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FIFTH REPORT BY THE OPCW INVESTIGATION AND IDENTIFICATION TEAM PURSUANT TO PARAGRAPH 10 OF DECISION C-SS-4/DEC.3 "ADDRESSING THE THREAT FROM CHEMICAL WEAPONS USE" KAFR ZEITA (SYRIAN ARAB REPUBLIC) – 1 OCTOBER 2016

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EXECUTIVE SUMMARY

1. The Director-General of the OPCW Technical Secretariat established the Investigation and Identification Team (IIT) pursuant to the decision by the Conference of the States Parties entitled “Addressing the Threat from Chemical Weapons Use” (C-SS-4/DEC.3, dated 27 June 2018). The IIT began its work in June 2019, focusing on certain incidents for which the OPCW Fact-Finding Mission in Syria (FFM) had determined that use or likely use of chemical weapons on the territory of the Syrian Arab Republic occurred and for which the OPCW-United Nations Joint Investigative Mechanism had not reached a final conclusion.

2. The IIT is not a judicial body with the authority to assign individual criminal responsibility, nor does the IIT have the authority to make final findings of non-compliance with the Chemical Weapons Convention. The mandate of the IIT is to establish the facts.

3. This fifth report of the IIT sets out the findings of the investigations conducted in the period between March 2024 and December 2025, focusing on the incident in Kafr Zeita, the Syrian Arab Republic, on 1 October 2016. On the basis of all the information obtained and its analysis, the IIT concludes that there are reasonable grounds to believe that, on 1 October 2016, between 19:00 and 19:40 (UTC+3), in the context of a military offensive aimed at halting the opposition’s advance towards Hama city, one Mi-8/17 helicopter of the Syrian Arab Air Force dropped at least one yellow pressurised cylinder which hit a cave system in the Wadi al-Aanz valley in Kafr Zeita. The helicopter departed from Hama Airbase and operated under the control of the Tiger Forces, commanded by then-Colonel [REDACTED].

4. The pressurised cylinder impacted near two ventilation openings located approximately 300 metres from the Al Maghara Hospital in Kafr Zeita. The cylinder then tumbled down and came to rest near the entrance to the cave system. Upon impact, the cylinder ruptured and released chlorine gas, which dispersed through the Wadi al-Aanz valley, injuring 35 named individuals and affecting dozens more.

5. The IIT reached its conclusions on the basis of the degree of certainty of “reasonable grounds”, which is the standard of proof consistently adopted by international fact-finding bodies and commissions of inquiry. In reaching its conclusions, the IIT carefully assessed the information obtained from the FFM, States Parties, and other entities, coupled with interviews conducted by the IIT and analyses of samples, munition remnants, computer modelling, satellite imagery, authenticated videos and photographs, as well as advice from independent experts, specialists, and forensic institutes, along with primary documentation and other relevant materials and sources. The IIT reviewed over 15,600 files, amounting to more than 980 gigabytes, obtained and assessed 53 witness statements, 3 of which were from women, and considered data related to 13 samples. The IIT assessed this information holistically, scrutinising carefully its probative value through a widely shared methodology in compliance with best practices of international fact-finding bodies and commissions of inquiry. In so doing, the IIT strictly adhered to applicable OPCW procedures, including with respect to chain of custody, supplemented as appropriate. The conclusions in this report are based on the combination, consistency, and corroboration of all of the information gathered as a whole.

6. Throughout its investigation, the IIT thoroughly considered the positions put forward by the authorities who had represented the Syrian Arab Republic until former President [REDACTED] fled the country on 8 December 2024. However, the IIT was unable to obtain any concrete information supporting those positions.

7. The IIT welcomes the assistance received from the new authorities of the Syrian Arab Republic. This included the provision of full and unfettered access to the country—for the first time since the establishment of the IIT in the context of an investigation—and of information and primary documentation relevant to the incident, marking the first instance of cooperation by the Syrian Arab Republic with an IIT investigation.

8. The IIT is also grateful for the support received during its investigation from other States Parties, entities, and individuals.

9. Decision C-SS-4/DEC.3 by the Conference of the States Parties requires the OPCW Technical Secretariat to provide the reports on the IIT investigations to the OPCW Executive Council and to the United Nations Secretary-General for their consideration, and to preserve and provide information to the mechanism established by the United Nations General Assembly in resolution 71/248 (2016), as well as to any relevant investigatory entities established under the auspices of the United Nations.

10. Accordingly, the IIT has endeavoured to compile this report and its related records and findings in a manner suitable for future use by these bodies. This also means that, in reaching its conclusions, the IIT has carefully considered that the information used in this report may be assessed and used by other such bodies in the future.

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I. MANDATE

1. ESTABLISHMENT OF THE INVESTIGATION AND IDENTIFICATION TEAM

1.1 This report is submitted pursuant to paragraph 10 of the decision adopted by the Conference of the States Parties (the Conference) at its Fourth Special Session entitled "Addressing the Threat from Chemical Weapons Use" (C-SS-4/DEC.3, dated 27 June 2018), and covers investigations conducted by the Investigation and Identification Team (IIT) in the period from March 2024 through December 2025.

1.2 In decision C-SS-4/DEC.3, the Conference recalled its own responsibility under paragraph 20 of Article VIII of the Chemical Weapons Convention (the Convention) to oversee its implementation, to act in order to promote its object and purpose, and to review compliance with it.[1]

1.3 In paragraph 10 of C-SS-4/DEC.3, the Conference specifically decided that the OPCW Technical Secretariat (the Secretariat):

> shall put in place arrangements to identify the perpetrators of the use of chemical weapons in the Syrian Arab Republic by identifying and reporting on all information potentially relevant to the origin of those chemical weapons in those instances in which the OPCW Fact-Finding Mission in Syria determines or has determined that use or likely use occurred, and cases for which the OPCW-UN Joint Investigative Mechanism has not issued a report; and … that the Secretariat shall provide regular reports on its investigations to the [Executive] Council [of the OPCW] and to the United Nations Secretary-General for their consideration.

1.4 As stated in the "First Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use', Ltamenah (Syrian Arab Republic), 24, 25, and 30 March 2017" (S/1867/2020, dated 8 April 2020) (the "First IIT Report"),[2] and consistent with the standards applied by international fact-finding missions and commissions of inquiry, the mandate of the IIT is to identify—on the basis of a sufficient and reliable body of information (namely, the "reasonable grounds" standard)—individuals, as well as entities, groups, and governments (that is, non-State and State actors) directly or indirectly involved in the use of chemical weapons in the incidents within the scope of the investigations of the IIT.

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[1] See preambular para. 6 of C-SS-4/DEC.3.

[2] Also reiterated in para. 1.4 of the "Second Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use', Saraqib (Syrian Arab Republic), 4 February 2018" (S/1943/2021, dated 12 April 2021) (the "Second IIT Report"), in para. 1.4 of the "Third Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use', Douma (Syrian Arab Republic), 7 April 2018" (S/2125/2023, dated 27 January 2023) (the "Third IIT Report"), and in para. 1.4 of the "Fourth Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use', Marea (Syrian Arab Republic), 1 September 2015" (S/2255/2024, dated 22 February 2024) (the "Fourth IIT Report").

2. THE TASKS OF THE IIT

2.1 The IIT is not a judicial body with the authority to assign individual criminal responsibility, nor does the IIT have the authority to make final findings of non-compliance with the Convention. The IIT is rather meant to facilitate the work of other mechanisms such as (a) primarily, the OPCW policy-making organs in their determinations of non-compliance and related consequences for a State Party in accordance with the Convention;[3] and (b) through the International, Impartial and Independent Mechanism to Assist in the Investigation and Prosecution of Persons Responsible for the Most Serious Crimes under International Law Committed in the Syrian Arab Republic since March 2011 (IIIM), courts or tribunals, whether at the domestic, regional, or international level, having jurisdiction over the conduct investigated by the IIT. The support of the IIT to the work of the latter is foreseen by Conference decision C-SS-4/DEC.3, which specifically reaffirms the principle that "those responsible for the use of chemical weapons should be held accountable"[4] and stipulates that the Secretariat shall, inter alia, "provide information to the investigation mechanism established by the United Nations General Assembly in resolution 71/248 (2016)" (namely, the IIIM),[5] "as well as to any relevant investigatory entities established under the auspices of the United Nations".[6]

2.2 The IIT aims at fulfilling these tasks by establishing the facts relevant to the identification of perpetrators of the use of chemical weapons in the incidents in the Syrian Arab Republic under its purview.

2.3 The factual findings of the IIT relate to the process of gathering, analysing, and reporting on facts relevant to the imputation of a specific human conduct to an individual or an entity. These factual findings are intrinsically different from legal findings, which instead relate to any wrongfulness of that conduct under the applicable legal framework and its legal consequences (namely, liability).[7] The latter findings are not within the purview of the IIT. Notwithstanding, since the factual findings of the IIT may provide the initial grounds for further legal action, it is important for the IIT to adopt an information-gathering and review methodology which is consistent with future endeavours in this respect.

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3 See para. 11 of C-SS-4/DEC.3.

4 See preambular para. 5 of C-SS-4/DEC.3.

5 The IIIM has the primary mandate to "consolidate, preserve and analyse evidence of violations of international humanitarian law and human rights violations and abuses and to prepare files in order to facilitate and expedite fair and independent criminal proceedings, in accordance with international law standards, in national, regional or international courts or tribunals that have or may in the future have jurisdiction over these crimes, in accordance with international law". See United Nations General Assembly resolution 71/248 (21 December 2016), para. 4.

6 See para. 12 of C-SS-4/DEC.3.

7 See, for example, United Nations General Assembly resolution 46/59 (1991), Declaration on Fact-Finding by the United Nations in the Field of the Maintenance of International Peace and Security, UN Doc. A/RES/46/59 (9 December 1991), para. 17, which notes that the report of a fact-finding body "should be limited to a presentation of findings of a factual nature". See also, among others, G. Arangio-Ruiz, State Responsibility Revisited. The Factual Nature of the Attribution of Conduct to the State, Quaderni della Rivista di Diritto Internazionale 6, vol. C-2017, pp. 3 and 110.

2.4 The IIT therefore endeavours to compile its records and factual findings in a manner suitable for future use by the OPCW policy-making organs, as well as the IIIM and any other relevant investigation body that may request material from the IIIM.

2.5 Details on the mandate and methods of work of the IIT can be found in the First IIT Report,[8] as well as in three Notes circulated by the Secretariat, respectively EC-91/S/3 (dated 28 June 2019),[9] EC-92/S/8 (dated 3 October 2019), and S/1918/2020 (dated 27 November 2020).

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8 See First IIT Report, paras 1.1 to 3.7 and Annexes 1 and 2 (and references therein).

9 In the preparation of the present report, the composition of the IIT included personnel from all five regional groups.

II. INVESTIGATIVE ACTIVITIES

3. APPROACH AND CHALLENGES IN THE INVESTIGATION

3.1 Referring to the findings of the FFM as a starting point,[10] the IIT conducted an impartial, objective, and independent examination of all available information concerning the use of chemical weapons in the incident in the town of Kafr Zeita (Syrian Arab Republic) on 1 October 2016, with a view to collecting, comparing, and analysing further information to identify the perpetrators, as described above.

3.2 This incident was not included in the list of incidents on which the IIT initially decided to focus its investigative work, and which was made available to States Parties by the Secretariat in Annex 2 to Note EC-91/S/3, since the related FFM report was issued on 31 January 2022. In selecting this incident for further investigation, the IIT applied the criteria elaborated on in the First IIT Report concerning, inter alia: (a) the severity of the incident; (b) the amount and apparent reliability of the information already available on the incident; and (c) the type of chemical substance(s) detected. The IIT also took into account patterns of similar incidents, and the reliability of persons who allegedly witnessed the events.[11]

3.3 The approach to the investigation of the incident in Kafr Zeita of 1 October 2016 undertaken by the IIT is consistent with that described in the First,[12] Second,[13] Third,[14] and Fourth[15] IIT Reports. In particular, the IIT: (a) analysed the information received from the FFM; (b) requested information from States Parties, including the Syrian Arab Republic,[16] and upon receipt reviewed this information; (c) assessed the statements previously provided by witnesses and itself conducted interviews with persons of interest, including spotters;[17] (d) accessed and independently assessed and measured the remnants of the munition, which was stored on OPCW premises since its receipt by the FFM on 12 April 2017; (e) obtained videos, documents, and other material from various sources; (f) requested analytical data underlying the FFM Report on Kafr Zeita, 1 October 2016, as well as supplementary analyses for 12 relevant samples by two OPCW designated laboratories and one forensic institute, and technical assessments from a number of specialists; (g) requested and analysed satellite imagery, maps, and 3D models; (h) collected information from open sources; and (i) consulted independent experts.

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10 See "Report of the OPCW Fact-Finding Mission in Syria Regarding the Incident of the Alleged Use of Toxic Chemicals as a Weapon in Kafr Zeita, Syrian Arab Republic, 1 October 2016" (S/2020/2022, dated 31 January 2022) ("FFM Report on Kafr Zeita, 1 October 2016"), paras 1.11 and 8.15.

11 See First IIT Report, paras 3.4 and 3.5.

12 See First IIT Report, paras 4.1 to 4.10 and Annexes 1, 2, and 3 (and references therein).

13 See Second IIT Report, paras 3.1 to 3.11 and Annexes 1, 2, and 3 (and references therein).

14 See Third IIT Report, paras 3.1 to 3.22 and Annexes 1, 2, and 3 (and references therein).

15 See Fourth IIT Report, paras 3.1 and 3.2 and Annexes 1, 2, and 3 (and references therein).

16 See further below in this Section.

17 See First IIT Report, para. 6.19; Second IIT Report, para. 5.9; Third IIT Report, para. 6.95.

3.4 In carrying out the activities listed above, the IIT relied on the same methods and procedures it had applied during its previous investigations, as described in all of the previous IIT reports,[18] including with regard to (a) its approach to obtaining and securing information (for example, chain of custody, handling of information, security of witnesses, and sampling and analysis by OPCW designated laboratories); (b) its information and case management systems; and (c) the degree of certainty applied to the identification of perpetrators.

3.5 The IIT proceeded in a manner consistent with the Convention, relevant decisions of the policy-making organs,[19] established internal procedures of the Secretariat, and best practices of international fact-finding bodies and commissions of inquiry, especially when collecting information, such as witness statements, and assessing their relevance, sufficiency, and credibility, including by corroboration through separate sources.

3.6 As mentioned above, the collection of information in respect of the Kafr Zeita incident of 1 October 2016 involved reaching out to States Parties, international and non-governmental organisations, and individuals, as well as a number of internationally reputable forensic institutes and independent experts and other relevant entities. The IIT is grateful for the ample support received during its investigation.

3.7 Since the IIT is not judicially empowered to compel the submission of information and material, it relied, once again, on the voluntary cooperation of all these parties. In particular, regarding States Parties, the IIT requested them, consistent with paragraph 7 of Article VII of the Convention, to provide access to relevant information and locations.

3.8 Against this background, over the past months, the IIT has held several bilateral meetings with States Parties and other entities. It has reviewed over 15,600 files, amounting to more than 980 gigabytes, obtained and assessed 53 witness statements, 3 of which were from women; and requested and obtained analysis results and data for 13 samples related to this investigation, including one sample collected and analysed by the FFM.

3.9 To ensure the independence of its analysis, the IIT obtained examination results and technical assessments from a variety of experts and specialists (none of whom had worked on the incident before) from different nationalities and working at different institutions. The IIT reached out to four OPCW designated laboratories and to one forensic institute, as well as to an independent chemistry expert. Assessments of prevailing meteorological conditions were obtained from separate sources. Two toxicologists were consulted to complement the analyses carried out by the FFM on the basis of the information obtained by the Secretariat. One independent munitions specialist provided an assessment on the cylinder considered by the IIT during its investigation. An independent terminal ballistics expert and projectile trajectory expert

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18 See First IIT Report, paras 1.1 to 3.7 and Annexes 1 and 2 (and references therein); EC-91/S/3 and EC-92/S/8. Second IIT Report, Annex 2; Third IIT Report, Annex 2; Fourth IIT Report, Annex 2, and Annex 2 to this report.

19 In addition to C-SS-4/DEC.3, see the decision by the Conference entitled "Sampling and Analysis during Investigations of Alleged Use of Chemical Weapons" (C-I/DEC.47, dated 16 May 1997) which was applied *mutatis mutandis* by the IIT to its investigations. See Annex 2 below for details on these methodologies.

were consulted for the purpose of assessing the different hypotheses as to how the cylinder may have been delivered to, or placed at, the relevant location in Kafr Zeita. Over 40,000 trajectories were simulated. Two military experts complemented the internal analytical capacity of the IIT itself. The IIT further engaged one specialist in geolocation and open-source research.

3.10 Overall, the IIT engaged a total of nine independent experts and specialists from three different geographical regions to ensure the highest degree of objectivity, impartiality, and independence of its investigation, the thorough corroboration of the information and evidence it gathered, and the overall solidity and consistency of its findings.

3.11 The IIT assessed the information obtained, including by corroboration through other sources, to determine its sufficiency, relevance, and reliability. With specific regard to videos and photographs, the IIT verified their authenticity through geolocation, metadata assessment, and other techniques. The IIT will provide this information to the IIIM as required by paragraph 12 of Conference decision C-SS-4/DEC.3, and in accordance with applicable OPCW confidentiality rules and protocols.

3.12 During the investigation of the incident in Kafr Zeita of 1 October 2016, the IIT encountered issues similar to those mentioned in the First,[20] Second,[21] Third,[22] and Fourth[23] IIT Reports, especially with regard to: (a) the lack of cooperation from the former authorities of the Syrian Arab Republic, namely their unwillingness to respond to the Secretariat's requests, as explained below; (b) the impossibility to access the site of the incident for most of the investigation, owing to the IIT being denied entry to the Syrian Arab Republic by the former authorities; and (c) the lapse of time between the date of the incident and the investigation of the IIT.

3.13 In particular, it should be recalled that the incident under review in the present report occurred in the town of Kafr Zeita on 1 October 2016, that is, eight years prior of the launch of the IIT investigation in March 2024.[24] This posed a challenge for some of the witnesses and affected individuals interviewed by the IIT when recollecting specific details, or seeking to retrieve supporting documentation and materials, from the day of the incident and its aftermath.

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20 See First IIT Report, paras 4.1 to 4.10.

21 See Second IIT Report, paras 3.5 to 3.11.

22 See Third IIT Report, paras 3.9 to 3.15.

23 See Fourth IIT Report, paras 3.12 to 3.22.

24 The IIT is mandated to identify the perpetrators (and thus undertake the relevant investigations) once the FFM has determined that the use or likely use of chemical weapons occurred (and the OPCW-United Nations Joint Investigative Mechanism has not issued a report). The FFM report establishing that a chlorine cylinder was used as a weapon in the incident under review was issued on 31 January 2022 (S/2020/2022).

3.14 On 24 June 2024, the Secretariat addressed a note verbale[25] to the Permanent Representation of the Syrian Arab Republic to the OPCW, attaching a note by the IIT inviting the Syrian Arab Republic to, inter alia, submit any concrete information regarding the incident in Kafr Zeita of 1 October 2016. The note further reiterated the availability of the IIT to meet with representatives of the Syrian Arab Republic at their convenience and at a location of their choosing. The purpose of this meeting would have been to discuss the progress of the investigation and the provision of any information and access to relevant locations that the authorities of the Syrian Arab Republic may have been able to facilitate.

3.15 Pending a response from the Syrian Arab Republic, the IIT thoroughly reviewed and assessed notes verbales transmitted by the Syrian Arab Republic to the Secretariat, as well as other communications and statements[26] issued by the Syrian Arab Republic that it deemed potentially relevant to its investigation, and duly took relevant information and leads into account.

3.16 On 8 December 2024, the then-President of the Syrian Arab Republic, [REDACTED], fled the country leaving his Prime Minister to transfer power to new authorities.[27] Through Note Verbale No. NV/ODG-636/24 (dated 9 December 2024), the Secretariat reminded the Syrian Arab Republic of its continued obligations under the Convention, and requested that it fulfil these obligations.

3.17 On 8 February 2025, the OPCW Director-General, accompanied by a delegation from the Secretariat, visited Damascus to meet with the Syrian Arab Republic's (then-interim) President and (then-caretaker) Foreign Minister. The delegation included a member of the IIT—for the first time on the territory of the Syrian Arab Republic. During the visit, the President committed, among other things, to providing full support and unfettered access for the investigations conducted by the OPCW FFM and IIT.[28]

3.18 On 22 May 2025, a letter from the IIT Chief Coordinator was transmitted to the Point of Contact of the Syrian Arab Republic with the OPCW.[29] In the letter, the IIT Chief Coordinator reiterated the request for cooperation that had already been conveyed to the former authorities of the Syrian Arab Republic in Note Verbale No. NV/ODG/564/24, and shared a series of outstanding questions relevant to the identification of the perpetrators of the incident in Kafr Zeita.[30]

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25 NV/ODG/564/24 (dated 24 June 2024).

26 See, for example, identical letters dated 11 March 2019 from the Permanent Representative of the Syrian Arab Republic to the United Nations addressed to the Secretary-General and the President of the Security Council (S/2019/250, dated 22 March 2019); Statement by H.E. Ambassador Bassam Sabbagh, Permanent Representative of the Syrian Arab Republic to the OPCW at the Twenty-Fourth Session of the Conference (C-24/NAT.40, dated 26 November 2019); Statement by H.E. Ambassador Milad Atieh, Permanent Representative of the Syrian Arab Republic to the OPCW at the Ninety-Ninth Session of the Executive Council (the Council) (EC-99/NAT.78, dated 8 March 2022).

27 See Note by the Secretariat "The Situation in the Syrian Arab Republic in Relation to the Syrian Chemical Weapons Programme and the Way Forward" (S/2376/2025, dated 26 February 2025), para. 6.

28 Ibid., para. 15.

29 L/ODG-281/25 (dated 22 May 2025).

30 NV/ODG/564/24, see Annex 3.

3.19 In the course of two subsequent deployments to the Syrian Arab Republic (from 11 to 18 June and from 17 to 22 September 2025), members of the IIT held meetings with relevant Syrian authorities.[31] The request of the IIT for cooperation and information in relation to its ongoing investigation featured prominently in the discussions. During the latter deployment, Syrian Government representatives shared relevant information and primary documentation with the IIT, marking the first instance of cooperation by the Syrian Arab Republic with an IIT investigation.

3.20 As noted above, for most of the duration of the investigation the IIT was unable to access the territory of the Syrian Arab Republic owing to a lack of cooperation from the former authorities. As also highlighted above, while the IIT was granted full and unfettered access to the country after the events of December 2024 and the change of Government in the Syrian Arab Republic, operational, logistical and security constraints on the ground did not allow the team to deploy to Kafr Zeita before the completion of the IIT investigation. However, based on consultations with technical and scientific experts—and in line with the assessment of the FFM at the time of its own investigation[32]—the IIT determined that, given the significant period of time elapsed since the attack and the damage incurred by the relevant sites in the meantime,[33] a deployment to the area of the incident would have offered limited potential to identify any additional evidence in relation to its perpetrators.

3.21 The IIT further reached out, through notes verbales and other means, to other States Parties which, based on public documentation and open sources, it assessed to be privy to—or in possession of—information and materials relevant to its investigation.

3.22 As with its previous investigations, the IIT considered it imperative to ensure the necessary degree of care during its gathering and assessment of the information, including its consultations with experts in various disciplines. In line with a consistent methodology, the IIT also employed best practices aimed at ensuring the safety, security, and well-being of the persons with whom it interacted. This included protecting the privacy of individuals and using only information for which informed consent was provided. Whenever, in the course of the investigation into the incident and subject to a thorough case-by-case risk assessment, the IIT had reasonable grounds to believe that a potential witness would be endangered as a result of their engagement with the IIT, it refrained from approaching them, in line with the "do-no-harm" principle, which is a key component of its methodology.

3.23 Despite the constraints outlined above, the IIT was able to carry out its investigative activities, and to secure information and evidence in accordance with its methodology and standard of proof.

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[31] See Report by the Director-General "Progress in the Elimination of the Syrian Chemical Weapons Programme" (EC-110/DG.5, dated 25 August 2025), para. 39.

[32] See FFM Report on Kafr Zeita, 1 October 2016, para. 6.12: "the FFM considered that a deployment to the site of the alleged incident in 2021 … would add limited or no value to the findings, especially when weighed against the amount of effort and resources that the Secretariat and the Syrian Arab Republic would need to deploy."

[33] See "General situation in the area" subsection in Section 5 below.

