April 2017; (b) to review entry and exit logs and interview responsible personnel; (c) to photograph the types of munitions flown on 4 April 2017 in accordance with logs received; and
 - (d) to photograph the mechanisms for attaching such munitions onto Sukhoi-22 aircraft. Collecting samples at the airbase was not an objective of the visit. The Mechanism had assessed that doing so would not advance the investigation. If a single chemical munition was flown from that base, the Mechanism considered that there was little chance of finding any trace of sarin or its degradation products in an airbase of that size without specific information as to where to sample.
- In addition to these visits to the Syrian Arab Republic, the Leadership Panel held regular meetings with representatives of the Syrian Arab Republic in New York.

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- As stated in the fourth, fifth and sixth reports of the Mechanism (S/2016/888, S/2017/131, and S/2017/552), on 10 October 2016 the Syrian Arab Republic notified the Mechanism that the Syrian national committee opened an internal investigation, which included flight plans and air operations. To date the Syrian Arab Republic has not provided the Mechanism with the outcomes of this investigation.

Organisation for the Prohibition of Chemical Weapons

- The Mechanism's investigation initially commenced with a comprehensive review and analysis of all the information collected and prepared by the Fact-Finding Mission regarding the two cases. This comprised 2,554 files, which included documents, video interviews, audio recordings, photographs and laboratory results.
- The OPCW provided the Mechanism with three technical experts who were deployed with the Mechanism's technical team to visit Al-Shayrat airbase. These experts provided the Mechanism with additional specialist skills, including to ensure the safety of the operation.
- The OPCW also provided invaluable support through the OPCW laboratory and its designated laboratory network.
- The Leadership Panel was in regular contact with the Director-General of the OPCW both from New York and in The Hague. Moreover, the Mechanism interacted with the OPCW on a frequent basis throughout the Mechanism's mandate.

Information from Member States

- The Leadership Panel sent formal requests for information to Member States, including the Syrian Arab Republic, members of the Security Council and countries in the region, on three occasions. The requests for information were sent on 15 June 2017 regarding the case at Umm Hawsh; on 5 July 2017 regarding the case at Khan Shaykhun; and on 30 August 2017 regarding both cases. The Mechanism also sent tailored follow-up requests on both cases to a number of Member States who had responded to the initial requests.
- Twelve Member States provided case-specific information, which was subjected to the same rigorous review and analysis as other information gathered. The Mechanism always sought to collect additional material from at least one other independent source for corroboration purposes.
- Throughout the reporting period, the Leadership Panel met with Member States, including members of the Security Council. This was also an opportunity to brief Member States on the general status of the work of the Mechanism and to engage with regional States. Members of the Leadership Panel also visited capitals of four Member States, including the Syrian Arab Republic, upon their invitation, to be briefed on specific aspects of the two cases.

Allegations from Member States

- Since the issuance of its sixth report on 28 June 2017, the Mechanism has formally received 15 allegations related to non-State actors' acquisition, possession or transfer of, or intent to use, chemical weapons or toxic chemicals. Two allegations specifically referred to Islamic State in Iraq and the Levant (ISIL). Thirteen allegations also included the acquisition of missiles and rockets fitted with toxic chemicals by non-State actors, including seven allegations involving the Nusrah Front. These allegations were shared with the OPCW.

- **Consultation with the United Nations counter-terrorism and non-proliferation bodies**

- In fulfilling its mandate, the Mechanism consulted appropriate United Nations counter-terrorism and non-proliferation bodies to exchange information, as encouraged in resolution 2319 (2016), including with the experts of these committees.

- **Information management**

- The Mechanism took measures to ensure that its personnel complied with the confidentiality and security protection requirements as set out in the memorandum of understanding concluded between the Mechanism and the OPCW on 26 November 2015, concerning the provision of access, storage and handling of information.
- All personnel and all other individuals and entities with whom the Mechanism engaged were also required to enter into confidentiality undertakings.
- The Mechanism followed standard operating procedures and guidelines on information management (S/2016/888, annex), as well as on the conduct of interviews and the collection of evidence and information, including chain of custody forms. In addition, the Mechanism applied the Secretary-General's bulletin on information sensitivity, classification and handling (ST/SGB/2007/6) in relation to the information collected and produced by the Mechanism. Furthermore, relevant sections of the Secretary-General's bulletin on record-keeping and the management of United Nations archives (ST/SGB/2007/5), concerning the creation, management and disposition of records, have been applied by the Mechanism.

VI. Challenges, risks and constraints

- While the Mechanism actively collected information relevant to its investigations from a range of sources, it also depended on Member States to assist by providing quality information in a timely manner.
- The conditions for receiving information in a highly sensitive political environment with complex security considerations made the investigation extremely challenging. On-site visits were subject to high security risks. Moreover, as an investigative body without judicial powers, the Mechanism relied on the voluntary cooperation of witnesses, was required to meet strict standards of confidentiality in all its operations, and was to ensure the safety of witnesses without any witness-protection means.

VII. Way forward

- The Leadership Panel understands that several additional cases are currently subject to Fact-Finding Missions. Based on its recent work, the Leadership Panel commends the continued scientific progress and development that has provided invaluable support

to complex investigations of this nature. In this regard, it is important to maintain and grow a network of internationally recognized expertise on these particular issues.

- The Leadership Panel notes that the investigations conducted in this reporting period have provided a series of important lessons for future investigations of this

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nature, which should be captured by conducting a comprehensive lessons-learned exercise.

- It is vital for the international community to maintain an effective investigative capacity to rapidly respond to any future use of chemical weapons, including acts of chemical terrorism.

VIII. Concluding remarks

- The Leadership Panel is deeply concerned by the findings of the Fact-Finding Mission that chemical weapons—sulfur mustard and sarin—were used. The Leadership Panel expresses its shock and dismay about the existence and use of these weapons in the Syrian Arab Republic, and its deep sympathy to those affected by them. We encourage the international community not only to make united efforts to ensure that such use will not be repeated, but also to provide assistance to those affected.
- The continuing use of chemical weapons, including by non-State actors, is deeply disturbing. If such use, in spite of the prohibition by the international community, is not stopped now, a lack of consequences will surely encourage others to follow—not only in the Syrian Arab Republic but also elsewhere. This is the time to bring these acts to an end.
- The Leadership Panel wishes to give recognition to the professionalism, dedication and sacrifice of its staff, and to express its deep appreciation for all their work and commitment during the reporting period.
- The Leadership Panel extends its appreciation for the support received from the United Nations Secretariat, in particular the Office for Disarmament Affairs, and from the Organisation for the Prohibition of Chemical Weapons, which provided invaluable technical and logistical support to the Mechanism.

Annex I

Umm Hawsh

• Findings of the Organisation for the Prohibition of Chemical Weapons Fact-Finding Mission in the Syrian Arab Republic

- Based on interviews conducted with witnesses, including a visit to the Syrian Scientific Studies and Research Centre in Barzeh to conduct physical examinations of items related to the reported incidents, the documents reviewed and the results of blood sample analyses, the Organisation for the Prohibition of Chemical Weapons Fact-Finding Mission in the Syrian Arab Republic confirmed that the two female casualties reported to have been involved in the incidents in Umm Hawsh on 15 and
- September 2016 were exposed to sulfur mustard. Furthermore, the Fact-Finding Mission stated that it “conducted a thorough technical weapon exploitation on a 217-mm calibre mortar”. Supported by the results of laboratory analyses, the Fact-Finding Mission determined that this mortar shell contained sulfur mustard.