4. SCENARIOS

4.1 In preparing its investigation plan for the incident in Kafr Zeita on 1 October 2016, the IIT considered various hypotheses as to how the incident might have occurred, and then proceeded to develop concrete scenarios based on all available information. In doing so, the IIT took into account the positions presented by representatives of the Syrian Arab Republic and other States Parties, considering the challenges mentioned above.[34]

4.2 Among these scenarios, the IIT considered the view that the incident had been "staged" in order to make accusations against the Government of the Syrian Arab Republic. The IIT specifically considered hypotheses that the "staging" of the incident had been carried out by, for example, manually placing a chlorine cylinder from a previous strike at the scene, fabricating videos portraying medical personnel and first responders pretending to treat casualties, and individuals pretending to have suffered symptoms of exposure to chemicals.

4.3 In light of the above, the scenarios developed for this investigation can be succinctly summarised as follows:

(a) a chemical agent was prepared elsewhere and deployed at the site of the incident identified by the FFM, while a cylinder from a previous attack was placed at (or around) the same site in order to blame one party to the conflict. In this case the symptoms displayed by people affected by the attack would be real; or

(b) no chemical weapons were used, but an empty chlorine cylinder intended for commercial purposes was placed; video material was fabricated and civilians pretending to have suffered symptoms of exposure to chemicals were arranged in order to blame one party to the conflict. In this case the symptoms displayed by people affected by the attack would be fake; or

(c) chemical weapons were delivered by air on—or around—the site of the incident identified by the FFM; or

(d) chemical weapons were launched, spread, or deployed otherwise to—or around—the sites of the incidents identified by the FFM.

4.4 For each of these scenarios, the IIT took into account that the operation to use chemicals (including by "staging" an incident) could have been organised through the chain of command of a formal or de facto structure, or that "rogue" units or individuals could have taken it upon themselves to use them.

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34 See "Approach and challenges in the investigation", Section 3 above.

4.5 In pursuing its investigation, the IIT also took specific note of the categorical denials by the Syrian authorities at that time of allegations that their Government used chemical weapons against the Syrian people and of the condemnations issued by the Syrian Arab Republic of the use of chemical weapons by anyone, anywhere, at any time, and under any circumstances.[35] The IIT also took into consideration the position expressed by the Syrian Arab Republic that the use of chemical weapons in an open area like the Wadi al-Aanz valley in Kafr Zeita would have been futile from a military point of view.[36]

5. BACKGROUND

The findings of the Fact-Finding Mission

5.1 As noted above, the IIT is mandated to investigate those instances in which the FFM has determined that the use or likely use of chemical weapons occurred, and for which the OPCW-United Nations Joint Investigation Mission did not reach findings as to the perpetrators.

5.2 The FFM determined in its report that all information it obtained and analysed provided reasonable grounds to believe that a "chlorine cylinder was used as a weapon" in the attack on 1 October 2016 in Kafr Zeita.[37] The FFM had obtained "an industrial chlorine cylinder retrieved from the location of the incident and was able to link it to the incident on 1 October 2016."[38]

5.3 The FFM further concluded that the "acute onset of similar signs and symptoms in a large number of people in the same time frame and location are suggestive of a chemical toxidrome characteristic of exposure to an irritant substance affecting the respiratory system and mucous membranes".[39]

General situation in the area

5.4 Located centrally in the Syrian Arab Republic, Hama Governorate served, at the time of the incident, as a vital corridor for military logistics and movements across the country. This made it a focal point for various military operations throughout the Syrian conflict.

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35 See, for example, identical letters dated 11 March 2019 from the Permanent Representative of the Syrian Arab Republic to the United Nations addressed to the Secretary-General and the President of the Security Council (S/2019/250, dated 22 March 2019); Statement by H.E. Ambassador Bassam Sabbagh, Permanent Representative of the Syrian Arab Republic to the OPCW, at the Twenty-Fourth Session of the Conference (C-24/NAT.40).

36 Statement by H.E. Ambassador Milad Atieh, Permanent Representative of the Syrian Arab Republic to the OPCW, at the Ninety-Ninth Session of the Council (EC-99/NAT.78).

37 FFM Report on Kafr Zeita, 1 October 2016, paras 1.11 and 8.15.

38 FFM Report on Kafr Zeita, 1 October 2016, para. 1.5.

39 FFM Report on Kafr Zeita, 1 October 2016, para. 8.13.

5.5 Furthermore, the M5 highway—which runs through the Hama Governorate—links major cities including Damascus, Homs, and Aleppo, and extends further into Jordan, connecting the Syrian capital with Amman.[40] Military specialists consulted by the IIT assessed that control over this route was crucial for both government and opposition forces, as it facilitated the movement of troops and supplies.[41] In particular, as parts of the M5 highway north of Hama city were under the control of armed opposition groups in 2016, Government forces fighting in and around Aleppo could only be supplied via one alternative route. This route circumvented the opposition-held sections of the M5 highway and connected Hama city and the Government-held part of Aleppo. This made villages and cities along the M5 highway a regular target of air strikes going back to at least 2012.[42]

5.6 As allegiances in the Syrian conflict often ran along sectarian lines, the diverse sectarian landscape of Hama further increased its military significance. The area featured a fault-line between Alawite and Christian towns in the west and southwest (under the Government's authority) and Sunni towns in the northeast (controlled by the opposition). This demographic distribution influenced control over key areas and supply routes, while providing both pro-government and opposition forces with significant recruitment potential.

5.7 Economically, the Hama Governorate was of substantial value due to its favourable geographic and climatic conditions, facilitating a significant agricultural industry. These conditions were in part created because of the Ghab Plain, a man-made fertile depression that makes up substantial parts of the Hama Governorate. Furthermore, the Orontes River—running through the Governorate—further ensured fertile and arable soil.[43]

5.8 The city of Hama itself was a critical strategic asset at the time of the Kafr Zeita incident. It housed the Hama Military Airbase, which had been the Syrian Arab Air Force's backbone for operations in the area, as several other air bases had been overtaken or rendered unusable by the opposition's advance earlier in the conflict.[44] Consequently, losing control over Hama Airbase would have significantly hampered the Syrian Government's capacity to deploy its aerial assets—helicopters in particular. Furthermore, the Jabal Zayn al-Abidin mountain, the most significant high ground close to the city, overlooks the city of Hama from the north. This mountain was used as a command and logistics centre by the Syrian Arab Army in 2016 and, if captured by armed opposition forces, its commanding ground could have been used to threaten the entire city as well as Hama Airbase.

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40 The IIT has elaborated on the strategic relevance of the M5 highway in previous reports, see, for example, Third IIT Report, para. 5.3.

41 First IIT Report, para. 6.7.

42 First IIT Report, para. 6.7, Second IIT Report, para. 5.3.

43 See for example: Ronald, Jaubert, Myriam Saadé, Mohamed Al Dbiyat, Ahmed Haj Asaad, Atlas of the Orontes Basin Rivers, available at: https://www.researchgate.net/publication/362313213_Atlas_or_Orontes_River_Basin. Monthly Digest UNCT Syria, Wheat production contributes to a better living for Nadia's family, available at: https://syria.un.org/en/187754-wheat-production-contributes-better-living-nadia%E2%80%99s-family. Syria Recovery Trust Fund, Reestablishing Seed Production and Multiplication Programmes in Aleppo, Idleb, and Hama Governorates, available at: https://www.srtfund.org/projects/134-reestablishing-seed-production-and-multiplication-programmes-in-aleppo-idleb-and-hama-governorates. Food and Agriculture Organization of the United Nations, Transboundary River Basin Overview-Asi-Orontes, available at: https://openknowledge.fao.org/server/api/core/bitstreams/f33629776-73ca-4768-9cba-9b90446c62c7/content

44 See infra in "Origins of the Munition".

General Situation in Kafr Zeita

5.9 Located around 30 km to the north of Hama city, Kafr Zeita was, at the time of the incident, a predominantly Sunni Muslim town, and one of the largest in the northern Hama Governorate. Kafr Zeita lies in the homonymous subdistrict that forms part of the Muhradah district.[45] Nearby towns include Tall Sayyad and Khan Shaykhun to the northeast, Morek to the east, Ltamenah to the southeast, Kernaz to the west, and Hobait to the northwest.[46]

5.10 The Kafr Zeita subdistrict lies on the edge of the Ghab Plain and is, therefore, among the most fertile agricultural areas in the Syrian Arab Republic.[47] The area is known for the cultivation of pistachios, potatoes, and olives for the production of olive oil—a practice from which Kafr Zeita derives its name.

5.11 Prior to the conflict, the Kafr Zeita subdistrict had a population of 17,052, according to the Syrian Central Bureau of Statistics census of 2004.[48] By August 2014, the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) estimated that 61,000 people in the Kafr Zeita area were in need, with internally displaced persons and returnees making up 58,500 people.[49] However, this number had decreased as a result of the conflict,[50] with UNOCHA estimating that the population in Kafr Zeita town had dropped to 1,234 inhabitants by August 2021.[51]

5.12 Anti-government demonstrations erupted in Hama city in March 2011. Protests first took place in Kafr Zeita at the end of April 2011 and continued when the uprising escalated into an armed conflict. For example, on 15 September 2012, large demonstrations were reported in Kafr Zeita where hundreds of people chanted for the fall of then-President [REDACTED].

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45 United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), Rehabilitating of Pistachio Sector in Hama Countryside, available at: https://projects.hpc.tools/project/156078/view

46 FFM Report on Kafr Zeita, 1 October 2016, para. 7.2.

47 See, for example, Syrian Arab Republic and United Nations, Al-Ghab Development Programme SYR/010/002, available at: info.undp.org/docs/pdc/Documents/SYR/00059531_Alghab%20PD.pdf. Food and Agricultural Organization of the United Nations and World Food Programme, Special Report: FAO/WFP Crop and Food Security Assessment Mission in the Syrian Arab Republic, available at: https://www.ecoi.net/en/file/local2017240/ca5934en.pdf

48 2004 Populating and Housing Census Results at the City/Village Level, available at: https://archive.ph/20130112133023/http://www.cbssyr.org/newwebsite/General_census/census_2004/NH/TAB05-21-2004.htm

49 United Nations Office for the Coordination of Humanitarian Affairs, Syrian Arab Republic Governorates Profile, available at: https://reliefweb.int/report/syrian-arab-republic/syrian-arab-republic-governorates-profiles-june-2014

50 Third FFM Report, paragraphs 5.56 to 5.59 (S/1230/2014, p. 23).

51 Humanitarian Needs Overview, Syrian Arab Republic, available at: https://www.unicef.org/mena/media/15726/file/hno_2022_final_version_210222.pdf. United Nations Office for the Coordination of Humanitarian Affairs, Syrian Arab Republic, Developments in the Northern Governorates – Situation Report No. 1, available at: https://www.unocha.org/publications/report/syrian-arab-republic/syrian-arab-republic-developments-northern-governorates-situation-report

5.13 Kafr Zeita was first occupied by armed opposition groups in December 2012 and remained outside of the Government's control until August 2019, with multiple factions often present in and around the town at the same time.[52] However, throughout this period, the town was persistently attacked by pro-government forces in an effort to regain control.

5.14 In 2016, Kafr Zeita was located at the centre of a number of opposition strongholds and logistic hubs, with several bases having been set up by armed groups in the caves of the Wadi al-Aanz and other nearby valleys.

5.15 The Wadi al-Aanz valley lies 4 km to the northwest of the centre of Kafr Zeita, close to the border of the Hama and Idlib Governorates. The valley is surrounded by farmland and intersected by roads connecting various villages and towns.

5.16 Until the recapture of Kafr Zeita by pro-government forces in August 2019, vital medical services were provided from Kafr Zeita to the population in the surrounding areas. Initially, the town featured two hospitals. However, as the conflict raged on and both facilities were frequently damaged,[53] one underground hospital—the Al Maghara Hospital—was established in Wadi al-Aanz.[54]

5.17 The new hospital became operational in 2015 and—despite being frequently damaged by air strikes—remained so until it was abandoned in 2019 and then completely destroyed in 2021.[55] Besides the Al Maghara Hospital, medical services were also provided by the Kafr Zeita Specialised Hospital, located in Kafr Zeita town.

6. INCIDENT IN KAFR ZEITA, 1 OCTOBER 2016

The context of military activities in the area

6.1 With regard to the military activities in the area of Kafr Zeita, northern Hama Governorate, in late 2016, the IIT made its assessments on the basis of accounts by witnesses, expert reports, technical and observational data, as well as imagery and open-source information, and through consultation with external entities and specialists.

6.2 As of mid-2016, armed opposition forces controlled two separate areas in the Hama Governorate. The northern area stretched north towards the Turkish border and the besieged city of Aleppo, south to about 25 km north of Hama city, and contained the town of Kafr Zeita. The southern pocket was substantially smaller and lay between the cities of Hama and Homs along the M5 highway, extending also to about 23 km from Hama.[56]

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52 See, for example: 11 to 18 April 2014 the Nusrah Front and several armed opposition groups were present in Kafr Zeita (Third Report of the Organization for the Prohibition of Chemical Weapons-United Nations Joint Investigation Mechanism) (S/2016/738/Rev.1 (dated 24 August 2016), pp. 15 and 17).

53 Third FFM Report, paras 5.56 to 5.59 (S/1230/2014. p. 23).

54 The Syrian Campaign, Saving Lives Underground, available at: https://d1p8u7ytnu6qui.cloudfront.net/Saving%20Lives%20Underground%20report.pdf

55 FFM Report on Kafr Zeita, 1 October 2016, paras 6.10 and 3.6 (S/2020/2022). UOSSM, Cave Hospital, Built Under 60 ft of Rock, Wrecked by Powerful Blast, available at: https://reliefweb.int/report/syrian-arab-republic/cave-hospital-built-under-60-ft-rock-wrecked-powerful-blast

56 For a visual representation of the occupied territories see: www.ohchr.org/en/hr-bodies/hrc/iici-syria/reportofthe-commission of-inquiry-syria

6.3 In June 2016, the Syrian Arab Army launched its summer campaign in an effort to fully encircle the opposition-held part of Aleppo city.[57] Up until its capture in December 2016, the eastern part of Aleppo remained a key opposition stronghold, and the battle for its control was widely regarded as potentially decisive for the broader Syrian conflict.[58] In response, Syrian armed opposition groups initiated a military offensive[59] in the northern part of the Hama Governorate on 29 August 2016.

6.4 Prior to the offensive, the Syrian Arab Army had established a defensive arc spanning from the village of Ma'an in the (north) eastern countryside of Hama south through Sawran, al-Buwayda, Maarkaba, al-Zlakiat and Zlin to Shalliot in the west and extending into the (north) western countryside of Hama reaching the city of Karnaz. This meant that, prior to the 29 August 2016 offensive, opposition forces held a bulge in the Syrian Government's line around Kafr Zeita, Ltamenah, and Murak. This front line formed the southern edge of the large pocket of opposition-held territory centred on the Idlib Governorate.

6.5 The opposition's overarching goal of this offensive was to relieve military pressure on opposition forces fighting in Aleppo. This was to be achieved by advancing towards Hama and thereby threatening the balance of power in and around Hama city and disabling the only remaining supply route between Hama and Aleppo. To prevent this, the Syrian Government would have had to commit troops to the defence of Hama, which would have then been unavailable for the fighting in Aleppo. Further, the opposition aimed to disrupt the Syrian Arab Air Force's operation at Hama Airbase, as this would have reduced the intensity of air strikes against forces fighting in Aleppo and in the Hama countryside.

6.6 Around 15 armed groups participated in this offensive, the most prominent factions being Jaysh al-Izza (Army of Glory) (one of the most influential groups operating in the area of Kafr Zeita in 2016), Jund Al-Aqsa (Soldiers of al-Aqsa), Jaish al-Nasr (Army of Victory), and local branches of Ahrar al-Sham (The Free Men of Syria). These groups operated heavy weaponry but lacked manned aerial assets. [60]

6.7 At the start of the offensive, opposition forces established three operations rooms, that is to say ad hoc command structures through which they coordinated their efforts.[61] While these command structures nominally operated independently from one another, information obtained by the IIT attests to a high level of coordination, to the extent that mobile anti-tank units commanded from one operations room would support units commanded from another.

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57 United Nations Security Council, Report of the Secretary-General, 20 July 2016, UN Doc. S/2016/63, paras 8 – 10.

58 Human Rights Council, Report of the Independent International Commission of Inquiry on the Syrian Arab Republic, 2 February 2017, UN Doc. A/HRC/34/64, paras 21 – 24.

59 FFM Report on Kafr Zeita, 1 October 2016, para. 3.12 (S/2020/2022); See "Four citizens injured due to terrorist rocket attack in Hama", available at: www.sana.sy/en/?p=86714

60 Human Rights Council, Report of the Independent International Commission of Inquiry on the Syrian Arab Republic, 2 February 2017, UN Doc. A/HRC/34/64, para. 13.

61 The offensive was called "Fi Sabeel Allahi Namdhee" (For God's Sake We Go) by *Jaysh Al Izza*, whereas *Jund Al-Aqsa* called it "Ghazouat Sheikh Marouane Hadeed" (the Sheikh Marouane Hadeed Raid). *Jaysh al Nasr* referred to it as "Hemam Al Ghadhab Li Nosrati Halab" (Lava of Anger in Support of Aleppo).

6.8 In the initial days of the offensive, opposition forces pushed outwards from the Ltamenah bulge towards Hama city, capturing territory in the southern and south-eastern direction. By early September 2016, the armed opposition had managed to secure several towns and villages north of Hama city and south of Ltamenah.

6.9 Following these initial gains, the front line north of Hama city became relatively static from early September 2016 until infighting among the opposition factions weakened their combat effectiveness. This in turn allowed the Government to regain territory from early October 2016 onwards.

6.10 Importantly, these initial territorial gains allowed the opposition forces to strike Syrian Government priority areas and infrastructure like Hama Airbase and the command and logistics hub on the Jabal Zayn al-Abidin mountain more intensively.[62] Both military facilities were highly significant to the Government forces' ability to counter the offensive, and several opposition combatants and spotters highlighted to the IIT how pilots of the Government forces taking off from Hama Airbase would coordinate with the operations room on the Jabal Zayn al-Abidin mountain when executing air strikes. At its furthest extension in September 2016, opposition-held territory encompassed the village of Iskandariya (4.8 km from the Jabal Zayn al-Abidin mountain) and villages within a distance of 13 km from Hama Airbase.

6.11 As a result, open sources indicate that armed opposition groups were able to successfully strike Hama Airbase and the Jabal Zayn al-Abidin mountain 35 times between 29 August and 31 October 2016.[63]

6.12 In response to territorial advances by the opposition, the Syrian Arab Air Force and the Russian Aerospace Defence Forces[64] intensified their aerial campaign and reportedly conducted 52 strikes in 24 hours on 31 August 2016 alone.

6.13 On the ground, pro-government forces fighting the opposition around the Ltamenah bulge included the Tiger Forces (*Quwwat al-Nimr*), commanded by then-Colonel[65] [REDACTED], and forces associated with it, such as the Falcon Group, the Cheetah 6 Group, the Shaheen, the Qalamoun Shield forces-and the Ali Shalish Group. The Tiger Forces were an elite unit deployed on various fronts of the conflict in the Syrian Arab Republic, and played a leading role in this operation, having been delegated a considerable degree of (or even overall) command responsibility alongside other units fighting for the Government of the Syrian Arab Republic. Besides the Tiger Forces, the 87th Mechanised Brigade of the 11th Division[66] and limited elements of the 555th Regiment of the 4th Division (closely linked to [REDACTED]) were operating in the Hama countryside.

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62 See First IIT Report, para. 6.14.

63 The damage caused by some of these strikes at Hama Airbase could be verified by the IIT via a longitudinal analysis of satellite images of the airbase.

64 Human Rights Council, Report of the Independent International Commission of Inquiry on the Syrian Arab Republic, 11 February 2016 , UN Doc. A/HRC/31/68, para. 19.

65 Promoted to the rank of Brigadier General in early 2017. See for example: [REDACTED]

66 Commanded by Brigadier General [REDACTED] until [REDACTED]. The IIT was unable to identify his immediate successor.

6.14 According to independent military experts consulted by the IIT and to Iranian media outlets, Iranian officials and armed factions supported by the Islamic Republic of Iran were also active in the Hama region (being stationed, for example, at a former School for Veterinary Medicine located between Hama and Mahardeh) around October 2016, in support of the Syrian military.[67]

6.15 As noted above, pro-government ground forces fighting in the area were also supported by a sizeable contingent of aerial assets—both rotary and fixed-wing aircraft—operated by the Syrian Arab Air Force and the Russian Aerospace Defence Forces. Among the units active in the northern Hama airspace were units of the 22nd Air Division (commanded by Major General [REDACTED]) stationed at Hama Airbase, including the 14th Air Brigade, which operated two squadrons (the 678th and 679th) of fixed-wing aircraft. In addition, the independent 63rd Helicopter Brigade, commanded by [REDACTED], operated at least one squadron—the 255th squadron commanded by [REDACTED]—of Mi-8/17 rotary-wing aircraft from Hama Airbase in September and October 2016. The IIT understands from witness testimonies and other sources that the logistics and maintenance of flight operations at Hama Airbase (for example, ensuring that helicopters were fuelled and airworthy) was overseen by the commander of the airbase at that time, namely, Brigadier General [REDACTED].

6.16 While the IIT has not received conclusive information as to the formal appointment of an overall commander of the Syrian military forces in northern Hama, credible sources indicate that Colonel [REDACTED], commander of the Tiger Forces, played a leading role in the military operation, having been delegated a considerable degree of (or even overall) command.

6.17 Beginning in mid-April 2016, Kafr Zeita and other nearby towns were subjected to near-daily air strikes and artillery attacks. Overall, according to witness statements and other sources of information in the possession of the IIT, Syrian and Russian air forces struck Kafr Zeita using both fixed- and (mostly) rotary-wing aircraft on a near-daily basis between 17 August and 31 October 2016.

6.18 On 9 September 2016, the United States of America and the Russian Federation reached a new agreement on the cessation of hostilities in the Syrian Arab Republic. The agreement entered into effect on 12 September and ended on 18 September 2016. This six-day period coincided with a marked reduction of fighting in the Hama region, which was followed by renewed hostilities after September 18.[68]

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67 https://baladi-news.com/ar/articles/7992/

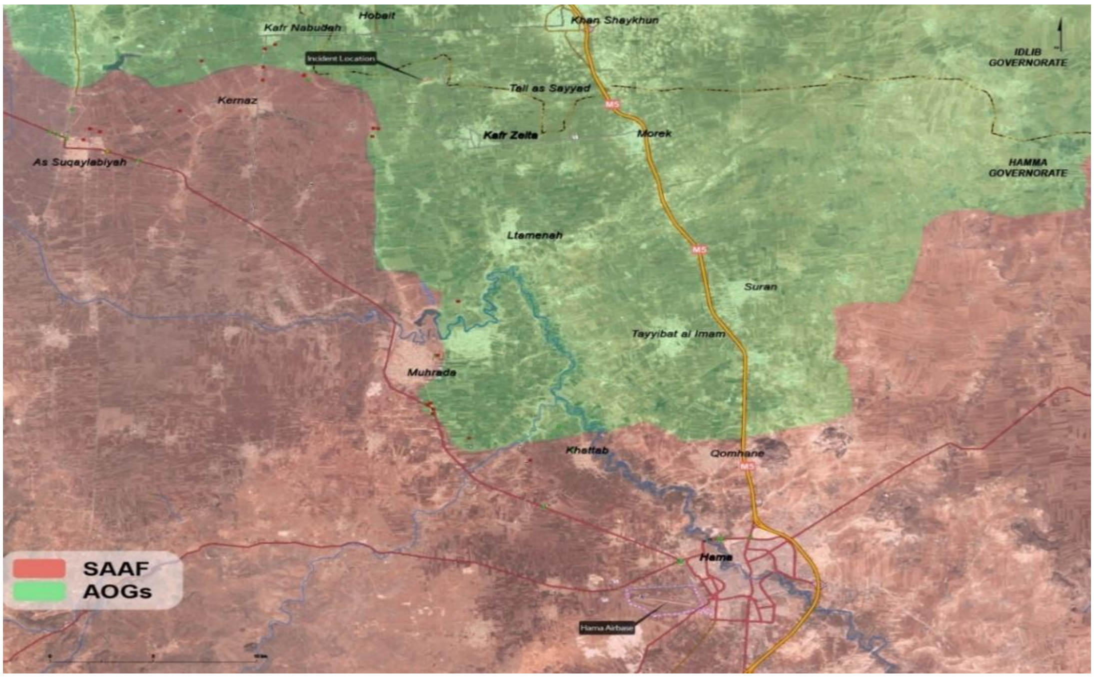
68 See for example: United Nations Security Council, Implementation of the Security Council resolutions 2139 (2014); 2165 (2014); 2191(2014); and 2258 (2015); S/2016/873 (dated 18 October 2016), para. 10; Russian Draft Resolution S/2016/847 (dated 8 October 2016); www.securitycouncilreport.org/monthly-forecast/2016-10/syria_36.php; www.presstv.ir/Detail/2016/09/10/484089/Syria-truce-deal-US-Russia-Aleppo

6.19 Until early October 2016, the Government's efforts to regain operational momentum were largely unsuccessful, and no significant territorial gains materialised—with both sides repeatedly losing and then regaining control of several towns and villages. Notably, on 24 September 2016, opposition forces captured Ma'an—a town that had been fought over since the beginning of the opposition's offensive. Also, on 28 September and 1 October 2016 regional pro-opposition media reported that the armed opposition group Jaysh al-Izza, which maintained a significant presence in Kafr Zeita, successfully launched Grad rockets at Hama Airbase and the majority Alawite cities of Masyaf and Salhab in the western Hama Governorate.

6.20 In the evening of 1 October 2016, reports of a chemical attack carried out north of Kafr Zeita started circulating. Video footage from within the Al Maghara Hospital and Kafr Zeita Specialised Hospital, obtained and authenticated by the IIT, show medical personnel treating individuals seemingly affected by a toxic gas. Photographs showing one yellow industrial cylinder, which reportedly had landed in the Wadi al-Aanz valley, also emerged by 2 October 2016. Also on 2 October, the Al Maghara Hospital, located some 300 metres from the reported point of impact, was hit by at least two air strikes, causing several injuries among medical personnel and significant damage to the structure of the cave hospital.

6.21 Also on 1 October 2016, the Chief of Staff of the Army and Armed Forces, Lieutenant General [REDACTED], visited Jabal Zayn al-Abidin mountain, overlooking the front lines in the northern countryside of Hama.[69] According to video footage that the IIT was unable to authenticate, on that occasion [REDACTED] met Air Force Intelligence Director [REDACTED], the commander of the Tiger Forces, Colonel [REDACTED], and several other high-ranking officers of the Syrian Arab Army.

FIGURE 1: COURSE OF THE FRONT LINE AS OF 1 OCTOBER 2016



(In green, territory held by armed opposition groups (AOGs). In red, territory controlled by the Syrian Arab Armed Forces (SAAF)).

69 [REDACTED]

6.22 In early October 2016, substantial infighting erupted between various opposition groups, which severely hampered their coordination and combat effectiveness.

6.23 By 7 October 2016, the Syrian Arab Armed Forces, with substantial support of the Russian Aerospace Defence Forces, had regained the battlefield initiative and began reconquering territory that had been lost since August 2016. This trend continued until the end of October 2016, by which time pro-government forces had largely pushed armed opposition groups away from the strategically important Jabal Zayn al-Abidin mountain. Hostilities in the area then stalled until the opposition's next offensive, pushing towards Hama city, commenced in March 2017.

Meteorological conditions

6.24 Sunset in Kafr Zeita on 1 October 2016 was at 18:16 (UTC+3); sunrise on the next day was at 06:27 (UTC+3). The IIT established the meteorological conditions in the area of Kafr Zeita on the evening of 1 October 2016 based on official reports by the World Meteorological Organization (WMO), witness accounts, publicly available historical weather data, and other sources of information. The IIT acknowledges that meteorological conditions may vary slightly depending on the weather station closest to Kafr Zeita, therefore the conditions noted below are indicative of the forecast in the general area of the incident site, rather than the exact weather conditions in the exact location at the time in which the incident occurred.[70]

6.25 According to the WMO data analysed by the IIT, between 18:00 and 21:00 (UTC+3) the area experienced a temperature of around 20º C and the relative humidity dropped from 42% to 35%. Wind speed around the time of the attack was recorded at 1 m/s—that is, 3.6 km/h—from a north-north-easterly direction.[71] Witnesses present in Kafr Zeita at the time of the incident also described the wind as calm, without any strong breezes.

6.26 These circumstances are generally considered permissive for the use of chlorine gas, since the chemical agent would have remained close to the point of release owing to such light winds. Thus, a decision-maker with knowledge of such conditions and seeking to maximise the effectiveness of such gas would have been able to plan and use it as a chemical weapon in these circumstances—although the exact direction of any gas dispersion could not have been accurately foreseen in advance.

Time	Temp.	Wind direction[72]	Wind speed[73]	Precipitation	Clouds	Humidity
18:00	20.6 º C	NNE	1 m/s	0 mm	Cloudless	42%
21:00	19.8 º C	NNE	1 m/s	0 mm	Cloudless	35%

70 The historical weather data obtained from WMO relies on weather stations located at Hama and in Latakia. Where not indicated otherwise, the information presented in this section refers to the weather station located at Hama as it was the closest to the incident.

71 Wind speeds and directions were measured in Latakia.

72 Wind directions were measured in Latakia.

73 Wind speeds were measured in Latakia.

Assessment of remnants

6.27 On the evening of 1 October 2016, Syrian Civil Defence units were alerted to the presence of a "bomb that did not explode having been dropped from a helicopter" in Kafr Zeita. Based on witness accounts, the FFM report states that "the cylinder made impact next to two ventilation openings on top of a cave [...], approximately 300 metres from the Al Maghara Hospital. It then came to rest close to one of the cave entrances".[74] These accounts were further supported by authenticated photographs and videos taken the morning after the incident (that is, on 2 October 2016) showing both the munition's point of impact and the location where it came to rest after tumbling downhill to the bottom of the Wadi al-Aanz valley.

FIGURE 2: IMAGE SHOWING THE MUNITION USED IN KAFR ZEITA ON 1 OCTOBER 2016 BEING EXAMINED AT ITS RESTING LOCATION ON THE DAY AFTER THE INCIDENT

(Source: OPCW FFM Report, page 22).

6.28 In the course of its investigation, the FFM obtained an industrial chlorine cylinder retrieved from the location of the alleged chemical attack (see Figure 3 below[75]), which it was able to link to the incident.[76] The cylinder was received by the FFM on 12 April 2017[77] and has been in the custody of the OPCW ever since.

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74 FFM Report on Kafr Zeita, 1 October 2016, para. 7.58.

75 See FFM Report on Kafr Zeita, 1 October 2016, paras 7.49 and 7.50 for detailed description of the cylinder.

76 FFM Report on Kafr Zeita, 1 October 2016, para. 1.5.

77 FFM Report on Kafr Zeita, 1 October 2016, para. 7.39.

FIGURE 3: THE CYLINDER FOUND AT THE SITE OF THE INCIDENT ON 2 OCTOBER 2016

(Received by the FFM on 12 April 2017 (source of images: OPCW FFM)).

6.29 The FFM collected additional information which "made it possible to consider the cylinder as evidence" pertaining to the incident.[78] This included witness testimonies and the metadata of digital evidence gathered during the investigation.[79]

6.30 In its report, the FFM assessed that there were "reasonable grounds to believe that the chlorine cylinder" found in Kafr Zeita on 2 October 2016 "was used as a weapon."[80] The FFM concluded that the cylinder "ruptured as a result of mechanical force and released a toxic irritant substance that affects the respiratory system and mucous membranes."[81]

6.31 The IIT obtained—both from the FFM and from other sources—authenticated photographs and videos taken on the morning of 2 October 2016 showing where the cylinder had seemingly struck the ground and had come to rest below the point of impact, roughly 10 metres vertically and 16 metres horizontally.[82] The area of the incident and relevant locations were further documented in additional images received by the IIT.

6.32 As highlighted above,[83] owing to persisting security and operational challenges, the IIT was unable to deploy to the relevant sites of the incident in Kafr Zeita prior to the completion of its investigation. However, the IIT was able to access and independently assess and measure the remnant of the munition, which had been stored at OPCW premises since it was received by the FFM on 12 April 2017.

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78 FFM Report on Kafr Zeita, 1 October 2016, para. 7.40.
79 FFM Report on Kafr Zeita, 1 October 2016, paras 7.39 to 7.41.
80 FFM Report on Kafr Zeita, 1 October 2016, paras 1.11 and 8.15.
81 FFM Report on Kafr Zeita, 1 October 2016, paras 1.11 and 8.15.
82 According to IIT measurements based on satellite image analysis.
83 See "Approach and challenges in the investigation", Section 3 above.

6.33 The IIT consulted an independent munitions specialist to further inform its assessment as to whether the cylinder found in Kafr Zeita could be identified as the source of the toxic substance, if it was used as a chemical weapon and, if so, to determine the composition of the munition of which the cylinder was a part, and to make a determination as to the method of its delivery.

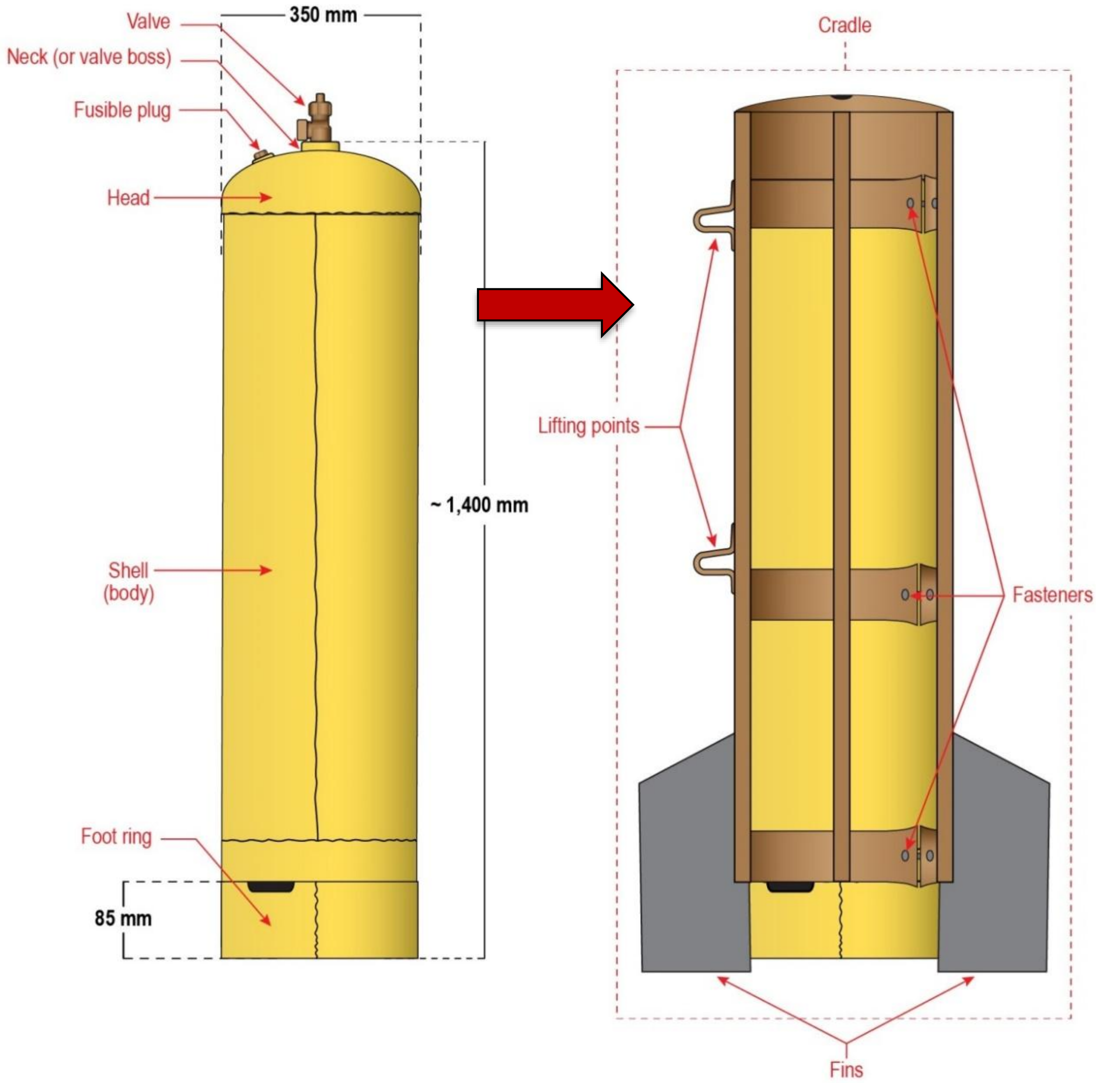
6.34 The munitions specialist independently engaged in a thorough study of imagery of the cylinder at the location where it came to rest on 1 October 2016. The specialist further assessed footage of the munition's remnants at the point of impact and surrounding areas, as well as relevant witness testimonies obtained by the FFM and the IIT. In addition, the specialist was able to directly examine and measure the cylinder found in Kafr Zeita, as it was in the custody of the OPCW at the time of the IIT investigation. The specialist further reviewed measurements taken and analytical results from samples collected by the FFM, assessments provided by other experts, and open-source materials.

6.35 Based on the aforementioned sources and materials, the munitions specialist independently assessed that the cylinder stored at OPCW premises was the same industrial gas cylinder photographed on 2 October 2016 and linked to the 1 October 2016 attack on Kafr Zeita by the FFM in its report.

6.36 The specialist confirmed that the cylinder found in Kafr Zeita formed part of a munition which had been built around an industrial gas cylinder. The latter is a pressure vessel designed to transport and store pressurised gases. It consists of a carbon steel container equipped with a valve to allow the loading and off-loading of gas. A protection cap is normally attached to the protruding valve via external threads on the cylinder's neck. This is a safety feature aimed at preventing any damage to the valve in the event that the cylinder should accidentally fall during its storage, transportation, or handling.

6.37 Figure 4 below shows the general arrangement of the industrial gas cylinder used to construct the munition found in Kafr Zeita, as well as a visual reconstruction of the complete munition, based on the available data and imagery from the incident.

FIGURE 4: GENERAL ARRANGEMENT OF THE INDUSTRIAL GAS CYLINDER AROUND WHICH THE MUNITION USED IN KAFR ZEITA WAS BUILT (LEFT), AND A HYPOTHETICAL VIEW OF A COMPLETED MUNITION BASED ON AVAILABLE DATA (RIGHT)



6.38 The cylinder retrieved in Kafr Zeita is long, relatively slender, and yellow in colour. The FFM report gives the approximate dimensions of the cylinder as 1,370 mm in length and 350 mm in diameter. This is consistent with the measurements taken by the IIT itself and, accounting for the deformation, in line with the expected dimensions for an industrial gas cylinder of this type. The dimensions of the cylinder—accounting for the deformation—are further consistent with the capacity of 130 litres marked on the cylinder's head (see Figure 7 below).

6.39 The cylinder shell is of welded construction, with a rolled body and domed top (head) and bottom (base) sections, both of which are convex. A longitudinal weld runs the length of the rolled body section, while the two domed sections have been circumferentially welded to the cylindrical body. An 85-mm foot ring (also called "base ring") has been circumferentially welded to the base to permit the cylinder to stand upright and to facilitate handling.

6.40 Much of the paint towards the top of the cylinder is visibly abraded or sheared off (see Figures 3 and 5). Where the paint is missing, the cylinder features prominent signs of corrosion, which are notably more prevalent and uniform towards the head and decrease in number and prominence towards the base. According to the munitions specialist, and as noted in previous IIT reports,[84] when a cylinder impacts a hard surface—such as rocky soil—the paint almost invariably chips off from the metal. If the cylinder is also damaged during impact, and contains a chemical payload, the escaping gas can then react with the exposed metal and corrode it. This is consistent with the corrosion observed when the cylinder was photographed on 2 October 2016. In light of the above, the munitions specialist concluded that both observed phenomena pointed to the cylinder having impacted the ground with a significant velocity and to the subsequent release of a corrosive gas from the top of the cylinder.

6.41 The cylinder's head incorporates a neck of 60 mm in diameter, which is threaded internally to accept a valve, and externally to accept a valve cap. A red-coloured brass remnant of the valve is indeed visible inside the neck in photos taken on 2 October 2016, although the top part of the valve was missing. The valve's brass remnant was still in place when the cylinder was obtained by the FFM[85] and by the time of examination of the cylinder by the IIT.[86]

6.42 However, no valve protection cap is visible from the images taken at the scene. Furthermore, no damage is visible on the external threads, as would have been expected had the cylinder impacted with a valve protection cap attached. As noted in previous IIT reports, the lack of a valve protection cap would facilitate the release of the contents of the cylinder, which provides an indication of its intentional weaponisation.

FIGURE 5: IMAGE OF THE REMNANT OF THE BRASS VALVE INSIDE THE NECK OF THE CYLINDER TAKEN BY FIRST RESPONDERS ON 2 OCTOBER 2016 AND AUTHENTICATED BY THE IIT

84 See, for example, Third IIT Report, para. 6.156.
85 Namely, on 12 April 2017, see FFM Report on Kafr Zeita, 1 October 2016, paras 7.29 and 7.53.
86 Namely, on 30 May 2024.

6.43 The head of the cylinder shell is also perforated to accept an additional threaded port measuring 40 mm in diameter. This port is closed with a fusible plug,[87] with a distinctive bimetallic construction as visible in Figure 6, which presents a view from the inside of the cylinder head. Independent experts consulted by the IIT confirmed that a fusible plug of this type is a safety feature most often present on containers designed to store explosive or corrosive gases.

FIGURE 6: THE FUSIBLE PLUG AS SEEN FROM THE INSIDE OF THE CYLINDER HEAD, WITH ITS DISTINCTIVE BIMETALLIC CONSTRUCTION VISIBLE

(Source: OPCW IIT)

6.44 The recovered cylinder featured a number of markings stamped into the cylinder's head (see Figures 7 and 8), showing that the cylinder was manufactured in 2001 to store pressurised chlorine gas. The markings identified on the cylinder are illustrated in Figure 7 and reproduced in the illustration further below.

87 A fusible plug is a type of pressure-relief device that relies upon a low-melting-point metal which liquefies at a given temperature, resulting in a controlled release of a pressure vessel's contents when the specified temperature is reached. This is contained within a hollow alloy body that is can be fitted to a pressure vessel (The Chlorine Institute, 2023b, Packaging Plant Safety and Operation Guidelines. Pamphlet 17, 6th ed, page 54).

FIGURE 7: MARKINGS ON THE HEAD OF THE RECOVERED CYLINDER

FIGURE 8: ILLUSTRATION RECONSTRUCTING THE APPROXIMATE POSITION OF THE MARKINGS ON THE HEAD OF THE RECOVERED CYLINDER

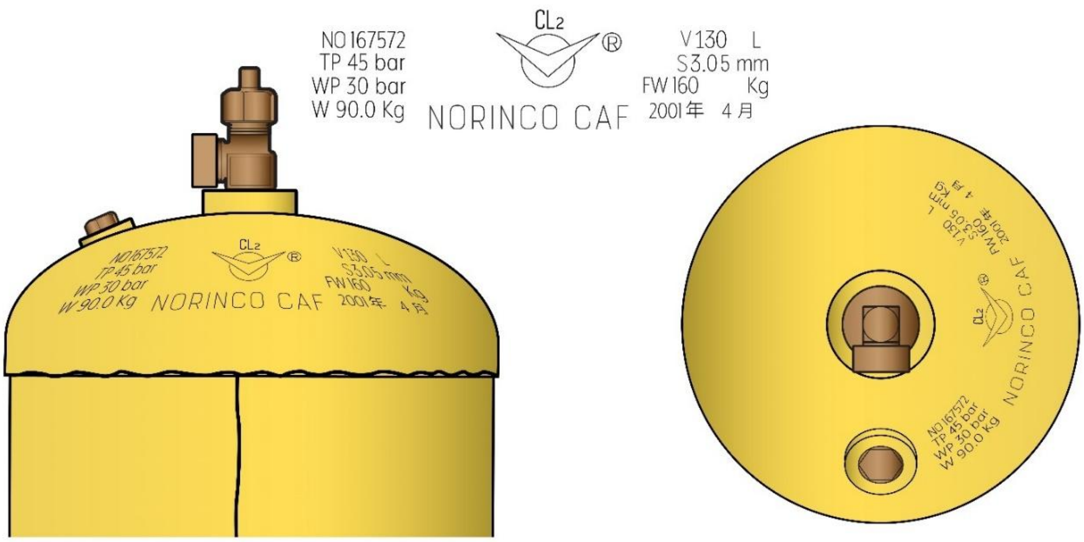


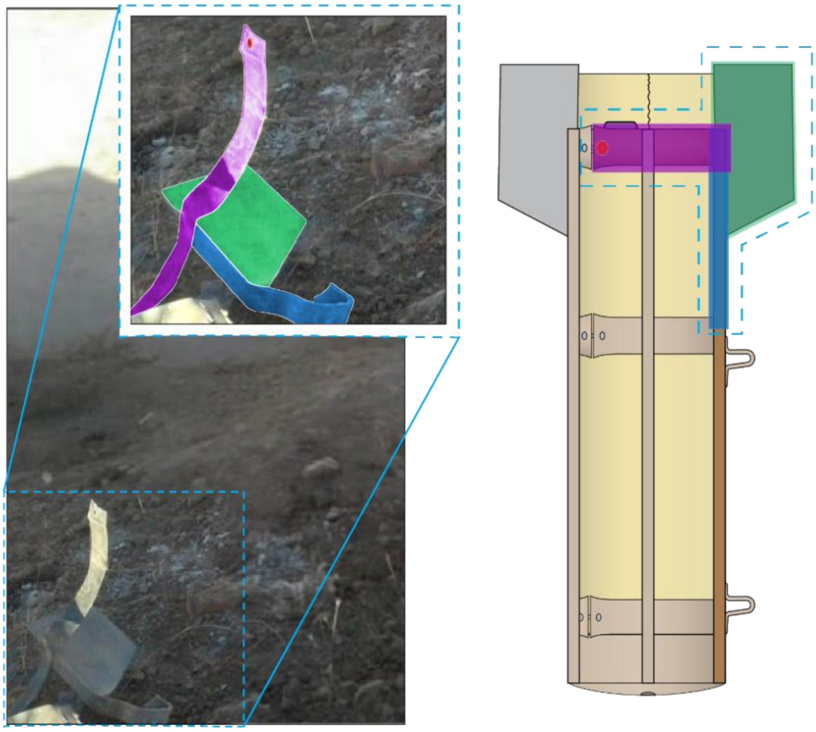
TABLE 1: LIST OF ALL MARKINGS ON THE HEAD OF THE RECOVERED CYLINDER AND INTERPRETATION BY THE IIT BASED ON INDUSTRIAL STANDARDS

Marking	Interpretation by the Munitions Specialist
CL_2	Contents (chlorine gas)
N0167572	Identifying number
TP 45 bar	Hydraulic test pressure
WP 30 bar	Nominal working pressure
W 90.0Kg	Weight
V 130 L	Water capacity (volume)
S 3.05mm	Design wall thickness[88]
FW 160Kg	Chlorine capacity (fill weight)
2001 年	Year of manufacture
4 月	Month of manufacture
NORINCO	Brand name (China North Industries Corporation)
CAF	Manufacturer name (Changzhou Aircraft Manufacturing Co., Ltd.)
	Manufacturer logo (Changzhou Aircraft Manufacturing Co., Ltd)

6.45 Metal remnants can be seen in footage taken near the point of impact on the day following the incident (see Figure 9). Based on the design characteristics of the remnants, their deformation, and their position near the impact location, the munitions specialist consulted by the IIT determined that the remnants were part of a cradle originally attached to the cylinder.

88 The IIT notes that, according to its measurements, the actual thickness was approximately 6 mm.

FIGURE 9: METAL REMNANTS PHOTOGRAPHED NEAR THE ALLEGED POINT OF IMPACT OF THE CYLINDER ON 2 OCTOBER 2016 AS WELL AS PHOTOGRAMMETRIC RECONSTRUCTION ILLUSTRATING THE PHOTOGRAPHED REMNANTS AS PART OF A COMPLETE CHEMICAL WEAPONS IMPROVISED AIR-DELIVERED MUNITION (IADM)



(Image edited for clarity)

6.46 Based on visual and photogrammetric analysis (Figure 9), the remnants of the cradle documented in Kafr Zeita consisted of one stabilising fin (attached to part of a longitudinal strap) and of a circumferential steel strap. These steel straps would have secured the cradle to the cylinder (with the hole marked in red in Figure 9 pointing to the presence of a fastener). The fin (together with two others not shown in Figure 9 above) would have improved the aerodynamic characteristics of the munition and facilitated its nose-down orientation, when air-delivered. As highlighted in previous IIT reports, nose-first impact is particularly beneficial when the munition is intended to be used as a chemical weapon, as it provides a greater chance of the pressurised cylinder being damaged and releasing its chemical payload. Statements and rough sketches provided by three witnesses present at Kafr Zeita shortly after the impact specifically confirmed the presence of fins. The IIT assesses that the crude cradle was likely separated from the munition during impact and a solid steel disc ("nose cap") was fitted to the cylinder to enclose its head.[89] This assessment is based on the pronounced deep semi-circular indentation and on the original curvature still visible on the cylinder's head. Such a nose cap would further shift the munition's centre of gravity towards the front, increasing the likelihood of a nose-first impact and of the cylinder rupturing.[90]

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89 See "Assessment of remnants" subsection above.