• The Mechanism’s investigation

- The Mechanism formulated possible scenarios to ensure that it approached the investigation comprehensively and in an objective and impartial manner. While the Mechanism sought to collect and analyse as much information as possible in connection with each scenario, by the end of the investigation most of the information obtained supported one scenario: that sulfur mustard munitions, one of which caused the exposure of the victims, were fired on Umm Hawsh by an actor.

Background

- Umm Hawsh, also known as Um Hosh, is a village in the Aleppo governorate (Mare‘ sub-

district, A‘zaz district). It is located at coordinates 36°24′51.12″N, 37°12′38.16″E, in the midst of a triangle of three larger cities: Aleppo, A‘zaz, and Al-Bab. Umm Hawsh is roughly 23 km north-east of Aleppo city and 35 km south of the Bab al-Salam border crossing with Turkey. It is located in a fork between two motorways to the north of Aleppo—i.e., east of the M214 and west of the M20 motorways.

- The population of Umm Hawsh according to 2004 Syrian census data was 3,542. At the time of the incidents in September 2016, the population of Umm Hawsh was estimated to be 728.
- Umm Hawsh and the surrounding area fell under the control of Islamic State in Iraq and the Levant (ISIL) on 9 August 2015. It was taken over by the Syrian Democratic Forces (SDF) on 30 August 2016. Additional non-State armed groups were present roughly 8 km to the north of Umm Hawsh, in Marea. The forces of the Syrian Arab Republic and its allies were not present in Umm Hawsh at the time of the incidents; the closest that they appear to have been was 8.7 km away in Misqan. By the time of the sulfur mustard incident, the frontline and conflict dynamics had not changed since Umm Hawsh was captured by the SDF on 30 August 2016. At that time, ISIL remained from 600 to 800 m east and 1 km north of the village, with an additional presence to the south of the village.

Date and time

- The incident leading to the exposure of the victims to sulfur mustard is assessed to have occurred at a house in Umm Hawsh at around 1500 to 1600 hours

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on Thursday, 15 September 2016. The Mechanism made this finding based on the following: medical records indicating that the victims had been admitted to Afrin Hospital on 16 September 2016, approximately 23 hours after exposure to the chemical agent; witness interviews; and the assessment of medical experts that the victims’ blisters would have been at least 12 hours old at the time of initial hospitalization.

- The Mechanism found that the following day, on Friday, 16 September, a mortar shell was lodged in a pavement in the village at around 1315 to 1500 hours. This assessment is based on verified media footage, witness statements and analysis of satellite imagery.

Impact location

- The Mechanism determined the location of the house² impacted by a mortar shell through a variety of means. One of the victims, who lived in the house, identified the location based on photographs presented during an interview with the Mechanism. Those photographs included images of the house, the street and the village. Moreover, the information with regard to the location of the house of the victim was corroborated via forensic analysis, the statements of several other witnesses, a review of satellite imagery and the findings of the Fact-Finding Mission. Lastly, the identification of the location is supported by original videos provided to the Mechanism showing damage to the house.

- The mortar shell in the pavement was determined to be located at approximately 36°24'43.29"N, 37°12'31.16"E. The identification of the location was based on forensic analysis of video footage taken by news crews who filmed the munition still protruding from the pavement. The finding with regard to the location of the mortar shell in the pavement was corroborated by analysis of satellite imagery, the statements of three witnesses, and the findings of the Fact-Finding Mission and the Russian Federation Chemical, Biological, Radiological and Nuclear Defence team.

Munition analysis

- Several witnesses interviewed by the Mechanism confirmed that a mortar shell or a munition hit the house of one of the two victims. The mortar shell was not recovered as the house owner had thrown it away sometime after the incident. However, a news crew photographed a damaged mortar shell the following day and provided images to the Mechanism. The house owner identified the mortar shell from photographs taken by the news crew. A forensic institute and an expert engaged by the Mechanism who specializes in energetic material stated that the mortar shell that hit the house was very likely of the same type as the mortar shell found in the pavement. A defence research institute, a forensic institute and an expert consultant, all engaged by the Mechanism, observed that the mortar shell recovered from the pavement was of poor production quality. After the munition hit the house, five witnesses described qualities, such as smell, which are consistent with the mortar shell containing sulfur mustard.
- With respect to the origin of the mortar shells, experts in energetic materials noted that the mortar shell recovered from the pavement had a similar appearance to those made by makeshift large-scale production methods. The Fact-Finding Mission established that the munition found in the pavement was a 217-mm calibre mortar

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- While the Mechanism obtained the geographical coordinates of the house damaged by the mortar, the location is not included in this report on account of concerns for the safety and security of the victims.

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shell. Mortars fitting 217-mm calibre mortar shells are easily produced from available high-quality steel tubing. The range of such munitions is from 1 to 2 km. Based on the limited information available, a defence research institute commissioned by the Mechanism concluded that it was impossible to identify the manufacturer(s) of the munitions.

- Regarding the characteristics of the munition that caused damage to the house, an expert in energetic material noted that, based on a review of photographs and video footage showing the damage to the house, the damage was consistent with having been caused by a mortar shell fired from a mortar with a calibre of about 220 mm. According to the Fact-Finding Mission, the mortar shell in the pavement contained sulfur mustard. The pavement was not seriously damaged and there was likely residual contamination from the leaking munition. A forensic institute observed that the lack of a major explosion suggests that these mortar shells were designed to carry a chemical agent. Regarding the penetration of the mortar shell in the pavement, two experts in energetic materials observed that the mortar shell penetrated the pavement, with little signs of damage to both the mortar shell and the pavement itself. Both

experts tried to find an explanation, with one noting that there was little resistance in the pavement because of an observed pre-existing cavity, which the mortar shell penetrated.

- With respect to the range of the mortar shells, forensic institutes and experts commissioned by the Mechanism assessed the distance from where they were launched to the impact site to be from 1 to 2 km. They also noted that the range and accuracy of homemade mortar shells are imprecise and depend on a number of variables, including the amount of explosive powder used.
- Additionally, the same experts assessed the trajectory for the mortar shell found in the pavement as being from the east to the south-east. Witnesses confirmed that its trajectory was from the eastern side of Umm Hawsh. The assessed trajectory for the mortar shell that hit the house was less precise, as it was based on the damage to the wall of the house. That trajectory was assessed as being an arc from due east to nearly due west, with the trajectory's subjective central line coming from the south-east.

Medical effects and response

- When interviewed by the Mechanism, the victim stated that, upon finding the house damaged by the mortar shell, she commenced cleaning her house with bare hands using laundry detergent. She later asked a neighbour to help. Both cleaned for about four hours until after the Maghrib call to prayer. The house owner reported becoming sick about that time, including having visual impairment. She took a shower, and later threw up and felt dizzy. Members of the SDF took the victim to Tall Rif'at Hospice the following morning, however, there were no doctors available at the time. They then went to Afrin Hospital later that day, where the victim lost consciousness. After a week, the victim woke up with bandaged hands. She was later admitted to a hospital in Damascus. The neighbour who helped clean the house also got sick and went to the hospital.
- The victim's neighbour was interviewed by the Mechanism and stated that they had tried to clean the "oil" away using water and laundry detergent. At the start of the cleaning process, the victim could smell the chemical, but then got somewhat used to it. The victim went home to take a shower and later became dizzy and could not eat or drink. After going to a relative's house, the victim fell to the ground and started to throw up, before losing consciousness. By the morning, the victim could no longer see and was transported to a hospital by relatives. They first went to Ahras Medical Center in the morning where the victim was treated. The victim's whole

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body was swollen by that time and had developed blisters. By 1000 to 1100 hours, the victim was taken to Afrin Hospital and stayed there for 20 days. Still in poor condition, the victim then went to Kafr Naya Hospice and later to a hospital in Damascus. The victim could not speak and her chest felt tight for a month.

- Several sources indicate that other civilians and three fighters from non-State armed groups were also affected by the chemical incident. This information is only

partially corroborated by one witness, who stated that Afrin Hospital received one male and two children with mild symptoms as ambulant patients on 16 September 2016. Another witness suggested that “some children were also affected and taken to the hospital”. This could not be corroborated by the Mechanism. Another witness insisted that “the hospital did not receive additional patients with similar symptoms. We only had those two cases.”

- An additional witness indicated to the Mechanism that a relative had cleared the furniture affected with sulfur mustard and, as a result, developed some minor symptoms on the fingers.
- While a number of other people may have been affected by the sulfur mustard incident and needed medical attention, only two of them were identified and interviewed by the Mechanism. The victims’ symptoms included large blisters on their upper and lower limbs and faces, and they still suffer from the consequences of sulfur mustard exposure to this date. Clinical toxicologists engaged by the Mechanism confirmed the exposure to sulfur mustard and noted that the victims may have permanent health implications owing to their exposure to the chemical.

Chemistry

- The chemical agent that affected the victims is sulfur mustard. It is a blistering agent, whose precursor chemicals are relatively cheap and easy to acquire.
- The Fact-Finding Mission conducted chemical analysis of the samples of sulfur mustard. It concluded that the presence and relevant quantities of disulfide and trisulfide mustard analogs indicated that this mustard was most likely produced using the Levinstein process, which is widely understood to be an alternative and relatively uncomplicated method to produce sulfur mustard to which non-State actors might turn.
- Witnesses and open sources point towards ISIL as a possible perpetrator of the chemical attack. Information provided to the Mechanism indicates that ISIL developed the capability to produce sulfur mustard as of 2015. ISIL had ample access to industrial zones, including oil and gas fields to produce the delivery systems, munitions and chemicals. ISIL has a historical record of using sulfur mustard, including in Marea in August 2015 (just 7.4 km north of Umm Hawsh). In its third report (S/2016/738/Rev.1), the Mechanism found that ISIL had the capacity to produce sulfur mustard through the Levinstein chemical reaction process.

• The Leadership Panel’s assessment and findings

- In order to determine to the greatest extent feasible those who were perpetrators, organizers, sponsors or otherwise involved in the use of sulfur mustard on 15 and 16 September 2016 in Umm Hawsh, the Leadership Panel requested the investigators to examine four possible scenarios as to how the events unfolded. Upon concluding the investigation, the prevailing scenario that emerged was that sulfur mustard munitions, one of which caused the exposure of victims, were fired on Umm Hawsh by an actor.

- Most of the information collected and analysed by the Mechanism supports this scenario. The majority of evidence suggests that the munitions were fired from the east or south-east, where one particular actor (ISIL) was positioned at the time of the incident.
- With respect to identifying those responsible, the Leadership Panel has determined that the information it has obtained constitutes sufficient credible and reliable evidence of the following:
 - The trajectory of the mortar shell found in the pavement was determined to be from an eastward or south eastward direction of the impact location. The damage to the victim's house indicated that the trajectory of the mortar shell that caused such damage was coming from the south-east;
 - ISIL was fighting against the SDF from the outskirts of Umm Hawsh on
 - and 16 September 2016;
 - ISIL was positioned along three sides of Umm Hawsh, specifically to the east and south east of the village (the assessed origin of the chemical mortar shells);
 - Owing to the limited range (1 to 2 km) of the mortar shells, only ISIL and SDF were within distance of the impact locations;
 - As SDF and ISIL were in active combat and witness statements and forensic analysis support the conclusion that the mortar shell came from the direction of ISIL-held areas, it is very unlikely that the SDF is responsible for the incident; and
 - Unlike ISIL, which was found by the Mechanism to have used sulfur mustard in Marea in August 2015 (S/2016/738/Rev.1), there is no evidence that the SDF have used sulfur mustard in the past.

Based on the foregoing, the Leadership Panel is confident that ISIL is responsible for the use of sulfur mustard at Umm Hawsh on 15 and 16 September 2016. The findings of the Leadership Panel regarding the evidence in this case are based on the information set forth in detail in this annex.

Annex II

Khan Shaykhun

- **Findings of the Organisation for the Prohibition of Chemical Weapons Fact-Finding Mission in the Syrian Arab Republic**

1. Based on its analysis of biomedical specimens, interviews, and supplementary material submitted during the interview process, as well as analysis of environmental samples, the Organisation for the Prohibition of Chemical Weapons (OPCW) Fact-Finding Mission found that a large number of people, some of whom died, were exposed to sarin or a sarin-like substance at Khan Shaykhun on 4 April 2017. While it received “limited information on the dispersal mechanism and therefore was unable to make firm conclusions on that specific matter”, it considered that “the release that caused exposure was likely to have been initiated in the crater in the road, located close to the silos in the northern part of the town”. It concluded that, “based on such a release, the only determination that could be made was that sarin had been used as a weapon”.

- **The Mechanism’s investigation**

- Upon receiving the final report of the OPCW Fact-Finding Mission on the incident of 4 April 2017 at Khan Shaykhun, the Mechanism conducted an in-depth investigation into the incident. The Leadership Panel defined the scope of the investigation by adopting an investigation plan that outlined eight possible scenarios, including those put forward by Member States, as to how sarin had been released in Khan Shaykhun. While the Mechanism sought to collect and analyse as much information as possible in connection with each scenario, by the end of the investigation, most of the information obtained supported three scenarios: (a) sarin was delivered via an aerial bomb that was dropped by an airplane; (b) sarin

was released from the ground as part of a staged attack; and (c) there was an air strike by the Syrian Arab Air Force (SAAF) against a storage facility containing toxic chemicals, which resulted in the dispersion of a toxic cloud.

- The first scenario is based on reports that aircraft were either seen or heard dropping bombs over Khan Shaykhun early in the morning of 4 April 2017. Sarin is believed to have emanated from an impact point on a road, hereafter referred to as “the crater”, caused by an aerial bomb, located close to silos in the north of Khan Shaykhun.
- The second scenario is based on a report that sarin was released from the same crater as in the first scenario caused by an explosive charge placed on the ground containing sarin, so as to stage an attack for which the Government of the Syrian Arab Republic would be blamed.
- The third scenario concerns a reported strike by the SAAF on an ammunition depot in the eastern outskirts of Khan Shaykhun that had workshops producing chemical warfare munitions. In a public statement, the Government of the Syrian Arab Republic stated that the SAAF only conducted an attack in Khan Shaykhun at around noon on 4 April 2017. An alternative third scenario is that a house in Khan Shaykhun that had been taken over by a non-State armed group and used for storage of toxic chemicals was bombed on 4 April 2017, thus releasing toxic chemicals.