90 See Third IIT Report, para. 6.186.

FIGURE 10: BASE OF THE RECOVERED CYLINDER

6.47 The munitions specialist consulted by the IIT noted that the cylinder's base lacked any signs of modification or indication that a rocket motor was attached to it (see Figure 10 above), and the munition was significantly larger than the improvised rocket-assisted munitions (IRAMs) whose use was documented in the Syrian context during the relevant time frame. Furthermore, for the cylinder to be delivered by an artillery piece, the design of the munition—a metal cradle with fixed fins and a nose cap attached to an industrial gas cylinder—would have required a tube of a calibre at least 5 to 10 times larger than modern mobile field artillery, and much larger than comparable weapons known to be used in the conflict in the Syrian Arab Republic. A weapon of these dimensions would be highly impracticable, and the IIT obtained no evidence of its existence.[91] Therefore, the munitions specialist concluded that the cylinder found in Kafr Zeita was not fired by a surface-to-surface weapon.

6.48 The munitions specialist's technical assessment as a whole indicates that the cylinder retrieved from Kafr Zeita on 2 October 2016 contained a corrosive pressurised gas and formed part of a munition that had been used as a chemical weapon. The munition consisted of an industrial gas cylinder strapped into an improvised cradle with stabilising fins and fitted with a nose cap. The IIT assesses that these attachments served to improve the aerodynamic stability of the munition while in the air, thus increasing its chance of impacting nose-first. Based on the design of the munition, the munitions specialist consulted by the IIT ruled out that the cylinder had been delivered via a surface-to-surface weapon. Having ruled out this hypothesis, the IIT focused its investigative efforts on two residual scenarios, that is, that the munition was delivered by aircraft or that it was manually deployed at the scene of the attack.

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91 See Third IIT Report, paras 6.175 to 6.178.

Chemical analyses

6.49 As noted in the previous Section, in the course of its investigation the FFM obtained an "industrial chlorine cylinder retrieved from the location of the incident."[92]

6.50 As also noted above, the FFM determined in its report that all the information it obtained and analysed provided "reasonable grounds to believe that the chlorine cylinder was used as a weapon" in the attack carried out on 1 October 2016 in Kafr Zeita,[93] and that "the cylinder […] released a toxic irritant substance that affects the respiratory system and mucous membranes."[94]

6.51 Chlorine has many uses—for water purification, as a disinfectant or a bleaching agent, and for the manufacture of many products, including antiseptics, paints, plastics, pharmaceuticals, textiles, and solvents. It is traded as compressed, liquefied gas, stored in pressurised industrial gas cylinders, such as the one retrieved in Kafr Zeita at the location of the incident.

6.52 Chlorine gas is a highly reactive and toxic gas with oxidative properties. It has a density 2.5 times higher than air, causing it to sink to low-lying areas once released.[95]

6.53 Chlorine gas, hypochlorous acid (HOCl) and sodium hypochlorite (NaOCl) (including bleach) are all species of reactive chlorine, and they are easily interchangeable. If chlorine gas is dissolved in water or moist air, it will react to produce HOCl and hydrochloric acid ($HCl_{(aq)}$).[96] If chlorine gas is dissolved in aqueous sodium hydroxide (NaOH, that is, caustic soda), NaOCl, which is the active ingredient in bleach, will form.

6.54 Reactive chlorine species are very strong oxidation agents. They will degrade other chemicals in the environment by oxidation and thereby discolour their surface. If chlorine gas is released into air, the combined effect of the oxidative agent HOCl and the strong acid $HCl_{(aq)}$ will have a marked corrosive effect, especially on metals.[97] This explains why chlorine gas can be stored only in carbon steel cylinders in its dry, pure form, since moist chlorine would have too strong a corrosive effect on such cylinders. When chlorine gas (Cl_2) acts as an oxidative agent, chloride ions ($2Cl^-$) are formed as its final degradation product.

6.55 Both chlorine gas and bleach have the capacity to react with organic molecules in the environment to produce their chlorinated analogues. However, chlorine gas has higher chlorination reactivity than sodium hypochlorite (the active ingredient in bleach).[98]

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92 See FFM Report on Kafr Zeita, 1 October 2016, para. 1.5.

93 See FFM Report on Kafr Zeita, 1 October 2016, paras 1.11 and 8.15.

94 Ibid.

95 See Third IIT Report, para. 6.30.

96 Ibid.

97 See Nickel Institute, "Alloy selection for service in chlorine, hydrogen chloride and hydrochloric acid", Report No 10020, (2022), available online at: https://nickelinstitute.org/media/8da1c603db456db/hydrochloricacid-hydrogenchlorine-chlorine_10020.pdf

98 See, for example, J.D. Sievey and A. L. Roberts, "Assessing the reactivity of free chlorine constituents Cl_2, Cl_2O and HOCl towards aromatic ethers", vol. 46, issue 4, *Environmental Science & Technology* (2012) 2141; M. Nunez-Gaytan et al., "Speciation and transformational pathways of chlorophenols formed from chlorination of phenol at trace level concentrations", vol. 45 Journal of Environmental Science and Health, *Part A* (2018) 1217.

6.56 Furthermore, unlike sodium hypochlorite, chlorine gas is fat-soluble, which allows it to dissolve into materials with a fatty character (such as plastic and dried paint), resulting in the chlorination of suitable organic molecules therein.

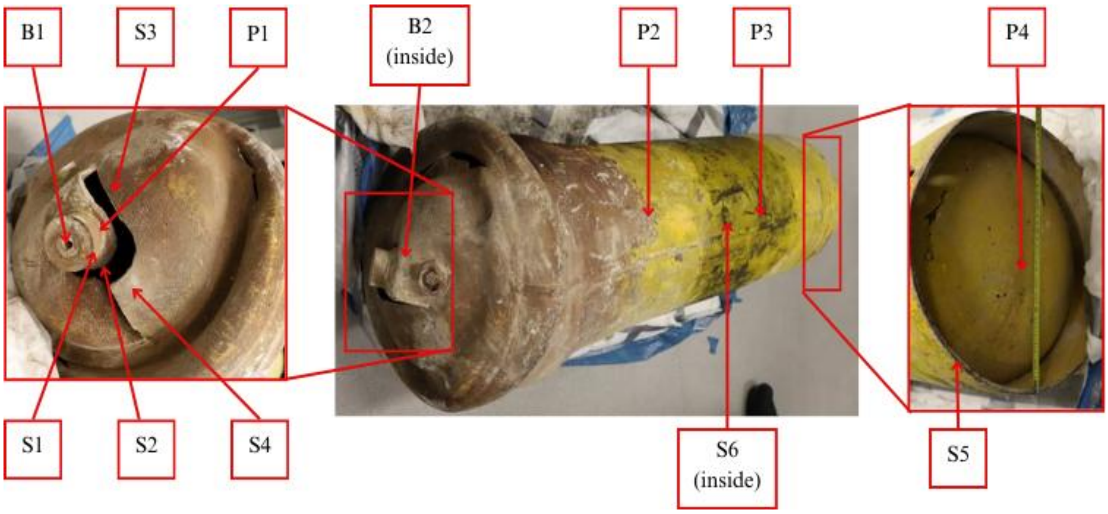
6.57 The IIT undertook a number of steps to clarify and deepen its understanding of the findings of the FFM and expand upon them.

6.58 To do so, the IIT assessed relevant analytical chemistry data underlying the FFM report, as provided by the two OPCW designated laboratories used by the FFM to analyse the samples collected.

6.59 The IIT engaged a leading chemist with specific expertise in the analysis of chlorine markers (not previously involved in the analysis, assessment, and interpretation of samples from Kafr Zeita) as an expert to assist the investigation in relation to the results of sample analyses and their significance. The expert researched relevant scientific literature, reviewed FFM and IIT witness statements and relevant videos and pictures, and consulted other chemists and specialists, as appropriate.

6.60 The IIT performed additional chemical sampling and analyses of the cylinder retrieved from the location of the incident in Kafr Zeita and subsequently obtained by the FFM. In total, 12 additional samples were collected from the cylinder, including 6 samples of corrosion on the cylinder's inner and outer steel surfaces, 4 samples of alkyd paint from the cylinder's body, and 2 samples from a brass valve remnant found in the cylinder's neck (see Figure 11 below).[99]

FIGURE 11: SAMPLING POSITIONS ON THE GAS CYLINDER OF SIX STEEL CORROSION SAMPLES (S1-S6), FOUR PAINT SAMPLES (P1-P4), AND TWO BRASS SAMPLES (B1, B2)



(Note that the positions for the inside sampling of steel corrosion (S6) and brass (B2) are not visible in the images)

[99] The samples were taken on 29 and 30 October 2024.

Chloride concentrations in corrosion inside the cylinder

6.61 To deepen its understanding of the finding of the FFM that a "chlorine cylinder was used as a weapon"[100] in Kafr Zeita, releasing "a toxic irritant substance that affects the respiratory system and mucous membranes,"[101] the IIT focused its initial efforts on the chemical analysis of two samples (S6 and B2) collected from the inside of the cylinder.

6.62 Two OPCW designated laboratories independently measured a high chloride concentration
(2.9 mg/g) in a steel corrosion sample from inside the cylinder (see Figure 11, sample S6). Chlorine gas, in its pure (that is, dry) state, is not prone to reacting with metals. When condensed chlorine gas is stored in steel cylinders, the reaction between the gas and the iron metal forms a passive layer of solid ferric chloride ($FeCl_3$); this is consistent with the findings of the OPCW designated laboratories.[102]

6.63 This conclusion was further corroborated by the measurement of a high chloride concentration in the corrosion of the inner brass remnant (sample B2).[103]

6.64 Thus, the analytical data as a whole confirms that the cylinder indeed contained chlorine gas as indicated, inter alia, by its markings.[104]

Chloride gradient from the top of the gas cylinder

6.65 In addition, the FFM reported significant, visible corrosion at the top of the gas cylinder.[105] This is consistent with the release of chlorine gas and its subsequent reaction with moisture in the air.[106] This would have exposed the top of the cylinder (and notably those areas where the protective paint had abraded as a result of the cylinder's impact on the ground) to a very corrosive mixture of hypochlorous acid (HOCl) and hydrochloric acid (HCl(aq)). This corrosion—which occurred relatively rapidly over the span of around one day—further supports the conclusion that the gas cylinder contained a payload of corrosive chemical.

6.66 Two OPCW designated laboratories analysed five authentic corrosion samples collected from the gas cylinder retrieved in Kafr Zeita: four samples were collected from the top of the cylinder (see Figure 11, samples S1-S4), and one from its base ring (see Figure 11, sample S5).

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100 See FFM Report on Kafr Zeita, 1 October 2016, paras 1.11 and 8.15.
101 Ibid.
102 P. C. Westen, "The Safe Use of Steel and Titanium in Chlorine". In: R. W Curry (ed.), vol. 6. Modern Chlor-Alkali Technology (1995), 62.
103 See "Dezincification of the cylinder's brass valve remnant" subsection below.
104 See "Assessment of remnants" subsection above.
105 See FFM Report on Kafr Zeita, 1 October 2016, para. 7.48 and Figures 7 and 8.
106 See, for example, Third IIT Report, paras 6.143, 6.156 and 6.155; Nickel institute (2022), op. cit.

6.67 High chloride concentrations (1.4 and 1.9 mg/g)[107] were measured by ion chromatography (IC) in two corrosion samples from the cylinder's neck (see Figure 11, samples S1 and S2). Lower chloride concentrations (0.2 and 0.3 mg/g respectively in two different samples) were measured in the corrosion sampled on the cylinder's body (see Figure 11, samples S3 and S4), while a concentration level of 0.6 mg/g was measured in the corrosion on the edge of the cylinder's base ring (see Figure 11, samples S5).

6.68 This analytical data shows that the chloride concentration in the corrosion of the cylinder's neck is seven times higher than the one found in the corrosion of the body. This is consistent with a stream of liquefied chlorine gas flowing out of the cylinder. The expanding gas would expose the cylinder's neck to higher chlorine concentrations than the cylinder's body. This explanation is also consistent with the fact that such high chloride concentration levels are normally not found in steel corrosion (that is, rust) occurring in rural, non-coastal areas.[108]

<u>A marker for exposure to reactive chlorine in alkyd paint</u>

6.69 By performing nuclear magnetic resonance analysis, the IIT was able to determine that the yellow Kafr Zeita gas cylinder was painted with alkyd paint.[109] This class of paint has a chemical structure that includes unsaturated fatty acids,[110] being targets for the chlorinating action of chlorine gas.[111]

6.70 In the framework of its investigation, the IIT commissioned research aimed at identifying chemical markers for exposure of alkyd paint to chlorine gas, and at developing analytical methods for their analysis. As a result, the chlorinated fatty acid 9,10-dichlorooctadecanoic acid (DCOA) was identified as a marker for chemical exposure to reactive chlorine.[112]

6.71 Following the method's development and validation, two OPCW designated laboratories verified the presence of DCOA in an authentic alkyd paint sample P1, collected at the base of the gas cylinder's neck (see Figure 11, sample P1).

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107 In rural, non-coastal climates (such as in Kafr Zeita), steel corrosion has a chloride concentration close to zero when occurring in natural conditions, see, for example, Steel Construction Info, *"Corrosion of structural steel"*, available at: <u>https://www.steelconstruction.info/Corrosion_of_structural steel</u>

108 Ibid.

109 Cf. G. Bartolozzi et al., "Chemical curing in alkyd paints: An evaluation using FR-IR and NMR spectroscopies". vol. 118 *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* (2014), 520.

110 Ibid.

111 See W.I. Lyness and F.W. Quackenbush, "Addition of chlorine to unsaturated fatty acids and esters", vol. 32, issue 10, *Journal of American Oil Chemists Society*, (1955) 520.

112 The DCOA is integrated into the chlorinated paint matrix and two different methods were developed for its chemical derivatisation and release from the paint matrix.

6.72 This data confirms the exposure of the gas cylinder's paint to reactive chlorine. In particular, measurements of the relative concentration of DCOA performed by one OPCW designated laboratory show that sample P1, contained a significant,[113] 21 times higher, concentration level of DCOA as compared to the one found in sample P2, which was collected from the cylinder's body (see Figure 11, samples P1 and P2). All three samples collected along the cylinder's body contained comparable relative concentration levels of DCOA (see Figure 11, samples P2-P4).

6.73 The identification of DCOA in the paint of the Kafr Zeita gas cylinder provides strong evidence of the latter's exposure to reactive chlorine. Furthermore, considered together, the respective concentration values of chloride in steel corrosion and DCOA in alkyd paint point to a decreasing exposure gradient from the cylinder's neck to the cylinder's body.[114] This further points to the release of chlorine gas from the ruptures at the top of the cylinder.[115]

Dezincification of the cylinder's brass valve remnant

6.74 The FFM reported that "the top part of the cylinder's gas valve is visibly missing"[116] from the photographs from the morning after the incident when the cylinder was found. However, a remnant of the brass valve's body was still present in the cylinder's neck and its inner and outer sections were sampled separately by the IIT (see Figure 11, samples B1 and B2). Measurements with inductive coupled plasma-mass spectrometry (ICP-MS) performed by two OPCW designated laboratories show that the valve was made of yellow brass, which is an alloy of copper and zinc. This was further confirmed through energy-dispersive spectroscopy, as performed for the IIT by a national forensic laboratory.

6.75 Images of the cylinder taken approximately 15 hours after the incident show a red-brown colour on the rupture surface of the brass remnant (see, for example, Figure 12(A) below). The chemistry expert consulted by the IIT considered the hypothesis that the change in colour could have resulted from the dezincification of the brass fracture's surface. This is an oxidative chemical reaction which, by removing the zinc from the yellow brass alloy, would have caused the enrichment of red copper on top of the yellow brass, and thus the red-brown coloration.[117]

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113 Significance level of $p<0.05$ (T-test, two-tailed, equal variance). Relative quantification based on the 9,10-Octadecanoic acid/Octadecanoic acid–peak area ratio.

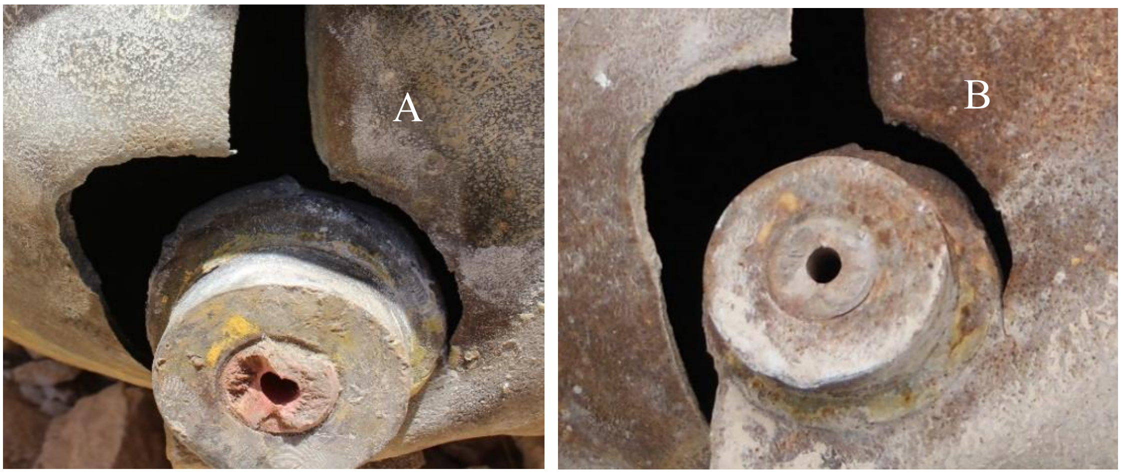
114 Over a distance of approximately 10 cm from the cylinder's neck to the sampling points of samples S3 and S4, a seven-fold drop in chloride concentration in steel corrosion was found. From the cylinder's neck to a sampling point approximately 60 cm away, the DCOA levels in paint dropped 21-fold.

115 The concentration gradients of chloride ions and DCOA did not decrease further down along the cylinder's body. This is consistent with the assessment of both the FFM and the IIT that, following its initial impact, the cylinder tumbled approximately 13 metres down a slope before coming to rest. Such a movement would have prevented the formation of a well-defined chlorine gas concentration gradient further away from the point of release.

116 See FFM Report on Kafr Zeita, 1 October 2016, para. 7.53 and Annex 6 thereto entitled "Comparison of the Photographs of the Cylinder Taken by the FFM with Photos and Videos Received by the FFM and Taken at the Incident Location".

117 See, "Preventing and Treating the Dezincification of Brass – Canadian Conservation Institute (CCI) Notes 9/13", available online at: https://publications.gc.ca/collections/collection_2019/pch/NM95-57-9-13-2019-eng.pdf (visited on 15 January 2025).

FIGURE 12: COLOUR OF THE SURFACE OF THE BRASS FRACTURE ON 2 OCTOBER 2016 (A) AND 12 APRIL 2017 (B)



6.76 To test this hypothesis, the same national forensic laboratory mentioned above analysed the composition of different layers of the corroded brass, also using energy-dispersive spectroscopy. An almost pure copper layer depleted of its zinc content was detected on the corroded surface of both yellow brass samples, under a white layer of zinc chloride and zinc oxide (see Figure 12(B) above). A brass reference material exposed to chlorine gas displayed a similar enriched copper layer (see Table 2 below).

6.77 This strongly indicates that the dezincification of the brass alloy was the cause of the red-brown colour observed on the cylinder's brass remnant on the day after the incident.[118]

TABLE 2: COPPER CONTENT IN ENRICHED LAYER OF THE YELLOW BRASS REMNANT FROM THE CYLINDER'S NECK AS COMPARED TO CHLORINE GAS-EXPOSED YELLOW BRASS REFERENCE MATERIAL

Sample	Copper (%)	Zinc (%)
Bulk (from cut surfaces)	62.0 ± 0.8	36.4 ± 1.1
Inside surface	95.9 ± 0.0	2.9 ± 0.4
Outside surface	94.2 ± 1.4	4.6 ± 1.2
Reference brass exposed to chlorine gas	90.22 ± 2.40	9.06 ± 2.32

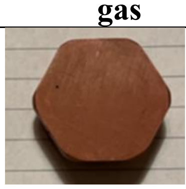
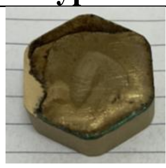
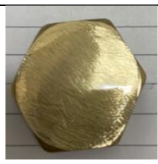
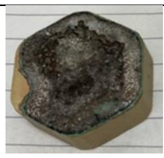
6.78 When dezincification of yellow brass occurs, it leads to the enrichment of copper on the brass's surface (which, in turn, results in the colour of the brass turning from yellow to red-brown). In parallel, a corrosion layer enriched with zinc is formed on top of the brass surface.

118 The results are in line with relevant scientific literature; see, for example, F. M. Al Kharafi, I. M. Ghayad and R. M. Abdullah, "Effect of chlorine gas bubbling on the dezincification of brass in acidified sodium sulfate solution", vol. 67. Issue 11, *Corrosion* (2011) 115002-2-6.

6.79 This process is illustrated by the analysis of the corrosion layers of the brass remnant (both on the inner and outer side) as performed by two OPCW designated laboratories. The high concentration ratios of zinc/copper ions (Zn^{2+}/Cu^{2+})[119] and the concentration levels of chloride ions (Cl^{-})[120] found in both corrosion samples analysed provide further evidence that the dezincification of the brass valve remnant was caused by an exposure to chlorine gas, rather than to another oxidative chemical species. A six-fold higher chloride concentration level was quantified in the corrosion of the inner—as compared to the outer—side of the brass remnant, in agreement with a long-term storage of dry chlorine gas in the gas cylinder.

6.80 Finally, in experiments performed by a national forensic laboratory, a similar red-brown colour was observed when yellow brass[121] (see Figure 13(A) below), was exposed to concentrated chlorine gas for 30 minutes (see Figure 13(B) below), confirming it as a powerful brass dezincification agent. When experiments were conducted on brass using sodium hypochlorite (the active ingredient in bleach), they resulted in a black-green discoloration of the brass[122] (see Figure 13(C) below), while exposure to hydrochloric acid only induced a limited brown discoloration within 24 hours (see Figure 13(D) below). This data further confirms that only exposure to chlorine gas would produce discoloration compatible with that visible on the brass remnant of the Kafr Zeita cylinder.

FIGURE 13: COMPARATIVE STUDY OF COLOUR CHANGE OF YELLOW BRASS (A) IF EXPOSED TO: (B) CHLORINE GAS; (C) SODIUM HYPOCHLORITE; (D) HYDROCHLORIC ACID, USING 30-MINUTE AND 24-HOUR EXPOSURE TIMES, RESPECTIVELY

Time/Exposure	(A) Control yellow brass	(B) Chlorine gas	(C) Sodium hypochlorite	(D) Hydrochloric acid
30 minutes				
24 hours				

119 Enriched zinc/copper ion concentration ratios of 240 and 15 were found in aqueous corrosion extracts of the inner and outer brass samples, respectively, giving rise to a 16-fold difference (analysed using ICP-MS).

120 Enriched chloride ion concentrations of 21 and 3.4 μg/mL were found in aqueous corrosion extracts of the inner and outer brass samples, respectively, giving rise to a six-fold difference (analysed by IC).

121 A reference material of yellow brass with a composition of 56% copper, 39% zinc, 2.4% lead, 0.6% trace elements (analysed by ICP-MS). The composition was similar to the authentic brass remnant.

122 See A. M. Shams El Din and F. M. Abd El Wahab, “The behavior of Copper-Zinc alloys in alkaline solutions upon alternate anodic and cathodic polarization”, vol. 17, *Corrosion Sciences* (1977) 49.

6.81 These results point towards exposure to chlorine gas as the cause of the red-brown colour of the brass valve remnant on the cylinder. At the same time, the results of the experiments performed during the course of the IIT investigation rule out sodium hypochlorite (that is, bleach) and hydrochloric acid as the chemical species causing the observed colour change.

6.82 The concurrence of analytical data relating to the copper layer on the brass remnant and to the concentration levels of both zinc and chloride ions in its corrosion, conclusively point to the dezincification of the valve remnant as a result of chlorine gas exposure.

Assessment of "staging" hypotheses based on chemical data

6.83 During the course of its investigation, the IIT considered two additional scenarios, both of which would have entailed the fabrication of the chemical evidence found at the scene in Kafr Zeita to mimic a chlorine gas attack.

6.84 The first scenario would have required bringing an empty chlorine cylinder, used for commercial purposes, to the site of the incident in order to stage a chlorine attack. For this to happen, the ruptures and overall deformation on the cylinder would have had to be created deliberately. Additionally, the use of explosives to this end can be ruled out, since no traces of explosives were found by the FFM on the cylinder.[123]

6.85 Furthermore, the chemical markers identified as a result of the IIT investigation weave in a complex pattern which cannot be formed by any single chemical other than chlorine gas. Therefore, implementing such a staging operation would have required, at a minimum, a well-trained team of highly skilled chemical experts using multiple chemical agents to produce the chemical markers detected at the scene, and in the same gradient. The IIT did not obtain or find any evidence that such activities were performed in connection with the incident, and thus assessed this hypothesis as highly unlikely.