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Background

- Khan Shaykhun is both a town and a sub-district of the Maarrat al-Nu'man District, within the governorate of Idlib in north-western Syrian Arab Republic, with the coordinates 35.44° N, 36.65° E , at 376 m above sea level. Located about 10 km away from the border of Hama governorate to the south and about 100 km away from Aleppo Governorate to the north, Khan Shaykhun is positioned on the M5 motorway, which runs from the Jordanian border in the south of the country, through Damascus city, to Aleppo city in the north of the country.
- Recent information available to the Mechanism estimates that the sub-district of Khan Shaykhun has a population of approximately 34,000 people, with the town itself having 16,000 people.
- A review of open source information indicates that, in mid-2014, the Nusrah Front launched an offensive in southern Idlib governorate and seized the town of Khan Shaykhun. According to witness statements, as well as open sources, on the date of the incident on 4 April 2017, the Hay'at Tahrir al-Sham (HTS), which includes the Nusrah Front as its major component, had a prominent presence in the area of Khan Shaykhun, with Ahrar Al-Sham also being present in the general area, along with several other non-State armed groups.

- A review of open sources further indicates that, on 21 March 2017, HTS and its allied groups launched an offensive against Syrian government forces in the direction of Hama city from its positions in the northern parts of the Hama governorate. By 23 March 2017, HTS and its allied groups reportedly advanced to areas 3 to 5 km from the Hama city line and threatened to capture the Hama Military Airport. On 24 March 2017, Ahrar Al-Sham and its allied groups reportedly launched a separate offensive in the north-western parts of the Hama governorate. At around this time, open source information suggests that Syrian government forces started to gain momentum, although with some temporary setbacks, in repelling these attacks. Reinforcements reportedly arrived from other parts of the Syrian Arab Republic. Syrian government forces were also reportedly aided with air attacks on locations in northern Hama and southern Idlib governorates. According to the Director-General of the OPCW, sarin was found to have been released in Latamenah on 30 March 2017. By 3 April 2017, Syrian government forces had made rapid advances, reportedly regaining control over most of the areas lost since 21 March 2017, and had moved deeper into some of the areas controlled by non-State armed groups prior to 21 March 2017. Media sources indicate that, between 17 March and 3 April 2017, aerial attacks were conducted regularly against targets in Khan Shaykhun.

Date and time

- Based on witness statements and forensic analysis of photographs and video footage, the Mechanism found that the sarin incident occurred in Khan Shaykhun between 0630 and 0700 hours on 4 April 2017. Moreover, the Mechanism collected multiple reports released in the media during the morning of 4 April 2017, which reported that a “chemical attack” occurred in Khan Shaykhun between 0630 and 0700 hours local time.
- Witnesses reported that the alleged attack in Khan Shaykhun on 4 April 2017 was carried out by an airplane between 0630 and 0700 hours. The Mechanism obtained original photographs and video footage from witnesses that show plumes on the morning of 4 April 2017, indicating that several explosions occurred in Khan Shaykhun between 0630 and 0700 hours. Based on forensic analysis, the plume videos and images are assessed to have been recorded on 4 April 2017 between

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0642 to 0652 hours. Further forensic analysis confirmed that the footage had not been manipulated and was taken from the outskirts of Khan Shaykhun.

- Moreover, based on satellite images of 3 April 2017, which do not show the presence of the crater at that time, the Mechanism has confidence that the crater was caused by an impact on 4 April 2017.

Early warning

- Witnesses interviewed by the Mechanism described an “early warning system” (commonly referred to as “spotters”, “observers” or “observatories”), which possibly played a role in warning residents of the attack on 4 April 2017. By intercepting communications between SAAF aircraft and the bases from which they operate, members of the spotter network monitor flight activities and

communicate early warning information to residents of impending air strikes.

- The Mechanism collected information from witnesses to the effect that a first warning of a possible upcoming chemical attack was received by “Syrian Civil Defence” (also known as the “White Helmets”) and spotters in Khan Shaykhun. Witnesses stated that the Syrian Civil Defence in Khan Shaykhun was in contact via the Internet with the spotters and that, at around 0630 hours on 4 April 2017, spotters announced that a “Su-22” (Sukhoi-22) military aircraft took off from Al-Shayrat airbase. A witness interviewed by the Mechanism, who reported working that morning as a spotter in Khan Shaykhun, recalled receiving an alert concerning the take-off of a Su-22 from Al-Shayrat airbase on the morning of 4 April 2017. The witness stated that the alert advised residents to be careful as the aircraft was likely carrying toxic chemicals.
- The Mechanism noted several witness statements that suggested that on the morning of 4 April 2017, the early warning system may not have been fully functional. The Syrian Civil Defence reported that, when the first volunteer team responded to the airstrike, they had no idea that it was a chemical attack and that they were all poisoned. Several witnesses stated that there was no warning of an attack on the morning of 4 April, while others reported receiving alerts at various times between 0630 and 0715 hours that morning.
- While there are varying accounts as to whether the early warning system was fully functional that morning, the above information gathered by the Mechanism neither supports nor excludes any of the three scenarios.

Air deployment

- While there are varied accounts of the nature and timing of the attack, and the subsequent number of explosions, several witnesses interviewed by the Mechanism and the Fact-Finding Mission stated that they had seen or heard aircraft flying over Khan Shaykhun in the early morning of 4 April 2017, consistent with the scenario that aircraft dropped bombs on Khan Shaykhun that morning.
- The Mechanism collected two original videos filmed by two witnesses from different angles showing several plumes that were confirmed by forensic institutes to have been filmed between 0642 and 0652 hours during the morning of 4 April 2017. Forensic analysis of the videos found that, at a certain point in each video, the sound of an aircraft could be heard in the background along with an explosion.
- The Mechanism investigated whether an SAAF Su-22 took off from Al-Shayrat airbase, located 110 km south of Khan Shaykhun, and launched an air attack on the town that morning. The Governments of France and the United States publicly provided information that an SAAF Su-22 took off from Al-Shayrat airbase

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on 4 April 2017, were “over” Khan Shaykhun at 0637 and 0646 hours, and launched up to six attacks “around” Khan Shaykhun.

- The Mechanism requested the Syrian Arab Republic to provide official records with respect

to activities at Al-Shayrat airbase on 4 April 2017, including log books of all operations, movements at the airbase, flights, names of the pilots flying aircraft and a detailed map or plan showing the layout of the airbase. In response to the requests of the Mechanism, the Syrian Government provided the Mechanism with a set of copies of official documents relating to Al-Shayrat airbase, including extracts from handwritten SAAF log books, as well as a document detailing the Al-Shayrat airbase chain-of-command and an aerial image of the airbase.

- During its visit to Al-Shayrat airbase, the Mechanism observed that the documents provided by the Syrian Arab Republic appeared to be copies of the original documents. The technical visit had the following objectives: (a) to verify the authenticity of the log books and flight operation records of 4 April 2017; (b) to review entry and exit logs and interview responsible personnel; (c) to photograph the types of munitions flown on 4 April in accordance with logs received; and (d) to photograph the mechanisms by which such munitions were attached on Su-22 aircraft.
- The Mechanism did not find any entries in any of the documents that referred specifically to Khan Shaykhun on 4 April 2017. Two entries in the log book provide details of the “time of execution” of missions that correspond with the time frame that sarin was released at Khan Shaykhun. The operations relating to those particular flights are logged as aerial attacks using conventional munitions targeting non-State armed groups in the vicinity of Kafr Zita and Tal Hawash, situated approximately 8 km southwest and 18 km west of Khan Shaykhun, respectively.
- The Mechanism interviewed the pilot associated with one of the entries in the log book, who used the call sign “Quds 1” and flew a Su-22 at the relevant time that day. The pilot stated that no chemical weapons had been used, and that the mission that morning had been to the west of Kafr Zita using three 500kg conventional munitions. This was found to be consistent with the details contained in the log book. According to the pilot, the closest distance to Khan Shaykhun on this date was approximately 7 to 9 km, while executing an attack against targets west of Kafr Zita. While the Mechanism was able to confirm severe structural damage to a building in the general vicinity of one of those targets via analysis of satellite imagery, it could not precisely determine when this damage occurred.
- The Mechanism did not interview the pilot associated with the second entry. The Syrian Arab Republic informed the Mechanism that the pilot was later shot down and is currently missing in action.
- Taking samples was not an objective of the visit to Al-Shayrat airbase. The Mechanism had assessed that the collection of samples at the airbase would not advance the investigation. If a single chemical munition was flown from that base, the Mechanism considered that there was little chance of finding any trace of sarin or its degradation products in an airbase of that size (approximately 10 square km) without specific information as to where to sample.
- During a briefing provided by the Syrian Arab Republic to the Mechanism in Damascus, an SAAF representative stated that no SAAF aircraft had attacked Khan Shaykhun on 4 April 2017. This contradicts the public statement made by the Syrian Government, as referred to in paragraph 5 of this annex. The Mechanism also interviewed the Commander of Al-Shayrat airbase who stated that no aircraft from Al-Shayrat airbase had attacked Khan Shaykhun on 4 April.

- At the request of the Mechanism, the Syrian Arab Republic provided the exact coordinates of six locations targeted by the SAAF aircraft operating from Al-Shayrat airbase on 4 April 2017. The coordinates were found to be similar to the description of the targets identified in the log book. While these entries contain flight times that correspond with the likely timing of the sarin event at Khan Shaykhun, they make reference to aerial attacks targeting unidentified non-State armed groups in the town of Tal Hawash and west of Kafr Zita. As noted above, while the Mechanism could confirm that one of these locations had suffered damage, it could not confirm that the damage occurred on 4 April.
- On 7 April 2017, United States authorities publicly released a statement and a map depicting a flight path of an aircraft originating from Al-Shayrat airbase that “was over Khan Shaykhun” at approximately 0637 and 0646 hours. The Mechanism had access to a further aerial map depicting the path of an aircraft alleged to have been in the airspace around Khan Shaykhun between approximately 0644 and 0651 hours on 4 April 2017. The flight is depicted as conducting a circular loop in the vicinity of Kafr Zita and the north-east of Khan Shaykhun. The map indicated that the closest point that the aircraft was to Khan Shaykhun was approximately 5 km away. Additional information provided to the Mechanism referred to two aircraft having taken off from Al-Shayrat airbase at around the same time as indicated above, ten minutes apart, following the same flight path. Based on the above, the Mechanism found that air activity had taken place around Khan Shaykhun at about the time of the sarin incident.
- The Mechanism compared the flight times of SAAF aircraft taking off from Al-Shayrat airbase as provided by the Syrian Government with other flight information received. Both the Syrian and other accounts are consistent that SAAF aircraft were in the air at the relevant time. Where the accounts diverge is with respect to whether or not the aircraft flew over or in the immediate vicinity of Khan Shaykhun.
- As noted in paragraphs 19, 23 and 28 of this annex, the Mechanism obtained information detailing the presence of a Su-22 within 5 km of Khan Shaykhun, as well as information from the pilot of a Su-22 interviewed by the Mechanism that he was within 7 to 9 km of Khan Shaykhun at the relevant time. The Mechanism consulted with a weapons expert to ascertain the confluence of distance and altitude from which it may be possible to hit Khan Shaykhun with an aerial bomb. The expert concluded that, depending on a number of variables such as altitude, speed and flight path taken, it would be possible for such an aerial bomb to be deployed on the town from the aforementioned distances.
- To date the Mechanism has not found specific information confirming whether or not an SAAF Su-22 operating from Al-Shayrat airbase launched an aerial attack against Khan Shaykhun on 4 April 2017.

Ground explosion

- The Mechanism also sought to collect information with respect to possible activities related to the dissemination of sarin from an improvised explosive device on the

ground in accordance with the second scenario. While the Mechanism did not find any information relating to the preparation of an explosion via such means, it noted a witness statement consistent with this scenario. In an interview with the Mechanism, the witness reported waking up at around 0700 hours on 4 April 2017 to the sound of explosions. The witness stated that there had been no aircraft over Khan Shaykhun at the time and that aircraft had only started launching attacks at around 1100 hours.

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- No witnesses reported any activities related to the placing of an explosive charge on the ground at the location of the incident.
- The Syrian Arab Republic provided information to the Mechanism suggesting that the release of sarin was associated with an above-ground explosion, using an “explosive charge that did not exceed 10 kg and that was placed on the ground with a 25 litres container full of sarin”. This is examined in further detail in the sections below.

Bombing of a house taken over by a non-State armed group

- In connection with the third scenario, witness statements refer to reports of a house in Khan Shaykhun being taken over by a non-State armed group and thereafter used for storage of ammunition and barrels. The Mechanism identified the location of the house, which corresponded to the second plume shown in a video filmed between 0642 and 0652 hours that morning. Analysis of satellite imagery revealed that damage to the roof of the house occurred between 21 February and 6 April 2017. Original photographs provided by witnesses interviewed by the Mechanism also showed damage to the roof and front of the house. An independent expert engaged by the Mechanism found that the damage to the house was consistent with an explosion being caused by an air-delivered thermobaric bomb or fuel air explosives. Samples taken by the Syrian Arab Republic from the site of the house at a later date were not found to contain traces of sarin or its degradation products.
- The Mechanism has found no information indicating that sarin was released from this location on the morning of 4 April 2017. The Mechanism found no other information related to this scenario.

Bombing of a warehouse on eastern outskirts of Khan Shaykhun

- The Mechanism also conducted investigations with respect to the possibility that sarin may have been released following the bombing of a building on the eastern outskirts of Khan Shaykhun at around noon on 4 April 2017. The location, referred to in some public statements as a terrorist ammunition depot, appears to be a building used by the Syrian Civil Defence as a medical point in the eastern outskirts of Khan Shaykhun. Apart from the fact that victims of the sarin incident earlier that morning had been treated there, the Mechanism did not link that location to the release of sarin.

Impact location

- In accordance with the first two scenarios investigated by the Mechanism, the crater is the impact point of either of the following: (a) an aerial bomb deployed by an airplane, thus dispersing sarin; or (b) the explosion of an undefined mechanism on the surface of the road linked to the dispersion of sarin.
- The impact location was determined to be the site as identified by the Fact-Finding Mission as “to the west of grain silos in the northern part of Khan Shaykhun”. Samples taken from the crater and its surroundings were found by the Fact-Finding Mission to contain sarin.
- The Mechanism collected multiple photographs and videos of the crater from witnesses and open sources, as well as satellite imagery from a provider contracted by the Mechanism. Using these materials, forensic institutes engaged by the Mechanism determined that the crater is located at about 35°26'59.75"N, 36°38'55.91"E.