6.86 In a second staging hypothesis considered by the IIT, a chlorine gas cylinder previously used as a weapon would have been placed at the scene.

6.87 As recalled above, a red-brown surface is clearly visible on the remnant of the brass gas valve in pictures of the cylinder taken approximately 15 hours after the incident (see Figure 12(A) above). However, pictures of the cylinder taken seven months after it was found document how the red-brown brass surface gets covered by a prominent corrosion layer over time (see Figure 12(B) above).

6.88 Images related to a subsequent incident of use of chlorine gas as a weapon that occurred in Saraqib (Idlib Governorate, the Syrian Arab Republic) on 4 February 2018[124] clearly show how rapidly a brass surface exposed to chlorine gas oxidises. A comparison between a photograph taken in Saraqib less than 12 hours after the chemical incident[125] (Figure 14(A)) and a photograph of the same cylinder taken by the FFM 14 days later[126] (Figure 14(B)) illustrates that a visible change would occur in a brass surface within days following its exposure to chlorine gas.

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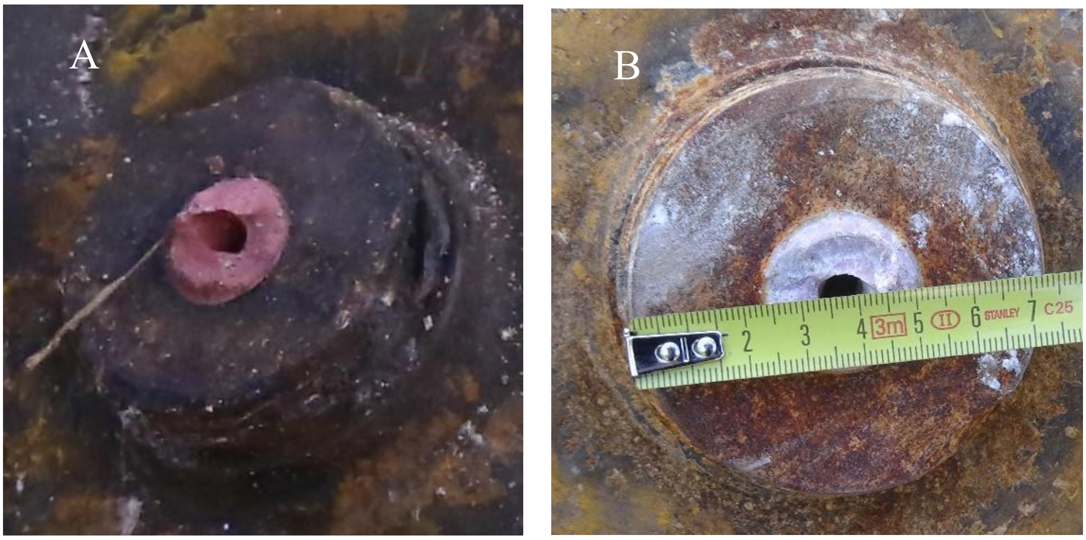
123 See FFM Report on Kafr Zeita, 1 October 2016, para. 7.72.

124 Also investigated by both the OPCW FFM and IIT, see FFM Report on Saraqib and Second IIT Report, both on the 4 February 2018 incident.

125 That is, on 5 February 2018 at 06:47; see Second IIT Report, 4 February 2018, para. 6.21.

126 That is, on 19 February 2018.

FIGURE 14: COLOUR OF THE BRASS FRACTURE'S SURFACE OF THE CHLORINE CYLINDER USED IN THE 4 FEBRUARY 2018 CHEMICAL ATTACK IN SARAQIB



(A: Photographed on 5 February 2018 less than 12 hours after the incident; and B: 14 days later, on 19 February 2018).

6.89 The vivid red-brown colour displayed by the valve remnant of the Kafr Zeita cylinder in the immediate aftermath of the incident (as opposed to the white-grey coloration normally associated with brass corrosion) indicates that the cylinder had only recently been exposed to chlorine gas. Based on the information available to the IIT, no other alleged chlorine attack involving gas cylinders had been reported in the vicinity of Kafr Zeita during a time frame consistent with the colour observed on the valve remnant at the time the cylinder was found. Therefore, the IIT assessed that a staging scenario in which a chlorine gas cylinder previously used as a chemical weapon elsewhere would have been placed at the scene of the Kafr Zeita incident could confidently be ruled out.

Conclusions regarding the chemistry-related aspects of the Kafr Zeita incident

6.90 In the course of the IIT investigation, a comprehensive set of chemical data was acquired in relation to the gas cylinder used in Kafr Zeita on 1 October 2016.

6.91 All the 12 samples collected from the cylinder contained chemical markers consistent with exposure to chlorine gas. In particular, the corrosion found within the cylinder had a significant chloride content, as would be expected in a canister used for chlorine gas storage. This points towards identification of the "toxic irritant" reported by the FFM as chlorine gas.

6.92 Furthermore, the extensive steel corrosion on the cylinder's surface points to the release of chlorine gas from its top, as supported by the high concentration of chloride ions in the corrosion. This conclusion is further supported by the identification of the chlorinated fatty acid (DCOA) in the cylinder's paint, confirming its exposure to a species of reactive chlorine.[127]

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127 In particular, either chlorine gas or NaOCl (the active ingredient in bleach).

6.93 Taken together, the levels of chloride in the steel corrosion of the cylinder and of DCOA in its paint point to a gradient of exposure consistent with the release of chlorine gas from the top of the cylinder.

6.94 The formation of an enriched copper layer explains the red-brown discoloration of the fracture's surface of the brass remnant in the cylinder's neck. The layer resulted from the dezincification of the yellow brass (as verified by the IIT through different analytical techniques). This chemical phenomenon is a signature of chlorine gas, which further supports the finding chlorine gas was released from the cylinder.

6.95 Finally, the results of experiments commissioned by the IIT show that the red-brown discoloration of the brass remnant could not have resulted from bleach exposure, leaving exposure to chlorine gas as the only plausible explanation for such discoloration.

6.96 In summary, based on the pattern of chemical markers identified in the 12 samples collected and analysed during its investigation, the IIT has reasonable grounds to believe that a cylinder filled with chlorine gas was used as a chemical weapon in Kafr Zeita on 1 October 2016.

6.97 The IIT thoroughly considered two alternative scenarios—both entailing the staging of the chemical attack—and concluded that the pattern of chemical markers found on the gas cylinder could not be explained by any scenario other than the use of chlorine gas as a weapon.

Symptoms of affected persons

6.98 Chlorine is a toxic chemical with low persistency and a variable rate of action. While chlorine has several legitimate uses, gaseous chlorine is considered to be poisonous and is classified as a pulmonary irritant. The determination of its toxicity is dependent on the duration and dose of exposure. As noted above,[128] chlorine gas is typically 2.5 times heavier than air, and therefore, following dispersion, tends to accumulate in low-lying areas.

6.99 Exposure to chlorine gas acts upon multiple body systems: the skin and mucous membranes, the gastrointestinal tract, and the respiratory system, where it is absorbed into the lungs. When chlorine makes contact with mucosal surfaces in the nasal, tracheal, and respiratory areas, moisture from those surfaces leads to the formation of a highly oxidative mixture of hypocholorous and hydrochloric acids.[129] Thus, chlorine gas inhalation causes an acute lung injury characterised by pulmonary oedema, pneumonitis, and hyper-reactive airways dysfunction syndrome (RADS).[130]

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128 See "Chemical analyses" subsection above.

129 See, for example, Fifi N.M Elwekeel, Xinguang Cui, Antar M.M Abdala, "Effects of chlorine particle concentration on the human airway", in *Journal of Nanoparticle Research*, vol. 24, article 105 (May 2022) in National Library of Medicine, available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9119845/; A. Morim, G. T. Guldner (eds), "Chlorine Gas Toxicity", National Library of Medicine, (last updated on 27 June 2022), available at: https://www.ncbi.nlm.nih.gov/books/NBK537213/

130 See, for example, C. Lemiere, J. L. Malo, M. Boutet, "Reactive airways dysfunction syndrome due to chlorine: sequential bronchial biopsies and functional assessment", in M. Eur. Respir. J., vol. 10(1), (1997), pp. 241-244.; J. G. Williams, "Inhalation of chlorine gas", in Postgrad. Med. J., vol. 73(865), (1997), pp. 697-700.; R. B. Evans, "Chlorine: State of the art", in Lung, vol. 183(3), (2005), pp. 151-176.; C. W. White, and J. G. Martin, in Proc. Am Thorac. Soc., vol. 7, (2010), pp. 257-263.; S. M. Brooks, M. A. Weiss, and I. L. Bernstein, "Reactive airways dysfunction syndrome (RADS). Persistent asthma syndrome after high levels irritant exposures", in *Chest*, vol. 88(3), (1985), pp. 376-384.

6.100 The concentration of the toxic chemical and the length of exposure to it are key determining factors in the symptoms experienced by an individual exposed to chlorine gas.[131]

6.101 For the purposes of its investigation, the IIT assessed the accounts it gathered from victims, medical personnel, and first responders, the symptoms they described, the communications of the “spotters”[132,133] as well as the medical records and treatments of casualties.

6.102 The IIT requested a team of two toxicology experts not involved in previous assessments of the incident to make their own independent evaluation of the reported symptoms. To minimise possible bias and protect confidentiality, the IIT provided the experts with anonymised accounts and data from 28 individuals interviewed by either the FFM or the IIT, including affected persons and others who were present at the scene or were otherwise involved in the rescue operations in the aftermath of the incident.

6.103 Both experts consulted by the IIT reviewed the FFM Report on Kafr Zeita, 1 October 2016, as well as videos, photographs, anonymised information provided by witnesses—including medical personnel—on the symptoms and treatment of the affected persons involved in the incident, and medical records. Following the review of relevant materials and medical literature, the toxicologists assessed each account against the symptoms that could be expected from chlorine exposure.

The incident in Kafr Zeita

6.104 Witnesses recounted to the IIT that, shortly after they had finished their sunset prayer on 1 October 2016, approximately between 19:00 and 19:40 local time, spotters operating in the Kafr Zeita area issued warnings that a helicopter was inbound and an aerial attack was “imminent”. A helicopter was subsequently heard over the Wadi al-Aanz valley, as well as what witnesses described as an “impact” but not as a loud explosion (which they normally associated with conventional barrel bombs).

6.105 Shortly after, some witnesses noticed a pungent odour and warnings were circulated about an attack having occurred which included chemical munitions. Based on the symptoms reported, what was suspected to be a toxic substance was released near a cave system which, at the time, was being held by the armed opposition group Jaysh al-Izza. There were several other caves near the munition’s point of impact that were used as hardened command positions for the various opposition groups, and some single-storey houses at the edge of the valley.

6.106 At least 13 witnesses who were either at or able to reach the scene in the immediate aftermath of the attack described to both the FFM and the IIT an odour similar to commercial chlorine-based cleaning products, and pointed to the cylinder as the source of the odour. At least 14 witnesses also described seeing a dark yellow cloud illuminated by the setting sun, which spread through the valley.

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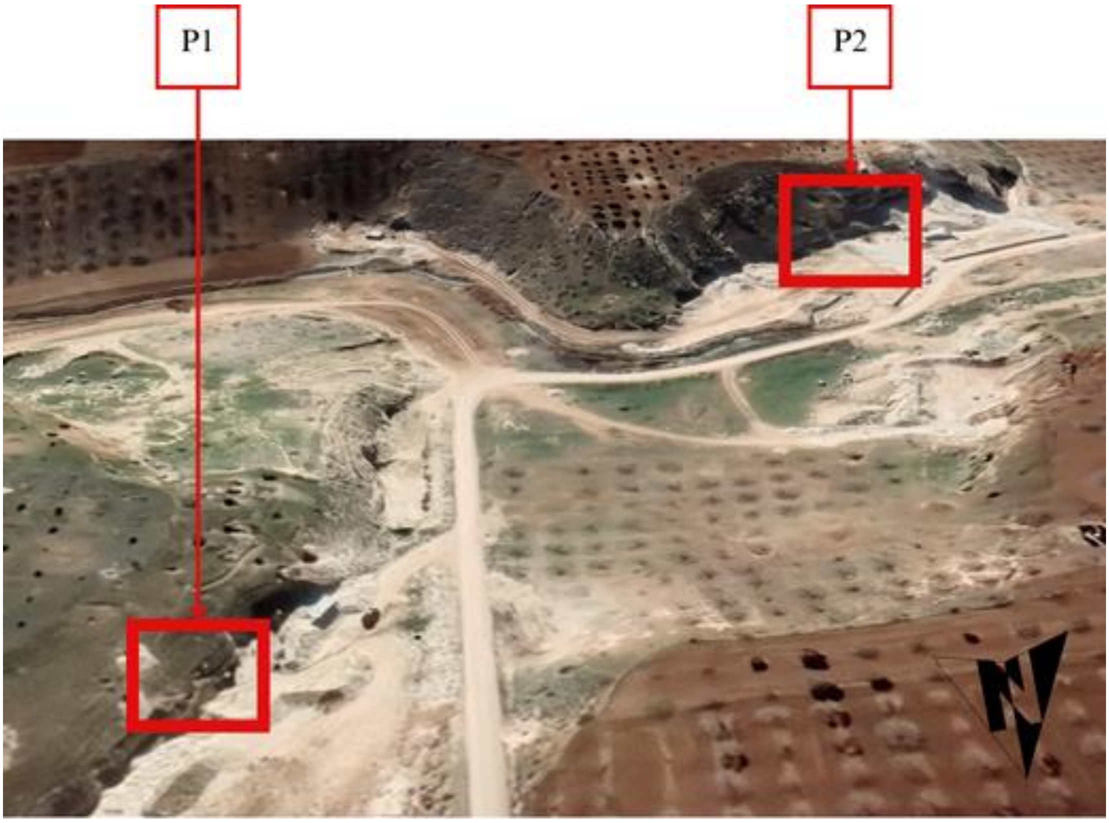
131 See, for example, C. W. White and J. G. Martin, “Chlorine Gas Inhalation Human Clinical Evidence of Toxicity and Experience in Animal Models”, in Proc Am Thorac Soc, vol. 7 (4), (July 2010), pp. 257-263.

132 As discussed in previous IIT reports, armed groups and civilians in areas not under the control of the Syrian Government rely on networks of “spotters” to identify communications between pilots and officers, coordinates of targets, and sights of aircraft, and share such information with other “spotters” and individuals in the areas likely to be targeted. See First IIT Report, para. 6.19 and Second IIT Report, para. 5.9.

133 To the extent that they were relevant to identifying the time frame in which the incident occurred.

6.107 The cave system was located around 300 metres from the Al Maghara Hospital. At the time of the attack, the hospital was staffed by medical and administrative personnel; local combatants occupied the surrounding caves, while civilians were living in the houses surrounding the valley.

FIGURE 15: VIEW INTO THE WADI AL-AANZ VALLEY (DATED 21 FEBRUARY 2017)



(P1 indicates the location of the combatants' cave system and the area where the cylinder impacted and came to rest. P2 indicates the area of the Al Maghara Hospital. The two highlighted areas are roughly 300 metres apart).

6.108 When people close to the location where the substance was released started noticing a pungent odour and began experiencing symptoms, most sought direct medical attention. Others who did not develop immediate severe symptoms and had experienced chemical attacks in the past managed to move away from the source of the odour and to higher ground, where they believed the concentration of the chemical agent would be lower. As noted in previous IIT reports, most Syrians at that time were aware of the recommended protocol during chemical attacks "to head to higher ground", as most chemical warfare agents would tend to sink rather than rise.[134]

[134] Third IIT Report, para. 6.104.

6.109 Those affected began arriving at the Al Maghara Hospital shortly after the attack was reported. They were brought in by first responders, assisted by other less affected individuals, or managed to walk toward the hospital themselves. Hospital personnel received the casualties outside the entrance and performed decontamination procedures by undressing the patients[135] and washing them with water. Medical personnel reported an obvious and strong chlorine odour coming from the casualties.

6.110 Upon their arrival, those affected were triaged into those experiencing mild, medium, or severe symptoms. The IIT was able to confirm that the most prevalent symptoms identified were: irritation of the eyes, nose, and throat; coughing; shortness of breath; and wheezing. Those most affected also experienced hemoptysis, cyanosis, and hypoxia, resulting in diminished consciousness.

6.111 Following decontamination procedures, casualties were treated with oxygen, antihistamines for rashes, antipyretics in cases of fever, and antibiotics to prevent infection of irritated tissue. In less severe cases, such treatment resulted in the timely improvement of the patients' condition. Five casualties experiencing severe symptoms were admitted to the intensive care unit of the Kafr Zeita Specialised Hospital. Stabilised patients were subsequently sent home after being instructed to seek medical help, if required, in the following days.

6.112 As some medical staff also started to experience symptoms, the hospital was fully evacuated on the night of 1 October 2016, with several casualties and some medical personnel being transferred to the Kafr Zeita Specialised Hospital (located 4 km away from the impact site, in Kafr Zeita town) for further treatment. Medical staff at that hospital had also heard the spotters' warning of an impending chemical weapons attack and thus were prepared to receive incoming patients. The IIT is aware of at least three named individuals who were treated at the intensive care unit of the Kafr Zeita Specialised Hospital, two of whom had to subsequently undergo further treatment at other hospitals within the Syrian Arab Republic. Several witnesses reported to the IIT that the pungent odour was still noticeable on their clothes and in the Wadi al-Aanz valley the next day, and even lingered in some of the caves for several days—albeit much fainter than on the day of the attack.

6.113 The IIT assessed information from several sources, including statements of affected persons, healthcare personnel and medical records from the Al Maghara Hospital and the Kafr Zeita Specialised Hospital. Overall, the IIT identified at least 62 individuals displaying symptoms consistent with exposure to chlorine, at least 35 of whom received medical treatment at the Al Maghara Hospital and at the Kafr Zeita Specialised Hospital. Of these casualties, the toxicologists consulted by the IIT rated the symptoms experienced by at least 20 casualties as mild and moderate, and one as severe. No fatalities were recorded.

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135 Women patients were not fully undressed for decontamination but only their hands and feet were washed and they were provided with a change of clothes before being treated further.

6.114 In addition to witness statements, photographs and videos taken in the aftermath of the incident—and received, authenticated and analysed by the IIT—show a number of affected persons exhibiting clear signs of lacrimation, drooling, coughing, and receiving treatment via oxygen masks (Venturi and non-rebreather masks), nebulisers, and intravenous fluids.

6.115 Following a review of the relevant material, the toxicologists consulted by the IIT concluded that the accounts of the victims and medical personnel were consistent with the release of an irritant gas with intermediate water solubility, such as chlorine gas, and that no casualty experienced symptoms consistent with exposure to other substances. The toxicologists further noted that the witnesses interviewed by the IIT consistently described the agent as akin to chlorine-based cleaning products, further pointing to chlorine gas as the most likely chemical to which the casualties were exposed.

6.116 As in previous reports,[136] the IIT notes that signs and symptoms experienced by those affected by chlorine gas are diverse, non-specific, and dependent on concentration and the extent of exposure (namely, the concentration of the released substance and the exposure time). Therefore, the IIT notes that, while the symptoms described by victims and medical personnel are not exclusive to chlorine exposure, when they are considered alongside the chemical data assessed by the IIT and the characteristics of the substance as described by survivors of the incident that occurred in Kafr Zeita on 1 October 2016, these symptoms are consistent with those originating from chlorine gas exposure.

6.117 The IIT further notes that, while pursuing alternative scenarios during the course of its investigation, it did not receive, nor was it otherwise able to obtain, any material that would substantiate claims that any irritant agent other than chlorine gas was used.

Assessment of remnants, impact and delivery of the munition

6.118 The IIT consulted separately two independent experts—a terminal ballistics expert and a projectile trajectory expert—neither of whom had worked on the incident before, for the purpose of assessing the different hypotheses as to how the cylinder may have been delivered to or manually placed at the location where it was recovered.

6.119 Such an assessment was critical to corroborate or discard the main scenarios on which the IIT investigation focused, namely: (1) an attack carried out in Kafr Zeita on 1 October 2016 with chlorine released through a cylinder dropped from the air, and (2) the "staging" of a chemical attack at Kafr Zeita on the same date.

6.120 In particular, the experts were tasked with assessing whether the damage observed on the recovered cylinder would match the damage one could expect from the cylinder's impact, and—if so—with what impact velocity and angle relative to the terrain (impact angle). In parallel, the experts were asked to consider other plausible methods of delivery, potentially constitutive of the "staging" scenario, for example, whether the cylinders may have been fired from a surface-to-surface weapon or placed manually at the location.

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[136] See Third IIT Report, para. 6.119.

6.121 To this end, the IIT thoroughly considered elements related to the terrain at the impact location, building upon the analysis conducted by several experts and specialists consulted independently from one another (including an expert consulted by the FFM in the framework of its own investigation, whose expertise ranged from engineering to munitions, ballistics, and metallurgy). The IIT further took into consideration empirical and analytical models, including: simulations modelling the impact of the gas cylinder; relevant scientific literature; satellite imagery and measurements; pictures and video recordings obtained in the aftermath of the incident; and open-source materials.

6.122 The terminal ballistics expert independently assessed the original FFM findings and considered additional variables. The projectile trajectory expert consulted by the IIT performed computer simulations of cylinder trajectories, which are used to assess what initial conditions for the trajectory, namely, the initial velocity and height, lead to trajectories that match the impact conditions found by the terminal ballistics experts consulted by both the IIT and the FFM.

6.123 Relying on visual analysis and simulations based on the mechanical properties of the cylinder as determined by the FFM, the terminal ballistics expert found that the damage visible on the cylinder was the result of a high-velocity impact. As noted above,[137] the nose of the cylinder is visibly bulged. That the bulging affects only the nose area of the munition is a typical impact phenomenon: the pressure in the liquefied chlorine at impact is higher in the nose region and decreases on the opposite side of the cylinder. The independent terminal ballistics expert assessed that the work required to reproduce the observed bulging with explosives, pressurised gas, or liquids would have been exceedingly complex and required highly sophisticated skills. Based on this assessment, the IIT has ruled out the possibility that the damage to the cylinder was manufactured or created artificially.

6.124 The terminal ballistics expert determined that the observed damage to the cylinder would have required the presence of a nose cap and a stabilising cradle to facilitate a nose-first impact. This conclusion is consistent with the independent assessment by the munitions specialist, who—as noted above[138]—concluded that the metal object photographed at the incident location corresponded to a part of a stabilising cradle.[139]

6.125 Once it was concluded that the damage observed on the cylinder was the result of an impact, the terminal ballistics expert performed simulations of the cylinder's impact with rocky soil to find the conditions that would result in such damage. The expert found an impact velocity of 120 m/s within 20 degrees from perpendicular to the terrain.[140]

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137 See "Assessment of remnants" subsection above.

138 See "Assessment of remnants" subsection above.

139 See Figure 9 in "Assessment of remnants" subsection above.

140 The computer simulations leading to these conclusions are part of the projectile trajectory expert report on file with the IIT.

FIGURE 16: PHOTOGRAPH OF THE CYLINDER'S HEAD TAKEN ON 2 OCTOBER 2016 (LEFT). SIMULATED IMPACT OF THE CYLINDER EQUIPPED WITH A NOSE CAP AND IMPACT VELOCITY OF 120 M/S ONTO TERRAIN SLOPED 20° FROM PERPENDICULAR (RIGHT)

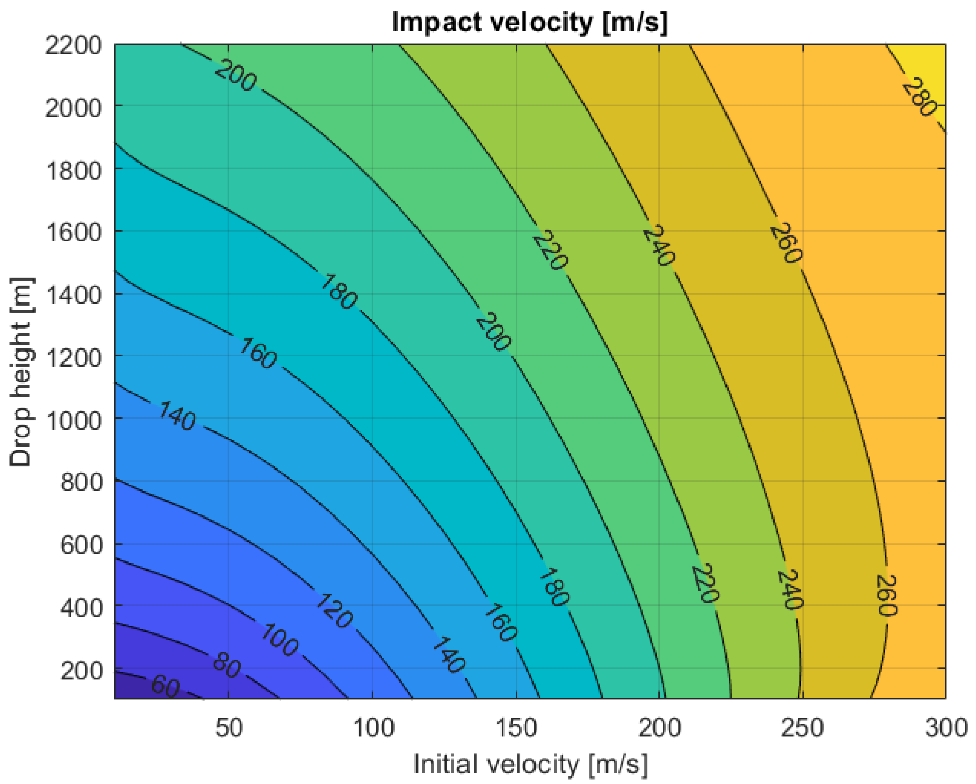
6.126 Since the cylinder was found in an agricultural area, with no high buildings in proximity, the IIT discarded a scenario whereby the munition would have been manually dropped from a location high enough to result in the required impact velocity. Having previously established that the cylinder was fitted with a stabilising cradle, the IIT could further rule out that the cylinder was delivered using an improvised surface-to-surface weapon (such as an improvised cannon), since the cylinder—combined with its cradle—would have been too large to fit inside such a weapon.