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- In order to identify other impact points possibly associated with the release of sarin, the Mechanism commissioned forensic analysis of video footage taken between 0642 and 0652 hours of 4 April that showed four plumes across Khan Shaykhun, three of which were located approximately 320 m south-west of the crater and the fourth approximately 1.3 km south-south-west of the crater, one of which was shorter and whiter than the others. None of the locations from which the plumes emanated could be associated with the location of the crater.
- Expert analysis of satellite imagery available to the Mechanism taken of Khan Shaykhun on 21 February 2017 and 6 April 2017 was undertaken to identify signs of damaged structures and craters in the area correlating to the location of the plumes. The Mechanism found that at least three of those locations were buildings that appeared to have been damaged by a thermobaric bomb or fuel air explosives. Damage to a building was observed in the general vicinity of the shorter plume, which appears to have been created between the aforementioned dates. Therefore, the Mechanism cannot conclusively determine that the building was bombed on 4 April 2017.
- The cause of the plume that was shorter and more white in appearance than the other three could not be conclusively identified by munitions experts engaged by the Mechanism. Two experts noted that the plume had probably been made up of aerosolized droplets of liquid. One elaborated that the plume's appearance might indicate the use of a vacuum bomb possibly not exploding, with the plume being a cloud of explosive liquid disseminated from the munition.
- Although the plumes cannot be associated with the crater, they indicate that an aerial attack occurred in Khan Shaykhun on the morning of 4 April 2017.

Crater analysis

- As the site where the sarin was released on the morning of 4 April 2017 was of particular importance to the investigation, the Mechanism undertook extensive efforts to collect photographs and videos of the location and to obtain expert analysis of its

characteristics from several independent sources.

- Original video footage and photographs of the impact location taken early in the morning of 4 April 2017 by a witness interviewed by the Mechanism, which were assessed by a forensic institute to have been recorded between 0804 and 0917 hours, showed the crater and a deformed piece of metal emanating from it. The crater was estimated by forensic experts to have a diameter of approximately 1.5 to
- 65 m and a depth of between 42 and 51 cm. The videos and photographs showed the crater to contain debris of rock and asphalt, fragments of metal and a circular metal object that appeared to be a munition filler cap. Remnants of green paint were observed on both the deformed piece of metal and the filler cap.
- The Government of the Syrian Arab Republic provided the Mechanism with a report setting forth a series of observations about the crater. In the report, the Government concluded that the shape of the crater, its characteristics and the lack of physical evidence did not indicate that it had been the result of an air strike. It was noted that the shape, depth and content of the crater had not been compatible with the effect of an aerial bomb, but that the crater and its contours indicated that it had been the result of a ground explosion using a device weighing not more than 10 kg. In support of its position, the Government referred to the incompleteness of the debris of the alleged explosion and the absence of any residues of the bomb or rocket, including a rocket motor, tail or fins. It was also stated that three pieces from an unknown source had been deliberately placed, including the remnants of an alleged shell. The Government stated that that confirmed that the scene had been fabricated to suggest the crater had been the result of the explosion of an aerial

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bomb. The report further noted that the crater and its surroundings had contained traces of live agent (sarin) and its degradation products, which had been found 10 days after the alleged attack, thus indicating that the explosion had not led to the dispersion of the full content of the sarin container, and that the explosion had not been well calculated.

48. The Mechanism obtained expert analysis of the characteristics of the crater by three independent, internationally recognized institutes with specialization in areas of forensics, defence and security, as well as by two individual independent experts on energetic materials.

- A defence research institute with expertise in high explosives and related events noted that the site appeared to have been disturbed after impact. Nevertheless, it found indications that the ground had been hit by a reasonably heavy object that had travelled at high velocity. While it could not rule out that the crater was caused by other means, it stated that indications of a high explosive being detonated on the ground were not visible.
- A further specialist forensic institute examined photographs and videos of the crater. In assessing what caused the crater, the forensic institute stated that the damage was consistent with that of an impact from an unguided aerial bomb, possibly containing a small burster charge. It explained that this conclusion was based on there being very

little damage evident around the crater caused by fragmentation of the munition casing, and no significant damage to structures near the crater due to blast overpressure. The aforementioned forensic institute also observed that the use of a ground-launched munition was unlikely as no remnants peculiar to a rocket had been evident in the crater or had been found within the vicinity of the crater.

- One of the individual experts noted that the impact location was a paved road very close to a metal cabinet. As there were no significant impacts or holes visible in the plates of the metal cabinet, the impact corresponds with that of a liquid-filled bomb with a thin shell and only a very limited amount of explosive in its burster charge. The expert found that the appearance of the crater was consistent with the pavement of the road having been hit by a relatively large object at high velocity, without any large amounts of explosives being involved.
- With regard to the suggestion that the crater may have been caused by an explosive charge placed on the ground, the expert noted that that was contradicted by the following: (a) the appearance of the edges of the surrounding pavement, where little fragmentation was seen; (b) the absence of an elevated rim around the crater; (c) the relatively few cracks in the pavement around the crater; and (d) the existence of objects buried deep in the crater. The expert also dismissed the suggestion that the crater may have been made by excavation and the emplacement of the objects found therein on account of the following: (a) the jagged appearance of the edges; (b) the radial cracks formed in the pavement; (c) the depth at which the objects were buried in the crater; and (d) the lack of any sign of the tools used to excavate the crater, which would have left marks on the edges. The expert concluded that it was very unlikely for the crater to have been caused by any ground-launched weapon, an explosive charge or liquid filled warhead emplaced on the ground, or an excavation and emplacement of the objects found therein.
- The expert examined the dimensions and shape of the crater and analysed whether it was consistent with the use of different kinds of bombs and rockets. The expert concluded that the most probable type of munition to have caused the crater would be a relatively large bomb, with a mass of 300 to 450 kg. The shape of the crater, which was relatively circular, indicated that the bomb was dropped from medium or high altitude, between approximately 4,000 and 10,000 m.

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- The experts agreed that the crater was unlikely to have been caused by high explosives as there were too few visible signs of damage through fragmentation or overpressure, especially on the metal cabinet located 3 to 5 m away from the crater. The expert analysis found that the characteristics of the crater were consistent with having been hit by a heavy object travelling at a high velocity, probably with a liquid fill. Any explosion from the burster charge would be small and, furthermore, the liquid surrounding the burster charge would have absorbed most of the energy from the explosion. The Mechanism notes that, based on the foregoing, the characteristics of the crater are more likely to have been caused by an aerial bomb with a small explosive charge, and that it probably contained liquid.

Munition analysis

- As described in paragraph 46 of this annex, two objects of interest that were seen in

photographs and videos of the crater were analysed by the Mechanism. These were the filler cap from a chemical munition and a deformed piece of metal protruding from deep within the crater.

- According to information obtained by the Mechanism, the filler cap, with two closure plugs, is uniquely consistent with Syrian chemical aerial bombs. The Mechanism was provided with an assessment of the filler cap and with chemical analysis showing sarin and a reaction product of sarin with hexamine that can only be formed under very high heat. Information was also received that additional metal fragments collected from the crater may possibly correspond to parts of Syrian aerial chemical munitions.
- Based on the size and thickness of the metal piece protruding from the crater, the two experts on energetic materials engaged by the Mechanism reported that it was indicative of being the casing of an aerial bomb measuring between 300 to
- mm in diameter.
- The munition remnants recovered from the crater by unidentified individuals are assessed to be associated with an air-delivered chemical bomb. Specific munition remnants, particularly the tailfin, could not be recovered. The absence of a chain of custody relating to the munition remnants diminishes their probative value.
- The Syrian Arab Republic provided information to the Mechanism suggesting that the release of sarin was associated with an above-ground explosion, which is reflected in the second scenario investigated by the Mechanism. According to the Government report, the impact point had been the result of a ground explosion using an “explosive charge that did not exceed 10 kg [of trinitrotoluene (TNT)] and that was placed on the ground with a 25 litres container full of sarin”. The Government further noted that the fact that the crater and its surroundings had contained traces of sarin and its degradation products 10 days after the incident proved that the explosion had not dispersed all the sarin in the container, which meant that the explosion was not well calculated.
- The Mechanism also requested the two individual experts, forensic institutes and defence institutes to examine whether an explosive device placed on the ground could have caused the crater. The forensic institutes and the experts on energetic material ruled out that an IED placed underground would have created such a crater. This was based on the characteristics of the crater and the lack of substantial cracks and radial detonation marks of blast products on the surface surrounding the crater.
- With respect to whether such a device could have been placed on the surface of the road, they assessed that that would need to contain an equivalent of 10 kg of TNT or 12 kg ammonium nitrate-fuel oil. The experts generally ruled out this possibility because such an explosion would cause much more damage than what

was observed to the surroundings. The two experts on energetic material also observed that the metal object protruding from the crater was too big and too deeply embedded for the IED scenario to be likely.

- Further to the statements of witnesses that they saw and heard aircraft, the observations with potentially the most probative value, namely those of the forensic institutes and individual experts, indicate that the crater was most likely caused by an unguided air-delivered bomb.
- Based on the lack of characteristics that would be expected following an explosion via an explosive charge placed on the ground, the Mechanism notes that the munition used would more likely have been an aerial bomb.

Dispersion of sarin

- Sarin of an undefined purity was disseminated from the crater in a direction that was defined by local air movements. The Mechanism noted that the wind speed in the area that day was <0.5 m/s, which would normally result in a considerable variation in the direction of the air movement. The Mechanism also noted that the location of victims, as described in the report of the Fact-Finding Mission, serves as an indicator of prevailing air movements west to south-west of the location of the crater during the early morning of 4 April 2017.
- A defence research institute with expertise in dispersion modelling was commissioned by the Mechanism to determine the likely amount of sarin released and its impact on the number of victims intoxicated. In conducting the modelling, the defence research institute took into account certain factors specific to Khan Shaykhun such as its population and weather conditions.
- While no firm conclusion as to the amount of sarin used in Khan Shaykhun on 4 April 2017 could be established, the institute noted that, if the same quantity of sarin were used, an aerial bomb would be expected to deposit smaller amounts of sarin on the ground than an explosive charge placed directly on the ground.
- The observation raised by the Syrian Arabic Republic that traces of live agent (sarin) could be observed, 10 days after the incident, in the crater area and in the area near the silos 80 m to the east of the crater may be explained by the amount of sarin deposited on the ground at the time of its release. The Mechanism therefore compared the amount of sarin that would be deposited onto the ground via the following: (a) a chemical aerial bomb; and (b) an improvised explosive device for dispersion. A chemical aerial bomb releasing 150 to 250 litres of sarin and depositing 10 to 15 per cent of its contents on the ground, would deposit more sarin on the ground than an improvised explosive device containing 25 litres of sarin. The Mechanism notes that, in both cases, sarin must have been dispersed to the general environment, as has been confirmed by the analysis of environmental samples.
- The above analysis supports the scenario of an aerial bomb depositing a larger amount of sarin on or into the ground than would be deposited by an improvised explosive device containing 25 litres of sarin.

Medical effects and response

- While noting the findings of the Fact-Finding Mission, the Mechanism collected and reviewed information concerning the medical effects on and treatment of persons in Khan Shaykhun following the incident from a range of sources, including open sources, interviews with victims and medical personnel, and a review of medical records. The Mechanism collected and analysed this information to assess the impact of the incident on the community, in particular its emergency response and health sector.

- Reports from open sources in the immediate aftermath of the incident noted that victims in Khan Shaykhun appeared to show symptoms consistent with exposure to organophosphorus chemicals also expressed as a neurotoxic agent. In addition, open sources reported that chlorine may also have been released, on account of the smell of bleach. While the Mechanism could not rule out that chlorine had been used, it focused its investigative efforts on the use of sarin.
- Based on medical records and witness statements, the Fact-Finding Mission identified approximately 100 fatalities and at least 200 other casualties who had survived acute exposure. Such an event in a town the size of Khan Shaykhun would constitute quite a challenge for a society already in distress. There are four critical immediate recourses that should be available in a mass casualty intoxication with sarin: (a) adequate decontamination to stop exposure and prevent rescue and health-care staff from secondary contamination; (b) assisted ventilation after intubation, either mechanical or manual ventilation; (c) sufficient administration of the primary antidotes atropine and pralidoxime; and (d) ample transportation capability of patients for their needs to be met.
- The Mechanism ascertained that more than 10 health-care facilities in Khan Shaykhun, Idlib governorate and a neighbouring country became involved in providing health care to the casualties from Khan Shaykhun. According to reports, doctors were struggling amid extreme shortages, including of the antidotes used to save patients. There were also reports that most of the fatalities had died before they reached the hospitals.
- The Mechanism found that the reported symptoms of the victims were consistent with exposure to sarin and that the available information on the medical impact of the attack on 4 April 2017, including the health-care sector response, consistently pointed to the use of sarin.
- Based on its review of open source material showing first responders in the hours immediately after the incident, the Mechanism observed several methods and procedures that appeared either unusual or inappropriate in the circumstances. In particular, the Mechanism noted that fully equipped hazmat teams appeared at the scene later that afternoon and reported early detection of the presence of sarin, seemingly using a Dräger X-am 7000 ambient air monitor, which was not known to be able to detect sarin. Of further concern to the Mechanism was the relative unprofessionalism by which certain environmental samples appear to have been taken, e.g. sampling from a muddy puddle.
- The Mechanism also noted scenes recorded just after the incident at the medical point to the east of Khan Shaykhun, where rescue and decontamination activities filmed shortly after 0700 hours showed rescue personnel hosing down patients with water indiscriminately for extended periods of time. Such video footage also depicted a number of patients not being attended to, and some para-medical interventions that did not seem to make medical sense, such as performing heart compression on a patient facing the ground.

- The Mechanism obtained expert analysis on the medical symptoms and response indicated in witness statements and medical records, as well as treatment received at a range of health care facilities, including those in a neighbouring country.
- Certain irregularities were observed in elements of information analysed. For example, several hospitals appeared to start admitting casualties of the attack between 0640 and 0645 hours. The Mechanism received the medical records of 247 patients from Khan Shaykhun who were admitted to various health-care facilities, including those of survivors and a number of victims who died from exposure to a

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chemical agent. The admission times of the records range between 0600 and 1600 hours. Analysis of the aforementioned medical records revealed that in 57 cases, patients were admitted in five hospitals before the incident in Khan Shaykhun (at 0600, 0620 and 0640 hours). In 10 such cases, patients appear to have been admitted to a hospital 125 km away from Khan Shaykhun at 0700 hours while another 42 patients appear to have been admitted to a hospital 30 km away at 0700 hours. The Mechanism did not investigate these discrepancies and cannot determine whether they are linked to any possible staging scenario, or to poor record-keeping in chaotic conditions.