6.127 Having discarded the hypotheses of a manual drop from a position above the munition's point of impact and of a delivery from an improvised surface-to-surface weapon, the IIT sought to assess whether the drop could have taken place from a fixed-wing or a rotary-wing aircraft, and from what minimum heights and at what initial velocities.

6.128 Based on the parameters identified by the terminal ballistics expert, the projectile trajectory expert consulted by the IIT conducted over 40,000 computer simulations of airdrops. Since, as noted above, the IIT was able to conclude that the cylinder was fitted with a stabilising cradle, the simulations were performed taking this into account.

6.129 Trajectories were calculated for conditions applicable to two different methods of dropping the munition: a drop from a weapons hardpoint (for instance under the wing of a fixed-wing aircraft or a helicopter's stub wing), with initial velocities between 10 and 300 m/s, and a manual drop in which the munition was pushed out of the back of a helicopter.

FIGURE 17: IMPACT VELOCITY FOR AIRDROPS AT HEIGHTS BETWEEN 100 AND 2,200 M AND INITIAL VELOCITIES BETWEEN 10 AND 300 M/S



6.130 Figure 17 shows contour lines of the impact velocity from the trajectory simulations for a munition dropped from a weapons hardpoint, as a function of the drop height and the initial velocity of the delivery vehicle. Multiple combinations of initial velocities and drop heights result in an impact velocity of 120 m/s. As shown by the 120 m/s contour line in Figure 17, for a 10 m/s initial velocity, the 120 m/s impact velocity requires a drop height of 800 m. For an initial velocity consistent with the approximate top speed of a helicopter (that is, 70 m/s),[141] the drop height required for a 120 m/s impact velocity is reduced to 550 m. Notably, on its right side, the contour line exceeds speeds that can be reached by helicopters. This led the IIT projectile trajectory expert to also consider drops from a fixed-wing aircraft (travelling between 70 and 120 m/s).

6.131 In addition to the impact velocity—120 m/s—the terminal ballistics expert had also determined that, to create the damage documented on the cylinder recovered from Kafr Zeita, the cylinder must have impacted within a 20° angle from perpendicular to the surface. The impact angle is determined by the flight path angle[142] at impact and the slope of the terrain in the direction of flight.

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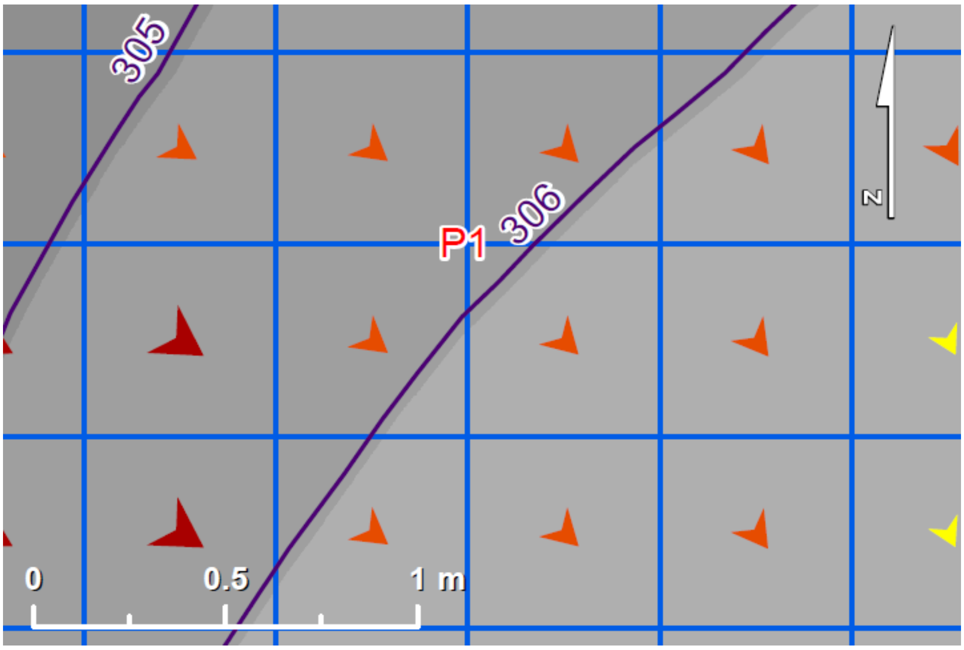
141 See, for example, Encyclopedia of World Military Aircraft, vol. Two., pages 316 – 317. Practical Aerodynamics of the Mi-8MT Helicopter (2006), available at: https://svvaul.ru/nashi-resursy/file/32-prakticheskaya-aerodinamika-vertoleta-mi-8mt. Mi-8MTV-5 Crew Instructions (n.d), available at: https://svvaul.ru/nashi-resursy/file/36-instruktsiya-ekipazhu-mi-8mtv-5-1.

142 The flight path angle is the angle between the cylinder's trajectory and horizontal. For a descending trajectory, the flight path angle is negative.

6.132 To assess the slope of the terrain, the IIT was able to obtain detailed information about the shape of the terrain, including the surface elevation in the area around the impact site, based on satellite measurements.

FIGURE 18: CONTOUR MAP OF THE TERRAIN ELEVATION NEAR THE POINT OF IMPACT (P1) BASED ON SATELLITE DATA FROM SEPTEMBER 2016, WITH VECTORS INDICATING THE DIRECTION OF THE SURFACE SLOPE



6.133 Figure 18 above shows a grid and contour lines of the elevation and vectors of the surface gradient in the direct vicinity of the point of impact (marked as P1). The colour of the vectors indicates the steepness of the terrain, with the arrows pointing in the direction in which the terrain is sloped up. Near the point of impact, the vectors are orange, indicating a maximum surface slope of 45°. Based on the analysis of the information in its possession, the IIT could not determine with certainty in which direction the aircraft was flying when it dropped the cylinder. Thus, the IIT sought to determine the flight paths in which the aircraft would have encountered the maximum downwards and upwards surface slopes, as well as the values in between (that is, between 45° and -45°).[143] At the extremes of the range (maximum surface slope of 45° and -45° respectively), the aircraft could have flown over the point of impact from either a north-western direction (that is, flying in the direction of the arrows in Figure 18) or from a south-eastern direction (that is, flying against the direction of the arrows in Figure 18). In the former case, the terrain would have sloped maximally downwards in the direction of flight (-45°). In the latter case, the terrain would have sloped maximally upwards in the direction of flight (+45°).

6.134 The trajectory simulations conducted by the projectile trajectory expert consulted by the IIT, namely, a drop from a weapons hardpoint with initial velocities between 10 and 300 m/s, also provide the flight path angle at impact.

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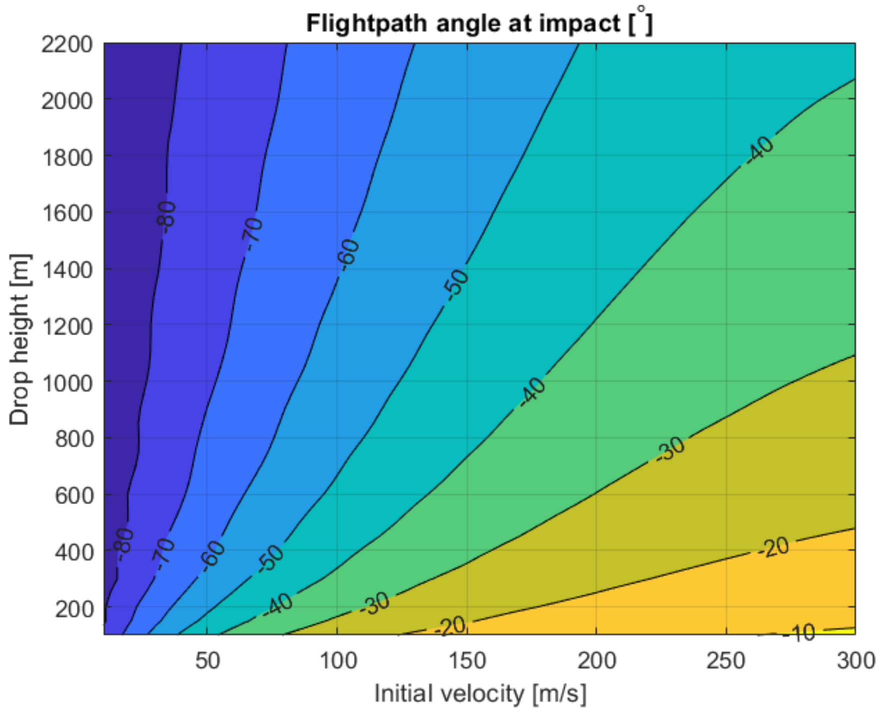
143 A negative slope for the terrain in this case signifies terrain that is sloping down in the direction of flight. A positive slope signifies terrain that is sloping upwards in the direction of flight.

FIGURE 19: FLIGHT PATH ANGLE AT IMPACT FOR AIRDROPS AT HEIGHTS BETWEEN 100 AND 2,200 M AND INITIAL VELOCITIES BETWEEN 10 AND 300 M/S



6.135 For low velocities and relatively high drops, the cylinder trajectory at impact would be steep, and would become less steep for an increasing initial velocity and as the height decreases. This is shown in the simulated flight path angle at impact as illustrated in Figure 19 above. For 10 m/s and a drop from 800 m, the flight path angle at impact is -85°, meaning the trajectory is nearly vertical. To match the impact conditions identified by the terminal ballistics expert, the difference between the trajectory and the direction perpendicular to the terrain should be less than 20°. Thus, the impact conditions required for the damage are met if the slope of the terrain in the direction of flight is between -15° and +25°. Depending on the aircraft’s flight path, the slope that the munition could have encountered upon impact ranges from -45° to +45°, so these values are plausible.

6.136 For the approximate top speed of a helicopter of 70 m/s and a drop height of 550 m, the flight path angle at impact is -57°. This is 33° from vertical, so for the impact to result in the damage observed on the cylinder recovered from Kafr Zeita, the slope in the direction of flight should be between +13° and +53°. Considering the terrain’s slope range discussed above, for most flight paths these values are plausible.

6.137 Similar simulations for the munition being dropped manually from a helicopter show that, to match the impact conditions for a given initial velocity, a greater drop height would have been required. Thus, based on the available data, the projectile trajectory expert consulted by the IIT assessed as plausible that the cylinder found in Kafr Zeita was dropped from a helicopter flying above 550 metres, either from a weapons hardpoint or by being manually pushed out from the back of its cargo compartment. Both scenarios would lead to impact conditions consistent with the observed damage to the cylinder.

6.138 Given that the maximum slope in the direct vicinity of the point of impact is 45° (as calculated from satellite measurements), the minimum possible flight path angle at impact of the cylinder would have had to be about -25°. This angle is reached when the cylinder is dropped from an aircraft flying 110 m/s at a height of 150 m. This scenario represents the fastest an aircraft could have flown when dropping the cylinder in order for it to impact the ground at a velocity and angle consistent with the damage observed on the cylinder recovered from Kafr Zeita. Given that helicopters generally cannot fly at such velocities, the IIT assesses that—in this scenario—the cylinder would have had to be dropped from a fixed-wing aircraft. Based on the trajectory simulations, this set of circumstances would be encountered only if the aircraft was flying in the direction of the gradient of the terrain (that is, north-west to south-east), resulting in the cylinder encountering the highest slope upon impact.

6.139 The simulations performed by the terminal ballistics expert show that the cylinder impacted the ground at 120 m/s and within an impact angle of 20 degrees from perpendicular to the terrain. The projectile trajectory expert consulted by the IIT considered all combinations of drop heights, initial velocities and slope angles that would result in an impact velocity and impact angle consistent with the impact conditions observed on the cylinder when it was retrieved from Kafr Zeita. This resulted in three scenarios, namely:

(a) a helicopter travelling very slowly (that is, 10 m/s) could have dropped the cylinder from more than 800 m; or

(b) a helicopter travelling near its maximum speed (that is, 70 m/s) could have dropped the cylinder from more than 550 m; or

(c) a fixed-wing aircraft travelling near the fastest speed matching the cylinder's impact velocity given the impact angle (that is, 110 m/s) could have dropped the cylinder from no more than 150 m.

Origins of the munition

6.140 As noted above, based on the assessment of the cylinder performed by the munitions specialist, the IIT determined that only two investigative hypotheses would be plausible, namely, that the munition was either delivered by aircraft or that it had been manually deployed at the scene of the attack.

6.141 The assessments by the terminal ballistics and projectile trajectory experts consulted by the IIT independently from one another indicated that the cylinder was deployed from an altitude and with a horizontal velocity consistent only with the release from an aircraft, either fixed- or rotary-winged. Based on scientific, technical, and military literature, the IIT notes that designing and manufacturing improvised munitions intended to be *attached* to an aircraft poses substantially higher challenges than doing so for munitions meant to be *pushed out* of the cargo bay of a helicopter. This is due to the fact that munitions affixed to aircraft must withstand much higher forces, especially when the aircraft accelerates during take-off or turns sharply. Therefore, munitions dropped from an aircraft's hardpoints must be robust enough to handle these forces.[144] As noted above,[145] the munition dropped on Kafr Zeita on 1 October 2016 consisted of a chlorine gas cylinder fitted inside an improvised metal cradle built from steel straps. The straps secured the cylinder by being tensioned around it. The IIT assesses that such a design facilitated the handling of the munition and improved its aerodynamic characteristics, but would not have been strong enough to reliably hold the cylinder when attached to an aircraft.[146]

6.142 As explained above,[147] to create the deformation documented on the cylinder as assessed by the terminal ballistics expert, any fixed-wing aircraft would have had to fly at a very slow speed (that is, 110 m/s) to drop the cylinder from no more than 150 m. In view of the technical and tactical considerations[148] of tasking a fixed-wing aircraft with flying such a manoeuvre to drop one chlorine cylinder, the IIT deemed it highly implausible that the Kafr Zeita chemical weapons attack would have been executed in such a manner.

6.143 Based on the specialised technical analysis of the munition and its plausible means of delivery, as outlined above, the IIT deemed it highly unlikely—and eventually discarded—any scenario in which the cylinder would have been affixed, and dropped from, an aircraft's hardpoint or in which the cylinder would have been dropped from inside the cargo bay of a fixed-wing aircraft.

6.144 Therefore, the IIT pursued the hypothesis that the munition was deployed from the cargo bay of a helicopter. This scenario is consistent with 22 witness testimonies obtained and reviewed by the IIT describing a helicopter having conducted the chemical weapons attack. A variety of helicopter types have been used to drop improvised munitions in the Syrian conflict. Given the size and weight of the munition identified in Kafr Zeita,[149] the helicopter would have had to be able to accommodate it and be set up so that the munition could be manoeuvred and ultimately dropped manually from inside. Considering these prerequisites, the IIT assessed that only a small number of helicopter variants and subvariants operating in the Syrian Arab Republic at the time of the incident would have been capable of delivering the munition dropped on Kafr Zeita on 1 October 2016. Having examined the technical specifications of alternative helicopter variants and subvariants which had the ability to deploy the chemical munition onto Kafr Zeita, the IIT has reasonable grounds to believe that the chemical weapons attack was executed using an Mi-8/17 helicopter variant.

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144 O. Nadar (2014), "Aircraft/Stores Compatibility, Integration and Separation Testing", Flight Test Technique Series, vol. 29, STO AGARDograph 300; B. Wang, L. Xie, J. Song, X. He, W. Luo, B. Zhao, T. Mu (2020), "Failure behavior of aerial bomb lifting lug under variable amplitude loading: Failure analysis and life prediction", in Engineering Failure Analysis, vol. 120, (October 2020); S. Sindura and G.R.S. Thangadurai (2020), "Design and Structural Analysis of Fighter Aircraft's Bomb Release Mechanism subjected to Aerodynamic and Inertial Loads using FEA", in International Journal of Engineering & Technology, vol. 9 (1), pp. 92-103

145 See "Assessment of remnants, impact and delivery of the munition" subsection above.

146 As noted in previous IIT reports. See First IIT Report, para. 8.27; Second IIT Report, para. 8.9; and Third IIT Report, para. 6.165.

147 See "Assessment of remnants, impact and delivery of the munition" subsection above.

148 These technical considerations include the need of the aircraft to physically accommodate the cylinder, possess a cargo bay that can be opened in flight, and the ability to fly reliably at speeds as low as 110 m/s.

149 See "Assessment of remnants, impact and delivery of the munition" subsection above.

6.145 The IIT then sought to identify from where the helicopter originated. Eighteen witnesses confirmed to the OPCW that the attack on Kafr Zeita was executed between 19:00 and 19:40 on 1 October 2016, with the first social media alert referencing an attack having been posted at 19:17. While the IIT was unable to obtain flight logs or comprehensive observation data documenting the number and type of aircraft operating in the Kafr Zeita airspace during the relevant time frame, it engaged in the mapping and analysis of 13 airbases[150] whose distance from Kafr Zeita would have been within the range of an Mi-8/17 helicopter.[151]

6.146 By the time of the incident, six of those airbases were under the control of the forces opposing the Government of the Syrian Arab Republic.[152] While these groups are known to have operated heavy weapons at the time of the incident, the IIT is not aware of any instances in which they operated manned aerial assets. This led the IIT to rule out that the Mi-8/17 helicopter that conducted the Kafr Zeita chemical attack originated from any of those six airbases. Among the remaining airbases, one—Aleppo International Airport—was under the control of the Government of the Syrian Arab Republic at the time, but was assessed by the IIT to have been located too close to the front line for helicopters based there to be conducting combat operations involving chemical weapons against targets over 100 km away.

6.147 The IIT commissioned longitudinal satellite imagery of the remaining six airbases[153] over the period August to October 2016, which was interpreted by specialists. The satellite imagery analysis confirmed that only four of these six airbases housed Mi-8/17 helicopters around the time of the Kafr Zeita chemical weapons attack. Therefore, the IIT considered only those four airbases (Khmeimim, Al-Shayrat, T4, and Hama) as the potential origin of the Mi-8/17 helicopter.

6.148 As noted above, during the course of its investigation, the IIT did not obtain flight logs or comprehensive observation data which unequivocally show an Mi-8/17 taking off from any of these airbases at a time consistent with the attack on Kafr Zeita. These include flight records covering Hama Airbase on 1 October 2016, as shared by the authorities of the Syrian Arab Republic with the IIT in September 2025. While these records do not include an Mi-8/17 helicopter taking off at a time consistent with the attack, experts consulted by the IIT assessed that omitting a sortie involving the deployment of a chemical payload from official flight records would not be inconsistent with the confidentiality practices applied to such missions by the Syrian Arab Republic. The IIT obtained information highlighting that the spotter network around Hama had only recently been established and was not fully operational at the time of the Kafr Zeita chemical attack.

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150 The 14 airbases assessed included Al-Shayrat Airbase (105 km from Kafr Zeita), T4 Airbase (130 km), Khmeimim Airbase (75 km), Abu al-Duhur Airbase (60 km), Kuweyres Airbase (120 km), Dabaa Airport (95 km), Aleppo International Airport (104 km), Hama Airbase (34 km), Tal Al-Aswad Agricultural Airport (30 km), Taftanaz Airbase (67 km), Al Tabqa Airport (183 km), Jirah Airbase (143 km), and Menagh Military Airport (124 km)"

151 See, for example, "Encyclopedia of World Military Aircraft", vol. 2, pp 316 and 317. "Practical Aerodynamics of the Mi-8MT Helicopter (2006)", available at: https://svvaul.ru/nashi-resursy/file/32-prakticheskaya-aerodinamika-vertoleta-mi-8mt. "Mi-8MTV-5 Crew Instructions" , available at: https://svvaul.ru/nashi-resursy/file/36-instruktsiya-ekipazhu-mi-8mtv-5-1

152 The six locations assessed included Taftanaz Airbase (67 km), Al Tabqa Airport (183 km), Jirah Airbase (143 km), Menagh Military Airport (124 km), Tal Al-Aswad Agricultural Airport (30 km), and Abu al-Duhur Airbase (60 km).

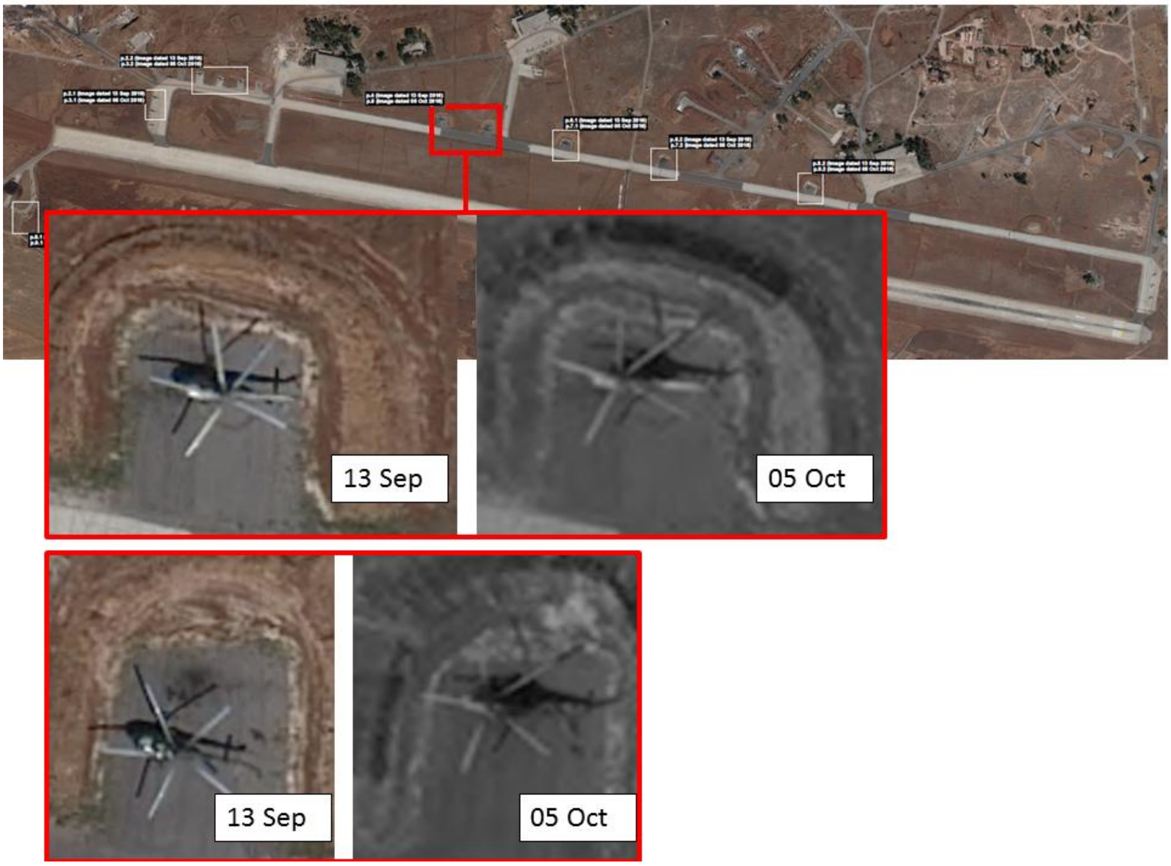
153 The six locations assessed included Al-Shayrat Airbase (105 km from Kafr Zeita), T4 Airbase (130 km), Khmeimim Airbase (75 km), Kuweyres Airbase (120 km), Dabaa Airport (95 km), and Hama Airbase (34 km).

6.149 The IIT also notes that the totality of witness statements gathered by the IIT, including from at least five spotters on duty around Hama at the time of the incident, consistently point to Hama Airbase as the origin of the helicopter which carried out the attack.