- An inconsistency was identified in one of the Fact-Finding Mission biomedical results from samples without a chain of custody. In sample number 13³, the blood tested negative for sarin or a sarin-like substance, while the urine sample tested positive for the sarin degradation product isopropyl methylphosphonate. There is currently no explanation regarding the inconsistency. Medical experts consulted by the Mechanism indicated that the combination of the negative result in the blood and the positive result in the urine was impossible. This inconsistency was considered to be most probably the result of cross-contamination in the sampling process.
- The Mechanism observed from open sources that treatment of victims from Khan Shaykhun frequently involved oxygen and cortisone therapy. This treatment is not recommended for sarin intoxication, but is mainly for lung damage, as would be caused by either chlorine or vacuum bombs.
- Based on consultations with two medical experts, the Mechanism found that the response by rescue workers and medical personnel in Khan Shaykhun on 4 April 2017 had been essentially consistent with the use of sarin on such a scale. While some potentially important irregularities were identified throughout the rescue operation and in medical records, they may be explained by factors such as poor training or the chaotic conditions, or by attempts to inflate the gravity of the situation for depiction in the media.

Chemistry

- In order to ascertain the origin of sarin dispersed in Khan Shaykhun, the Mechanism took steps to identify its components and possible method of production, including by commissioning studies at an OPCW designated laboratory.
- In the course of synthesizing a chemical, not only is the desired chemical formed, but also

certain by-products. If the production of a chemical requires several reaction steps, such by-products are also carried forward as impurities to the next step of the synthesis. Furthermore, impurities may undergo chemical transformations themselves, thus forming new and different impurities. Therefore, the production method for a chemical may be ascertained by identifying the impurities it contains. Impurities in samples can also link a sample to its starting material (its precursor), should the impurities in the sample and precursor match.

- During the removal of the stockpile belonging to the Syrian Arab Republic in 2014, the OPCW collected samples from the sarin precursor methylphosphonic difluoride (DF) before the rest of the stockpile was destroyed. The Mechanism commissioned a laboratory to study and compare the impurities, and their formation, in samples of stockpiled DF. Five different samples from the Syrian Arab Republic DF stockpile were analysed for impurities.

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- Report of the OPCW Fact-Finding Mission S/1510/2017 at page 41, table 4

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- Environmental samples were collected in Khan Shaykhun from both inside the crater and its surroundings. The analysis results of OPCW designated laboratories confirm the presence of sarin and some of its known degradation products (see OPCW document S/1521/2017, as well as United Nations documents S/2017/567 and S/2017/440). Moreover, the results confirm that sarin was produced by the binary route, in which DF is combined with isopropanol (iPrOH) in the presence of hexamine.
- The five DF samples from the Syrian Arab Republic stockpile and the environmental samples from Khan Shaykhun all contained the impurity phosphorous hexafluoride (PF6). The Mechanism studied the significance of PF6 as a “marker chemical” for DF produced by the Syrian Arab Republic. The study tested the conditions for the formation of PF6 in the production of DF, as well as the possibility of its removal from DF. Laboratory experiments showed that PF6 is formed when hydrogen fluoride (HF) is used as a fluorinating agent in the production of DF. If a different commonly used fluorinating agent is used, no PF6 is formed. PF6 is also not formed in such DF as a result of long-term storage. The test further showed that PF6 cannot be removed through distillation.
- Two of the five samples from the Syrian Arab Republic DF stockpile contained the impurity phosphorous oxychloride (POCl3). The environmental samples from Khan Shaykhun had two additional types of marker chemicals: isopropyl phosphates and isopropyl phosphorofluoridates. Laboratory tests show that such marker chemicals are formed if DF from the Syrian Arab Republic stockpile containing POCl3 is used to make binary sarin.
- Based on the foregoing, the Mechanism concludes that the presence of the marker chemical PF6 is evidence that HF was used to produce the DF

that was the precursor for the sarin released in Khan Shaykhun. HF is a very aggressive and dangerous gas and is, therefore, difficult to handle. The use of HF indicates a high degree of competence and sophistication in the production of DF and points towards a chemical plant type production.

- The samples from Khan Shaykhun contain the three types of marker chemicals described above: PF6, isopropyl phosphates and isopropyl phosphorofluoridates. Their presence is a strong indicator that the sarin disseminated in Khan Shaykhun was produced from DF from the Syrian Arab Republic stockpile.
- An initial screening of the reports concerning previous incidents of the release of sarin in the Syrian Arab Republic showed that some marker chemicals appeared to be present in environmental samples. This would warrant further study.
- The presence of marker chemicals, which are believed to be unique, is a strong indication that the sarin released in Khan Shaykhun, as well as in previous incidents, was produced using DF from the Syrian Arab Republic stockpile.
- In light of the marker chemicals identified in the DF and the sarin, which are believed to be unique, the Mechanism concludes that the precursor chemical DF, which is necessary to produce binary sarin, is very likely to have originated from the Syrian Arab Republic. This finding relates only to the origin of the DF used as a precursor and not as to those responsible for the dissemination of sarin.

• **The Leadership Panel's assessment and findings**

- In order to determine to the greatest extent feasible those who were perpetrators, organizers, sponsors or otherwise involved in the use of sarin at Khan Shaykhun on 4 April 2017, the Leadership Panel requested the investigators to examine eight possible scenarios as to how the events unfolded. Upon concluding

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the investigation, the prevailing scenario that emerged was that sarin was delivered via an aerial bomb that was dropped by an airplane. Most of the information collected and analysed by the Mechanism supports this scenario.

- With respect to identifying those responsible, the Leadership Panel has determined that the information it has obtained constitutes sufficient credible and reliable evidence of the following:
 - Aircraft dropped munitions over Khan Shaykhun between 0630 and 0700 hours on 4 April 2017;
 - Aircraft of the Syrian Arab Republic was in the immediate vicinity of Khan Shaykhun between 0630 and 0700 hours on 4 April 2017;
 - The crater from which the sarin emanated was created on the morning of 4 April 2017;

- The crater was caused by the impact of an aerial bomb travelling at high velocity;
- A large number of people were affected by sarin between 0630 and 0700 hours on the morning of 4 April 2017;
- The number of persons affected by the release of sarin on 4 April 2017 and that sarin reportedly continued to be present at the site of the crater 10 days after the incident indicate that a large amount of sarin was likely released, which is consistent with it being dispersed via a chemical aerial bomb;
- The symptoms of victims and their medical treatment, as well as the scale of the incident are consistent with a large-scale intoxication of sarin; and
- The sarin identified in the samples taken from Khan Shaykhun was found to have most likely been made with a precursor (DF) from the original stockpile of the Syrian Arab Republic; and
- The irregularities described in this annex are not of such a nature as to call into question the aforementioned findings.

Based on the foregoing, the Leadership Panel is confident that the Syrian Arab Republic is responsible for the release of sarin at Khan Shaykhun on 4 April 2017. The findings of the Leadership Panel regarding the evidence in this case are based on the information set forth in detail in this annex.