6.150 Based on the above, and on further specialised strategic and tactical analysis the IIT was able to secure (including from former pilots and military experts), the IIT has reasonable grounds to believe that the Mi-8/17 helicopter that carried out the Kafr Zeita attack did not originate from any airfield other than Hama Airbase.

6.151 Satellite imagery analysis of Hama Airbase shows four operational Mi-8/17 helicopters were present at Hama Airbase on 13 September, while five operational helicopters were present on 5 October 2016.[154,155] Satellite images taken on 2 October (that is, on the day following the attack) confirm the presence of two helicopters on the central apron, although the image quality did not allow for the identification of the specific helicopter variants.

FIGURE 20: SATELLITE IMAGERY OF HAMA AIRBASE



(Areas marked in white showing the presence of helicopters as of 13 September 2016. Zoomed-in images highlighted in red show the same two spots used to house Mi-8/17 helicopters on 13 September and 5 October 2016).

154 The satellite images of Hama Airbase taken with a resolution high enough to allow for identification of the model of aircraft and taken closest in time to the 1 October 2016 incident were taken on 13 September and 5 October 2016.

155 It should be noted that images are captured by satellite imagery providers only at specific hours within the day. Therefore, the number of aircraft identified on both aprons at Hama Airbase within a given time frame may not be representative of all aircraft stationed at the airbase.

6.152 The IIT has received audio recordings of alleged radio communications between the helicopter pilot who carried out the attack and flight control at Hama Airbase. However, the IIT was not in a position to verify their authenticity.

6.153 Information obtained by the IIT indicates that, during the time frame in which the incident occurred, the airspace over Kafr Zeita was controlled exclusively by the Syrian Arab Air Force and the Russian Aerospace Defence Forces. While the IIT assessed information showing that other States carried out air strikes and operations on the territory of the Syrian Arab Republic in September and October 2016,[156] it has not obtained any information suggesting that air strikes were carried out on Kafr Zeita by forces opposing the authorities of the Syrian Arab Republic.

6.154 The IIT has reviewed information from a number of sources indicating that, throughout 2016, both the Syrian Arab Air Force and the Russian Aerospace Defence Forces operated Mi-8/17 helicopters in the airspace of the Syrian Arab Republic.[157] However, the IIT has not obtained any information indicating that the Mi-8/17 helicopter which it identified as having carried out the attack was operated by any force other than the Syrian Arab Air Force.

6.155 Witness statements, expert reports, and other sources indicate that, at the time of the incident, the Mi-8/17 helicopters stationed at Hama Airbase were officially part of the 255th Squadron of the 63rd Helicopter Brigade. At the time, the 63rd Helicopter Brigade was commanded by Brigadier General [REDACTED] and the 255th Squadron was commanded by [REDACTED]. However, the IIT understands that the Syrian Arab Air Force assigned control over several of these Mi-8/17 helicopters to the Tiger Forces,[158] whose units were, at the time, fighting to halt the opposition's advance towards Hama city. The Tiger Forces were operating under the direct command of Colonel [REDACTED]. This is consistent with primary documentation and at least one witness statement obtained by the IIT.

6.156 Information obtained by the IIT indicates that, at that point in the hostilities, the authority to use chlorine as a weapon was delegated to operational-level commanders by the General Command, under the authority of the then-President of the Syrian Arab Republic and Commander-in-Chief of the Syrian Arab Armed Forces, [REDACTED]. The IIT understands that the Chief of Syrian Air Force Intelligence, Major General [REDACTED], subsequently transmitted any requests for chemical weapons to units that coordinated the delivery and loading of the chemical munitions. The IIT further understands from witness testimonies and other sources that the logistics and maintenance of flight operations at Hama Airbase (for example, ensuring that helicopters were fuelled and airworthy) was overseen by the commander of the airbase at that time, namely, Brigadier General [REDACTED].

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156 As part of the military coalition against the so-called Islamic State in Iraq and the Levant (ISIL), see, for example: https://www.centcom.mil/MEDIA/PRESS-RELEASES/Press-Release-View/Article/961497/october-2-military-airstrikes-continue-agaist-isil-terrorists-in-syria-and-iraq/; https://airwars.org/conflict/coalition-in-iraq-and-syria/

157 See, for example: https://tass.ru/armiya-i-opk/3502418?ysclid=mb7o4ekomm304380949; https://tass.ru/politika/3688669;

158 See "The context of military activities in the area" subsection above.

6.157 As noted both above and in the FFM Report on Kafr Zeita, 1 October 2016,[159] the then-Chief of Staff of the Army and Armed Forces, Lieutenant General [REDACTED], visited Jabal Zayn al-Abidin mountain (28 km from Kafr Zeita), overlooking the front lines in the northern countryside of Hama, on the day of the chemical weapons attack in Kafr Zeita.[160] According to video footage circulated by the Syrian Arab News Agency (SANA),[161] on that occasion he met Air Force Intelligence Director [REDACTED], Colonel [REDACTED], and several other high-ranking officers of the Syrian Arab Army. The IIT recalls that the same news agency reported on a meeting having taken place on 25 March 2017 between Lieutenant General [REDACTED], Brigadier General [REDACTED][162] and several other high-ranking officers also on Jabal Zayn al-Abidin mountain.[163] As documented by the IIT in its First Report, on the same day a helicopter of the Syrian Arab Air Force, departing from Hama Airbase, dropped a cylinder filled with chlorine gas on the Ltamenah hospital.[164]

6.158 The IIT recalls that the deployment of chlorine gas from helicopters in the framework of the Syrian conflict has been attributed by the OPCW-United Nations Joint Investigative Mechanism to the Government of the Syrian Arab Republic in at least three instances.[165] The IIT itself has further documented how, in at least three instances, Mi-8/17 helicopters operated by the Tiger Forces, in support of the Syrian Arab Armed Forces, deployed chlorine-filled improvised munitions of the same design as the one used in Kafr Zeita.[166]

6.159 The IIT further recalls that the 1 October 2016 incident in Kafr Zeita was, based on the information available to it, the first attack in which a gas cylinder used to deploy the chemical agent was fitted inside a metal cradle with three stabilisation fins. Munitions of substantially the same design have been well documented, including by the IIT, in later chemical weapons attacks throughout the conflict in the Syrian Arab Republic.[167] Furthermore, in three instances—also documented by the IIT—the crude cradle had detached from the cylinder as a result of the impact.[168] In all these instances the IIT concluded that there were reasonable grounds to believe that the Tiger Forces, operating under the command of [REDACTED]—in close cooperation with Syrian Air Force Intelligence and acting on behalf of the Syrian Arab Armed Forces—used chemical weapons.[169]

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159 FFM Report on Kafr Zeita, 1 October 2016, para. 3.29

160 See, for example, "Chief of General Staff inspects army units operating in Hama's northern countryside-VIDEO", [REDACTED]

161 Ibid.

162 [REDACTED] had been promoted. See, for example: [REDACTED]

163 See, for example, [REDACTED]. See also First IIT Report, para. 6.9.

164 First IIT Report, Section 14, subpara. (b).

165 Namely, Talmenes (21 April 2014), Sarmin (16 March 2015) and Qmenas (16 March 2015), see Third Report of the Joint Investigative Mechanism (S/2016/738/Rev.1), paras 54, 56, 64).

166 First IIT Report, para. 8.25; Second IIT Report, para. 6.25; Third IIT Report, para. 6.170.

167 First IIT Report, para. 8.26; Second IIT Report, para. 6.22; Third IIT Report, paras 6.139 and 6.151.

168 See First IIT Report, paras 8.25 to 8.29; Second IIT Report, paras 6.19 to 6.25; and Third IIT Report "cylinder on the roof", paras 6.126 to 6.148.

169 Second IIT Report, para. 5.8; Third IIT Report, para. 6.9.

6.160 This design became the de facto standard for improvised chemical munitions built around a chlorine cylinder employed by the Syrian Arab Armed Forces. The novelty of the design at the time of the incident further supports the assessment of the IIT that the incident was not fabricated. Any staging plans would likely have replicated munition designs previously used by the Syrian Arab Armed Forces—in an effort to make accusations against the latter. That anyone staging the attack would have had the clairvoyance of predicting that that specific design would become the standard for air-delivered chlorine gas munitions by the Syrian Arab Armed Forces is, in the opinion of the IIT, highly implausible.

6.161 Despite the assessment that the cylinder found in Kafr Zeita on 1 October 2016 was air-delivered, the IIT continued to actively pursue the remaining alternative scenario whereby the chlorine-filled cylinder was carried or delivered to the location where it was found on 2 October 2016 by an actor other than the Syrian Arab Army in order to "stage" the incident and make accusations against the Government of the Syrian Arab Republic. On the basis of its investigations into the matter, and on the technical assessments independently provided by a variety of experts and specialists, the IIT was unable to obtain any information (including satellite imagery, video or photographic footage, or intercepts) supporting the allegations of "staging" by armed groups or other entities, or corroborating that any of the required "staging" actions were performed in Kafr Zeita. Additionally, as mentioned above, the IIT did not obtain any credible evidence, supporting materials, or leads from the authorities representing the Syrian Arab Republic until the ousting of the Government led by [REDACTED]. Finally, no information obtained from other States Parties, pursuant to requests by the IIT and the Director-General on the basis of paragraph 7 of Article VII of the Convention, or other sources, supports the delivery of the cylinder in question by any means other than helicopter.

III. FACTUAL FINDINGS

7. GENERAL REMARKS

7.1 The IIT scrutinised the information obtained and reached its conclusions on the basis of a holistic assessment through a widely shared methodology, in compliance with the relevant provisions of the Convention, as well as international best practices of international fact-finding bodies and commissions of inquiry. In so doing, the IIT strictly adhered to applicable OPCW procedures.

7.2 Throughout the investigation, various hypotheses were considered and pursued. Taking into account the different mandates of the FFM and of the IIT, the IIT was able to expand its sources of information, perform supplementary analyses, and consult additional independent experts for the specific purpose of identifying the perpetrator of the attack. This allowed for further clarity, consistency, and corroboration as to what witnesses and the original chemical analyses had indicated about the origins of the toxic irritant substance identified by the FFM at Kafr Zeita.

7.3 The IIT holistically assessed all of the information it obtained, taking a critical approach against the posited scenarios, keeping an open mind, and encouraging States Parties—including both the former and the new authorities of the Syrian Arab Republic—and other entities to contribute to expanding its evidentiary basis.

7.4 As the investigation progressed, some scenarios appeared increasingly less likely, as they could not be substantiated through, nor reasonably explain, the information obtained from a variety of distinct sources, taken as a whole. As a result of its investigation, the IIT could not identify any plausible explanation for the concurrence of information before it, other than the conclusions presented below.

8. FACTUAL FINDINGS ON THE INCIDENT IN KAFR ZEITA

8.1 In relation to the incident of 1 October 2016 in Kafr Zeita, in light of the information obtained considered in its totality, the IIT concludes that there are reasonable grounds to believe that between 19:00 and 19:40 (UTC +3) on 1 October 2016, in the context of a military offensive aimed at halting the opposition's advance towards Hama city, one Mi-8/17 helicopter of the Syrian Arab Air Force, departing from Hama Airbase and operating under the control of the Tiger Forces commanded by then-Colonel [REDACTED], dropped at least one yellow pressurised cylinder which hit a cave system in the Wadi al-Aanz valley in Kafr Zeita.

8.2 There, the pressurised cylinder impacted near two ventilation openings on the top of a cave system located approximately 300 metres from the Al Maghara Hospital. The cylinder then tumbled down and came to rest near the entrance to the cave system. Upon impact, the cylinder ruptured and released chlorine gas—which dispersed through the valley, injuring 35 named individuals and affecting dozens more.

8.3 The IIT has reached this conclusion by applying a holistic approach to the assessment of the information related to the different hypotheses it pursued during its investigation.

8.4 In light of the analytical results presented above,[170] the IIT has reasonable grounds to believe that chlorine gas was used in Kafr Zeita, and that the cylinder was the origin of the chlorine gas.

8.5 As highlighted above, the IIT was unable to access the relevant sites of the incident in Kafr Zeita prior to the completion of its investigation.[171] However, the IIT was able to access and independently assess the chlorine gas cylinder which formed part of the munition used in Kafr Zeita, and which was received by the FFM on 12 April 2017.

8.6 The cylinder retrieved from the location of the incident is visibly deformed and ruptured at the top. The cylinder's head incorporates a neck with an internal thread set up to accept a valve and an external thread to accept a valve cover. Photos taken on the day after the incident show a remnant of the valve inside the cylinder's neck. The valve remnant was still in place both when the munition was obtained by the FFM and when it was examined by the IIT. Based on this, the IIT assesses that the cylinder was originally fitted with a complete valve which sheared off when the munition impacted. A similarly broken-off valve remnant was documented by the IIT in its Second Report[172] in relation to an analogous cylinder used to release chlorine gas. In that incident, the IIT concluded that the munition was deployed by a military helicopter of the Syrian Arab Air Force under the control of the Tiger Forces.[173]

8.7 The IIT further notes that the external thread of the valve neck was undamaged, and that no valve protection cap is visible in footage taken at the scene in the aftermath of the incident. This led the IIT to assess that the cylinder impacted the ground without a valve protection cap. The absence of this safety feature was already observed by the IIT in the incident documented in its Third Report, where cylinders similar to the one used in Kafr Zeita were employed to release chlorine gas. As noted in the Third IIT Report on the incident in Douma, on 7 April 2018, the lack of a valve protection cap would facilitate the release of the contents of the cylinder, which provides an indication of its intentional weaponisation. In that incident, the IIT concluded that the munition was deployed by a military helicopter of the Syrian Arab Air Force under the control of the Tiger Forces.[174]

8.8 The cylinder recovered in Kafr Zeita also features a number of markings stamped into it, which the IIT reproduced and interpreted. These markings show that the cylinder was manufactured in 2001 to store pressurised chlorine gas.

8.9 Much of the paint towards the top of the cylinder is visibly abraded and sheared off. Where the paint is missing, extensive signs of corrosion are visible, which are notably more prevalent and uniform towards the head and decrease in number and prominence towards the base. The observed pattern of corrosion is consistent with, and further supports, the conclusion that the cylinder contained a corrosive chemical payload which released from its top upon impact. The IIT further assesses that the visible deformation and ruptures on the head of the cylinder and its missing paint, along with the visible corrosion photographed on 2 October 2016, are consistent with the pressurised cylinder having impacted rocky soil with significant force and having subsequently released a corrosive gas.

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170 See "Chemical analyses" in Section 6 above.
171 See "Approach and challenges in the investigation" Section above.
172 Second IIT Report, para. 6.21.
173 Second IIT Report, para. 10.1.
174 Third IIT Report, para. 10.1.

8.10 Metal remnants were observed near the point where the cylinder impacted the ground in Kafr Zeita. Based on their design characteristics, their deformation and their position close to where the cylinder came to rest, photogrammetric analysis and a munition expert consulted by the IIT confirmed that the remnant formed part of a cradle originally attached to the cylinder. The IIT has observed analogous metal fragments near the points where similar industrial yellow gas cylinders impacted in the incidents documented in both its Second and Third Reports, and notes that the cradle became detached from the gas cylinders used to deploy chemical agent in three out of four incidents of use of chlorine as a weapon investigated by the IIT thus far.[175] In all three instances, the IIT attributed the use of chlorine gas as a weapon[176] to the Syrian Arab Armed Forces.

8.11 As a whole, the technical assessment of the IIT indicates that the cylinder retrieved from Kafr Zeita on 2 October 2016 contained a corrosive pressurised gas and formed part of a munition that was used as a chemical weapon.

8.12 The IIT notes that the 1 October 2016 chemical attack in Kafr Zeita marked the first time in which the specific munition design described above was documented, and that this design subsequently became the de facto standard for improvised chemical munitions built around a chlorine cylinder employed by the Government of the Syrian Arab Republic. The novelty of the design at the time of the incident also provides a strong indication that the incident was not fabricated, since, as noted above,[177] any staging plans aimed at making accusations against the Government of the Syrian Arab Republic would likely have replicated munition designs previously used by the Syrian Arab Armed Forces.

8.13 The IIT thoroughly considered the possibility that the cylinder retrieved at the site of the attack may have been delivered by a surface-to-surface weapon. However, the cylinder was significantly larger than the improvised rocket-assisted munitions (IRAMs) documented throughout the Syrian conflict, and lacked any signs that a rocket motor was attached to it. Furthermore, the design of the munition makes it highly unlikely, or even impossible, that it may have been fired from an artillery piece of the kinds documented in the Syrian context. Therefore, the IIT confidently ruled out the hypothesis that the cylinder was launched from a surface-to-surface weapon.

8.14 The IIT assessed the analytical data underlying the FFM report, as provided by two OPCW designated laboratories. It further performed additional chemical sampling and analyses of the cylinder retrieved from Kafr Zeita and obtained by the FFM. In total, the IIT collected 12 samples from the cylinder.

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175 First IIT Report, para. 8.26; Second IIT Report, para. 6.22; Third IIT Report, paras. 6.139 and 6.151 (note that only the cylinder documented at Location 4 in the Third IIT Report did not detach from its cradle; see Third IIT Report, para. 6.151).

176 First IIT Report, para. 8.25; Second IIT Report, para. 6.25; Third IIT Report, para. 6.170.

177 See “Assessment of remnants” subsection in Section 6 above.

8.15 Six steel corrosion samples taken from the cylinder's inner and outer steel surfaces showed a high chloride concentration. The analytical data provides a strong indication that the cylinder indeed contained chlorine gas in line with its outer markings. The analysis of the outer samples shows that the chloride concentration in the corrosion of the cylinder's neck is seven times higher than that found in the corrosion of its body. This is consistent with a stream of liquefied chlorine gas flowing out of the cylinder and down its side—exposing the top of the munition to higher chlorine concentrations than its body. This explanation is consistent with the corrosion visible at the top of the pressurised cylinder and with the fact that such high chlorine concentration levels are normally not found in steel corrosion (that is, rust) in non-coastal areas such as Kafr Zeita.

8.16 Independent research commissioned by the IIT investigated the interaction between the yellow alkyd paint present on the cylinder and reactive chlorine. As a result, the chlorinated fatty acid 9,10-dichlorooctadecanoic acid (DCOA) was identified as a marker for the paint's chemical exposure to reactive chlorine. Two OPCW designated laboratories verified the presence of DCOA in four authentic alkyd paint samples collected from the gas cylinder, and found the concentration level of DCOA in the sample taken from the cylinder's neck to be 21 times higher as compared to the one identified in the sample taken form the cylinder's body. The finding of DCOA in the cylinder's alkyd paint, taken together with the concentration values of chloride in its steel corrosion, further confirms that a gaseous chlorinating agent was released from the top of the munition.

8.17 Lastly, two samples were taken from the yellow brass valve remnant present in the cylinder and analysed by one national forensic laboratory. The spectroscopic analysis performed revealed, at the top of the valve's yellow brass, an almost pure copper layer depleted of its zinc content under a white layer of zinc chloride and zinc oxide. These findings confirm that the brass alloy underwent dezincification as a result of exposure to chlorine gas, rather than to other species of reactive chlorine.

8.18 The dezincification of the brass remnant is further consistent with the red-brown colour visible in images taken roughly 15 hours after the incident in Kafr Zeita. In photographs taken several months after the incident, the distinct red-brown colour had visibly been covered by a corrosion layer. The red-brown discoloration and subsequent corrosion were also observed by the IIT on the brass valve remnant of the chlorine cylinder used as a weapon in Saraqib on 4 February 2018.[178] In the case of the Saraqib incident, images taken less than 12 hours after the attack showed the red-brown colour, while those taken 14 days later showed a corrosion layer having formed. A study conducted on behalf of the IIT confirmed that only exposure of yellow brass to chlorine gas would produce a discoloration consistent with that visible on the valve remnant in the Kafr Zeita cylinder. The study further provided a scientifically sound explanation for the similar discoloration as observed by the IIT in its Second Report, unequivocally linking it to exposure to chlorine gas.

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178 Second IIT Report, para. 6.21.

8.19 The red-brown colour visible on the valve remnant in the immediate aftermath of the incident further allowed the IIT to discard any “staging” scenarios that would have entailed the “recycling” of a chlorine cylinder used prior to 1 October 2016 to fabricate the attack on Kafr Zeita. Taking into account the relatively short period in which dezincified brass remains visibly red-brown, and the fact that the 1 October 2016 incident was—based on the information available to the IIT—the first chemical attack carried out in the Syrian Arab Republic since 2014 involving a chlorine gas cylinder bearing the same characteristics as the one obtained by the OPCW, the IIT confidently ruled out such hypothesis.

8.20 The IIT further notes that all 12 samples it collected from the cylinder and subsequently analysed retained chemical markers consistent with exposure to chlorine gas. These markers weave in a complex pattern that cannot be formed by any single chemical other than chlorine gas. Therefore, implementing a staging operation would have required, at a minimum, a well-trained team of highly skilled chemical experts using multiple chemical agents to produce the chemical markers detected at the scene, and in the same gradient. The IIT did not obtain any evidence, including from the Syrian Arab Republic or other States Parties, that would corroborate that any of the aforementioned staging actions were performed at either the impact or resting location of the cylinder.

8.21 As a result, the IIT has discarded any investigative hypotheses that would have involved a chlorine cylinder previously used as a weapon or for commercial purposes being brought to the site of the attack in Kafr Zeita and made to resemble a chemical weapon.

8.22 The IIT further assessed information from several sources, including statements from affected persons and healthcare personnel, as well as medical records from the Al Maghara Hospital and the Kafr Zeita Specialised Hospital. Overall, the IIT identified 62 individuals displaying symptoms, 35 of whom received medical treatment at the Al Maghara Hospital and the Kafr Zeita Specialised Hospital. The toxicologists consulted by the IIT rated the symptoms experienced by at least 20 of those casualties as mild and moderate, while those displayed by one casualty were rated as severe. No fatalities were recorded.

8.23 Based on the toxicological assessment, the IIT determined that the symptoms described by both the victims and medical personnel were consistent with exposure to an irritant gas. Relying on the totality of the evidence available to it, the IIT has reasonable grounds to believe that no chemical other than chlorine gas was used in the Kafr Zeita incident.

8.24 Relying on visual analysis and on computer simulations based on the mechanical properties of the cylinder, the terminal ballistics expert consulted by the IIT found that the damage visible on the cylinder was the result of a high-velocity impact. The expert further assessed that the work required to obtain the same damage (for example, with explosives) would have been exceedingly complex and require highly sophisticated skills. Based on this assessment, the IIT ruled out the possibility that the damage to the cylinder was manufactured or created artificially.

8.25 Further, the expert determined that the distinct bulging in the head of the cylinder would have required the presence of a nose cap, which is consistent with the presence of a stabilising cradle fitted around the munition.

8.26 Based on the assessment and simulations performed by the independent terminal ballistics expert, the IIT was able to determine that the cylinder impacted the ground with a velocity of 120 m/s and within 20 degrees from perpendicular to the terrain.

8.27 The cylinder was found in an agricultural area, with no high buildings in proximity. The height difference between the valley's ridge and floor (between 20 and 30 metres) is also insufficient to account for the damage observed on the cylinder. This led the IIT to discard any scenario whereby the munition would have been manually dropped, since no location at or near the area of the incident would have been high enough to result in the impact velocity necessary to cause the damage observed on the cylinder.

8.28 The hypothesis of manual placement was similarly discarded, as it is inconsistent with the damage observed on the cylinder, as well as with the totality and consistency of the evidence obtained and analyses performed. As a reminder,[179] wipe samples taken by the FFM and analysed for explosives found no indication that explosives had been used to damage the cylinder. The IIT thus concluded that the only plausible explanation for the assessed damage was that the cylinder was dropped from an aircraft.

8.29 Building on these findings, the projectile trajectory expert consulted by the IIT conducted over 40,000 computer simulations considering drops from aircraft flying at heights of between 100 and 2,200 m with speeds between 10 and 300 m/s. The resulting impact velocities and flight path angles at impact were then matched against the terminal ballistics expert's simulations, showing that the cylinder impacted the ground at 120 m/s and within an impact angle of 20 degrees from perpendicular to the terrain. Based on the combination of these parameters, the IIT narrowed down the possible hypotheses for the delivery of the munitions to three scenarios, namely, that:

(a) a helicopter travelling very slowly (that is, 10 m/s) could have dropped the cylinder from more than 800 m; or

(b) a helicopter travelling near its maximum speed (that is, 70 m/s) could have dropped the cylinder from more than 550 m; or

(c) a fixed-wing aircraft travelling close to the fastest speed matching the cylinder's impact velocity given the impact angle (that is, 110 m/s) could have dropped the cylinder from no more than 150 m.

8.30 In total, 20 individuals who directly witnessed the Kafr Zeita incident explicitly stated that they saw and/or heard a rotary-wing aircraft, rather than a fixed-wing aircraft, executing the attack. The IIT further notes that, given the terrain's features at the impact location, a fixed-wing aircraft would have had to follow a north-western to south-eastern flight path, which is inconsistent with the totality of flight paths described by witnesses. Therefore, the IIT discarded the hypothesis that a fixed-wing aircraft dropped the chemical weapon on 1 October 2016 in Kafr Zeita.

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179 See "Chemical analyses" in Section above.

8.31 Based on the combined assessment by the munitions, terminal ballistics, and projectile trajectory experts consulted by the IIT, as well as on the totality of the evidence gathered, the IIT has reasonable grounds to believe that the cylinder recovered from Kafr Zeita was dropped by a helicopter. The IIT recalls the conclusions of its First, Second, and Third Reports, in which it determined that chlorine-filled gas cylinders similar to the one used in Kafr Zeita had been dropped from a helicopter of the Syrian Arab Air Force.[180] The IIT further recalls that, in at least three instances, the OPCW-United Nations Joint Investigative Mechanism documented the deployment of chlorine gas cylinders from helicopters in the framework of the Syrian conflict, attributing it to the former authorities of the Syrian Arab Republic.[181]

8.32 Based on the independent specialised technical analysis of both the munition and its plausible means of delivery, as outlined above,[182] the IIT deemed it highly unlikely—and eventually discarded—any scenario in which the cylinder would have been affixed, and dropped from, an aircraft's hardpoint or in which it would have been dropped from inside the cargo bay of a fixed-wing aircraft. In particular, the IIT found that only a small number of helicopter variants and subvariants operating over the Syrian Arab Republic in 2016 would have been able to accommodate the size and weight of the munition used in Kafr Zeita and set up so that the cylinder could be manoeuvred and ultimately dropped manually from inside.[183] Having examined the technical specifications of these aircraft, the IIT has reasonable grounds to believe that the chemical weapons attack was executed using an Mi-8/17 helicopter variant.

8.33 In an effort to identify from where the helicopter originated, the IIT assessed 13 airbases whose distance from Kafr Zeita would have been within the range of an Mi-8/17 helicopter. At the time of the incident, six of these airbases had fallen under the control of forces opposing the Government of the Syrian Arab Republic.[184] None of those forces operated manned aerial assets in 2016. Based on information in its possession, the IIT further assessed that, owing both to its proximity to the front line and to its distance from Kafr Zeita, Aleppo International Airport (which was under Government control at the time) would not have been suitable to support an aerial operation aimed at deploying chemical munitions such as the one carried out on 1 October 2016. Therefore, the IIT excluded this possibility. Out of the remaining six airbases, longitudinal satellite imagery studies showed that only four airbases housed Mi-8/17 helicopters in the months before and after the 1 October 2016 incident. Based on specialised analyses (including from former pilots and military experts), witness statements, and the totality of the information, the IIT has reasonable grounds to believe that the Mi-8/17 helicopter that carried out the Kafr Zeita attack did not originate from any airfield other than Hama Airbase.

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180 First IIT Report, para. 8.25; Second IIT Report, para. 6.25; Third IIT Report, para. 6.170.

181 Namely, Talmenes (21 April 2014), Sarmin (16 March 2015), and Qmenas (16 March 2015); see Third Report of the OPCW-United Nations Joint Investigative Mechanism (S/2016/738/Rev.1, paras 54, 56, and 64).

182 See "Origins of the munition" subsection in Section 6 above.

183 See Third IIT Report, paras 6.187 and 6.188.

184 The six locations assessed included Taftanaz Airbase (67 km), Al Tabqa Airport (183 km), Jirah Airbase (143 km), Menagh Military Airport (124 km), Tal Al-Aswad Agricultural Airport (30 km), and Abu al-Duhur Airbase (60 km).

8.34 Witness statements, independent expert reports, and other sources indicate that, at the time of the incident, the Mi-8/17 helicopters stationed at Hama Airbase were officially part of the 255th Squadron of the 63rd Helicopter Brigade. At the time, the 63rd Helicopter Brigade was commanded by Brigadier General [REDACTED], and its 255th Squadron was commanded by [REDACTED]. However, the IIT understands that the Syrian Arab Air Force assigned control over several of these Mi-8/17 helicopters to the Tiger Forces[185] whose units were, at the time, fighting to halt the opposition's advance towards Hama city. The Tiger Forces were operating under the direct command of Colonel [REDACTED]. The IIT has documented the same arrangement in previous reports, in which helicopters formally part of one unit would come under the control of [REDACTED] by being assigned to the Tiger Forces to support their operations.[186]

8.35 Information obtained by the IIT indicates that, at that point in the hostilities, the authority to use chlorine as a weapon was delegated to operational-level commanders by the General Command, under the authority of the then-President of the Syrian Arab Republic and Commander-in-Chief of the Syrian Arab Armed Forces, [REDACTED]. The IIT understands that the Chief of Syrian Air Force Intelligence, Major General [REDACTED], subsequently transmitted any requests for chemical weapons to units that coordinated the delivery and loading of the chemical munitions. The IIT further understands from a number of sources that the logistics and maintenance of flight operations at Hama Airbase (for example, ensuring that helicopters were fuelled and airworthy) was overseen by the commander of the airbase at that time, namely, Brigadier General [REDACTED].

8.36 Information obtained by the IIT from spotters, witnesses, military analysts, and other sources indicates that, during the time frame in which the incident occurred, the airspace over Kafr Zeita was controlled exclusively by the Syrian Arab Air Force and the Russian Aerospace Defence Forces. The IIT has not obtained any information suggesting that forces opposing the Government of the Syrian Arab Republic carried out air strikes in the northern Hama countryside (including Kafr Zeita) on 1 October 2016.

8.37 The IIT further notes that the Russian Federation—and notably the Russian Aerospace Defence Forces—was actively engaged in military operations north of Hama, and in close coordination with the Syrian Arab Air Force and the Tiger Forces at the operational and tactical levels. However, the IIT has not obtained any information indicating the involvement of any States Parties other than the Syrian Arab Republic in the incident of 1 October 2016 in Kafr Zeita. As noted above in this Section, no non-State actors opposing the Government of the Syrian Arab Republic operated manned aerial assets at the time of the incident.

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185 See "The context of military activities in the area" subsection in Section 6 above.

186 Second IIT Report, para. 5.8; Third IIT Report, para. 6.9.

8.38 The IIT reached its conclusions independently based on the totality of the information and evidence at its disposal in relation to the specific incident under investigation. The IIT notes that its findings are consistent with a pattern of chemical weapons attacks involving chlorine-filled cylinders similar to the one found in Kafr Zeita and deployed by Mi-8/17 helicopters on opposition-controlled areas across the Syrian Arab Republic. In three instances (Ltamenah, 25 March 2017;[187] Saraqib, 4 February 2018,[188] and Douma, 7 April 2018[189]), the IIT identified the former authorities of the Syrian Arab Republic as the perpetrators.

8.39 Until the final stages of its investigation, the IIT continued to actively pursue alternative scenarios. However, the IIT did not obtain any reliable information (for example, satellite imagery, video or photographic footage, or intercepts)—including from the former authorities of the Syrian Arab Republic—suggesting that the attack may have been "staged" by armed groups or other entities with no aerial assets, or corroborating that any of the required "staging" actions were performed in Kafr Zeita. As mentioned above, the IIT did not obtain any credible evidence, supporting materials, or leads from the authorities representing the Syrian Arab Republic until the ousting of the Government led by [REDACTED]. Furthermore, no information obtained from other States Parties, pursuant to requests by the IIT and the Director-General on the basis of paragraph 7 of Article VII of the Convention, or other sources, supports the delivery of the cylinders in question by any means other than helicopter.

9. GENERAL CONCLUDING OBSERVATIONS

9.1 The IIT obtained information from various sources suggesting that, for chemical weapons to be used in the manner described above, orders would be required. Nonetheless, the IIT could not draw definitive conclusions, with the requisite degree of certainty, as to the specific chain of command for any specific order issued in this particular incident.

9.2 During this investigation, the IIT did not obtain any information that would indicate that rogue units or individuals within the Syrian Arab Armed Forces used chemical weapons in this incident in the manner described in the present report.

9.3 As noted above, information obtained by the IIT in relation to the Kafr Zeita incident indicates that, at that point in the hostilities, the authority to use chlorine as a weapon was delegated by the General Command to operational-level commanders. However, as with its previous reports,[190] the IIT reiterates that, even if there was delegation, responsibility always also rests with the higher authority.

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[187] First IIT Report, paras 8.36 and 12.31.

[188] Second IIT Report, paras 8.26 and 8.27.

[189] Third IIT Report, paras 6.316 and 8.46.

[190] First IIT Report, para. 13.3; Second IIT Report, para. 9.3; Third IIT Report, para. 9.3.

9.4 As noted in the First IIT Report,[191] under the Convention, violations of the prohibition on the use of chemical weapons can engage State responsibility, whether directly (because the State Party used chemical weapons in contravention of subparagraph 1(b) of Article I of the Convention) or indirectly (for instance, because the State Party did not investigate or punish the use of chemical weapons by natural or legal persons anywhere on its territory or in places under its jurisdiction, in breach of paragraph 1 of Article VII of the Convention).

9.5 As highlighted above,[192] through Note Verbale No. NV/ODG-636/24 (dated 9 December 2024), the Secretariat reminded the Syrian Arab Republic of its continued obligations under the Convention, and requested that it fulfil these obligations.[193] Pursuant to Article VII of the Convention, such obligations include the enactment of penal legislation, which, according to the Report by the Director-General entitled "Overview of the Status of Implementation of Article VII of the Chemical Weapons Convention as at 31 July 2025" (EC-110/DG.6 C-30/DG.7, dated 26 August 2025), the Syrian Arab Republic has yet to adopt.[194]

10. SUMMARY OF FACTUAL FINDINGS

10.1 In light of its mandate to identify the perpetrators of the use of chemical weapons in the Syrian Arab Republic by identifying and reporting on all information potentially relevant to the origin of those chemical weapons in the incident under consideration, the IIT concludes that there are reasonable grounds to believe that, on 1 October 2016, between 19:00 and 19:40 (UTC+3), in the context of a military offensive aimed at halting the opposition's advance towards Hama city, an Mi-8/17 helicopter of the Syrian Arab Air Force dropped at least one yellow pressurised cylinder which hit a cave system in the Wadi al-Aanz valley in Kafr Zeita. The helicopter departed from Hama Airbase and operated under the control of the Tiger Forces, commanded by then-Colonel [REDACTED].

10.2 The pressurised cylinder impacted near two ventilation openings located approximately 300 metres from the Al Maghara Hospital in Kafr Zeita. The cylinder then tumbled down and came to rest near the entrance of the cave system. Upon impact, the cylinder ruptured and released chlorine gas, which dispersed through the Wadi al-Aanz valley, injuring 35 named individuals and affecting dozens more.

Annexes:

Annex 1: Information Management and Other Internal Procedures

Annex 2: Approach to Obtaining and Securing Information

Annex 3: Summary of Contacts with Representatives of the Syrian Arab Republic Relevant to the Work of the Investigation and Identification Team

Annex 4: Redacted Paragraphs

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191 First IIT Report, para. 2.10.

192 See "Approach and challenges in the investigation" Section above.

193 See "Approach and challenges in the investigation" Section, para. 3.7.

194 Report by the Director-General, "Overview of the Status of Implementation of Article VII of the Chemical Weapons Convention, as at 31 July 2025" (EC-110/DG.6 C-30/DG.7, dated 26 August 2025), subpara. 4.8(c).

Annex 1

INFORMATION MANAGEMENT AND OTHER INTERNAL PROCEDURES

1. As explained in the Note by the Technical Secretariat entitled "Work of the Investigation and Identification Team Established by Decision C-SS-4/DEC.3 (Dated 27 June 2018)" (EC-92/S/8, dated 3 October 2019), and further detailed in the "First Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use' – Ltamenah (Syrian Arab Republic) 24, 25, and 30 March 2017" (S/1867/2020, dated 8 April 2020)[195] since the activities of the Investigation and Identification Team (IIT) require vast amounts of information in all its forms to be collected and created, seamless and robust procedures are required to allow for the secure, consistent, and transparent management of such information, from the time of its collection or creation through to its ultimate preservation, transfer, or destruction. In setting up these procedures, the IIT took into account confidentiality and security requirements deemed necessary for the storage and use of the information material provided by other entities.

2. Starting from the premise that access to information within the IIT is on a "need-to-know" basis, effective and secure information handling is considered a key factor for the IIT to fulfil its mandate by: (a) ensuring the safety and security of IIT activities, personnel, and third parties; (b) maintaining the integrity of its records and information; (c) ensuring effective and timely search, analysis, and dissemination of information; and (d) increasing the awareness of confidentiality requirements by promoting correct information handling practices.

3. Established internal procedures related to information management cover all kinds of information material created, obtained, and managed by the IIT, which include both digital and physical material. Provisions are made to ensure the confidentiality of both categories of material in terms of organisational, physical, and information security measures.

4. In particular, and in addition to organisational and physical arrangements, the information management systems and file storage system of the IIT reside in the IIT Secure Network (ISN), designed and built in compliance with the OPCW Security Critical Network policies and requirements for the protection of OPCW confidential material. The ISN is accessible by designated terminals possessing appropriate security and confidentiality measures, which are "air gapped", with no external network interface.

5. The internal procedures of the IIT provide for the registry procedure, the structure of the central repository for its records and information, access permission based on roles, responsibilities, the repository's contents, as well as the retention schedule of IIT records and information. Such procedures ensure that the chain of custody of information and the audit trail of records are properly captured, in order to maintain their continued integrity and authenticity. The IIT has further implemented steps to capture and protect results from open-source searches directly related to the identification of perpetrators within the mandate of the IIT. A back-up plan was implemented in order to enhance security.

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195 See First IIT Report, especially Annex 1 thereto (Information Management and Other Internal Procedures).

6. The case management system within the ISN aims at supporting investigation activities. This case management system is designed to be conducive to investigation and analysis activities, as well as to ensuring the authenticity and reliability of records. The system, accessible through specific encrypted terminals in the ISN, is designed to allow only the IIT to securely and methodically keep the records and information associated with investigation and analysis activities, to add relationships among items, and to provide feedback on investigation steps. It allows for a comprehensive account of the chain of custody of each item obtained, including its movement, locations, and transfers. All electronic information collected and generated by the IIT as a result of its investigation activities is to be stored in the information management system. Moreover, the system organises material efficiently for its future transfer to the investigation mechanism established by the United Nations General Assembly in resolution 71/248 (2016) (IIIM), as well as to any relevant investigatory entities established under the auspices of the United Nations, as mandated by paragraph 12 of decision of the Conference of the States Parties entitled "Addressing the Threat from Chemical Weapons Use" (C-SS-4/DEC.3, dated 27 June 2018).

7. Access control functions in this customised case management system allow IIT personnel to access records only with specific predefined permissions (including permissions to create, read, and modify records). The system is further designed to ensure audit trails that cannot be modified or removed. IIT personnel are trained in the use of the system as required and maintain awareness of the necessary security and confidentiality measures taken to protect the information material.

Annex 2

APPROACH TO OBTAINING AND SECURING INFORMATION

1. The investigative activities of the Investigation and Identification Team (IIT) on the incident in Kafr Zeita on 1 October 2016 included gathering and assessing information provided to it by individuals, local entities, States Parties, and other international, regional, and local actors. They also involved, where applicable and relevant, technical and scientific examinations and analyses to identify the origin of the chemicals used, munition markings and physical characteristics, and technical information and/or extrapolations related to delivery means, such as munition trajectories. The activities further included interviews with alleged victims and other persons who might have witnessed the incident, as well as with experts in the various subjects relevant to the investigation, and evaluation of open-source material.[196] The IIT considered computer modelling and cylinder drop trials to model impact velocities of free-falling cylinders similar to the one used in Kafr Zeita on 1 October 2016. The projectile trajectory expert performed computer simulations of cylinder trajectories, which are used to assess what initial conditions for the trajectory (that is, initial velocity and height) lead to trajectories that match impact conditions found by the terminal ballistic experts consulted by both the IIT and the Fact-Finding Mission in Syria (FFM). In fulfilling its mandate, the IIT obtained and analysed information and material from any relevant sources, in addition to the information that had already been obtained from the FFM, in order to determine the relevance, probative value, and reliability of the information and the credibility of the sources.

2. The IIT takes particular care to ensure that any issues that may arise because of the different languages spoken by the investigators, on the one side, and interviewees, on the other, are properly addressed. Apart from having an interpreter present during interviews, and in addition to summaries of the interviews being prepared by the investigators, full transcripts of the interviews are subsequently translated into English by language professionals, so as to be able to properly verify the original interpretation. A transcript of the interview conducted by the IIT is produced through a process to accurately identify any discrepancy not easily captured when "live" interpretation of an interview is performed, either consecutively or simultaneously. Moreover, certain interviews are now also conducted directly in the language of the interviewee, with a transcript in English produced only afterwards.

3. For the specific purpose of this report, the IIT reached out to 23 witnesses directly related to the attack—at times reverting to certain individuals to request clarifications of previous statements and to expand on certain matters—including alleged victims. These interviews were considered in conjunction with 29 witness statements previously obtained by the FFM.

4. In relation to other entities willing to provide information or leads for the investigation, the general approach of the IIT has continued to be one of requesting access to information and to the sources of such information that the IIT considered could be obtained from those entities, and to assess them together with the rest of the information already at its disposal.

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196 See also Note by the Secretariat EC-92/S/8 (dated 3 October 2019).

5. When entities willing to assist the IIT did not have relevant information directly, but could put the IIT in contact with persons of interest, the IIT proceeded to request this type of facilitation on the basis of the following understanding:

(a) the IIT would not pay, in any way, fees or other forms of remuneration for the support provided by these entities;

(b) the entity in question would ensure that no person had been unduly influenced or pressured to provide information or to extend their cooperation for the purpose of the IIT investigations; and

(c) with a view to protecting persons of interest who might be at risk because of their interaction with the IIT, sufficient guarantees would be provided to protect confidentiality as well as the privacy of these persons, including their identification data and statements.

6. Unless specific circumstances dictated otherwise, the IIT treated all information obtained from external entities and individuals as "OPCW Highly Protected", the highest classification category within the OPCW confidentiality regime, and restricted its access on the basis of the "need-to-know" principle in accordance with the Confidentiality Annex to the Chemical Weapons Convention (the Convention) and the OPCW Policy on Confidentiality.[197]

7. The IIT treated the information collected through a widely shared methodology among investigatory bodies, such as international fact-finding bodies and commissions of inquiry, in particular with regard to the chain of custody of the samples and material.

8. These samples were treated so as to ensure their integrity, including during their transportation to the OPCW Laboratory in the Netherlands and from there to OPCW designated laboratories. This continues to be done in accordance with the Verification Annex to the Convention and corresponding applicable internal procedures and practices of the Technical Secretariat (the Secretariat).[198]

9. For such material and samples, the chain of custody was maintained and documented by the Secretariat from the moment of collection or receipt. For instance, once in the custody of the Secretariat, samples were treated according to OPCW procedures to ensure their integrity, as well as their security, preservation, and confidentiality. At the OPCW Laboratory, the samples were prepared for off-site analysis at two OPCW designated laboratories in accordance with paragraph 57 of Part II of the Verification Annex to the Convention. The sample processing included verification of their identity, that is, through sample codes, item descriptions, and seal numbers; solvent extraction and/or splitting into fresh primary containers; packaging of sample splits together with positive and negative control samples; and detailed analysis of positive and negative control samples before dispatch. Internal established procedures for splitting, packing, and transportation to the OPCW designated laboratories were applied, and all steps of the process were documented.

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197 See para. 4.1 of Part V and paras 3.1 to 3.4 of Part VI of the OPCW Policy on Confidentiality (C-I/DEC.13/Rev.2, dated 30 November 2017), as well as subpara. 2(h) of the Confidentiality Annex to the Convention.

198 With specific respect to the storage conditions in the OPCW Laboratory and the degradation of samples to be analysed, see further "Advice on chemical weapons sample stability and storage provided by the Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons to increase investigative capabilities worldwide", also available in *Talanta*, vol. 188 (2018), pp. 808, 810, and 811.

10. Upon arrival at the OPCW designated laboratories, the identity and seal integrity of the samples are once again verified against the accompanying chain of custody form. All samples, namely authentic and control samples, are prepared and analysed in accordance with instructions issued by the OPCW Laboratory. This is in the form of a document setting out the scope of the analysis, which also contains the identification data for the samples and their corresponding tamper-proof seal numbers.

11. The OPCW designated laboratories, which operate under a quality system in accordance with International Organization for Standardization/International Electrotechnical Commission Standard ISO/IEC 17025, are also obligated to maintain the chain of custody of the samples throughout their processes. All activities performed by the OPCW designated laboratories on behalf of the OPCW must conform to the terms and conditions of the technical arrangements between the Secretariat and the OPCW designated laboratories.

12. Owing to the ongoing conflict(s) occurring in the relevant areas, access by the Secretariat to the site of incident shortly after their occurrence was often not possible. Therefore, the IIT has consistently ensured that samples and other material taken by other entities were supported by documents, photographs, video footage, forensic analyses, and/or witness testimony. In order to do this, the IIT reached out to specialists and forensic institutes to provide geolocation and metadata from the image files obtained. This approach has been applied consistently in light of the fact that it is the combination, consistency, and corroboration of all of the information gathered as a whole, rather than single pieces of evidence, which form the basis of the conclusions of the IIT.[199]

13. The IIT took guidance from practices and principles derived from relevant decisions by the Conference of the States Parties (the Conference) and Secretariat procedures, as well as from the approach of States Parties investigating similar incidents, and applied them, mutatis mutandis, in full compliance with the Convention.[200]

14. Information gathered during the IIT investigation remains available for transfer to the mechanism established by the United Nations General Assembly in resolution 71/248 (2016) (IIIM), as well as to any relevant investigatory entities established under the auspices of the United Nations, as mandated by paragraph 12 of Conference decision C-SS-4/DEC.3, and reinforced by paragraph 9 of the decision of the Executive Council entitled "Addressing the Possession and Use of Chemical Weapons by the Syrian Arab Republic" (EC-94/DEC.2, dated 9 July 2020).

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199 See, for instance, Note S/1654/2018 (dated 20 July 2018), pp. 3, 9,10, and 21. The IIT further notes that this approach follows the practice of international and domestic investigations in these types of events.

200 See, among others: Conference decision C-I/DEC.47 (dated 16 May 1997) entitled "Sampling and Analysis During Investigations of Alleged Use of Chemical Weapons" and "Standard Operating Procedure for Evidence Collection, Documentation, Chain-of-Custody and Preservation During an Investigation of Alleged Use of Chemical Weapons" (QDOC/INS/SOP/IAU01), first issued in 2011.

Annex 3

SUMMARY OF CONTACTS WITH REPRESENTATIVES OF THE SYRIAN ARAB REPUBLIC RELEVANT TO THE WORK OF THE INVESTIGATION AND IDENTIFICATION TEAM

1. In relation to the investigations required under paragraph 10 of decision C-SS-4/DEC.3 "Addressing the Threat from Chemical Weapons Use", the Technical Secretariat (the Secretariat) has engaged in continuous and extensive communications aimed at obtaining input from all States Parties, and the Syrian Arab Republic in particular—as detailed in the "First Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use' – Ltamenah (Syrian Arab Republic) 24, 25, and 30 March 2017" (S/1867/2020, dated 8 April 2020),[201] the "Second Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use' – Saraqib (Syrian Arab Republic) 4 February 2018" (S/1943/2021, dated 12 April 2021),[202] the "Third Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use', Douma (Syrian Arab Republic), 7 April 2018" (S/2125/2023, dated 27 January 2023),[203] and the "Fourth Report by the OPCW Investigation and Identification Team Pursuant to Paragraph 10 of Decision C-SS-4/DEC.3 'Addressing the Threat from Chemical Weapons Use' – Marea (Syrian Arab Republic) – 1 September 2015" (S/2255/2024, dated 22 February 2024).[204]

2. With specific reference to the IIT investigation into the incident in Kafr Zeita on 1 October 2016, on 24 June 2024 the Secretariat addressed a note verbale[205] to the Permanent Representation of the Syrian Arab Republic to the OPCW, attaching a note by the IIT inviting the Syrian Arab Republic to, inter alia, submit any concrete information in respect of the incident. The note further reiterated the availability of the IIT to meet with representatives of the Syrian Arab Republic at their convenience and at a location of their choosing. The purpose of this meeting would have been to discuss the progress of the investigation and the provision of any information and access to relevant locations that the authorities of the Syrian Arab Republic may have been able to facilitate.

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201 See First IIT Report, Annex 3 (Summary of Contacts with Representatives of the Syrian Arab Republic Relevant to the Work of the Investigation and Identification Team).

202 See Second IIT Report, Annex 3 (Summary of Contacts with Representatives of the Syrian Arab Republic Relevant to the Work of the Investigation and Identification Team).

203 See Third IIT Report, Annex 3 (Summary of Contacts with Representatives of the Syrian Arab Republic and Other States Parties Relevant to the Current Investigations of the Investigation and Identification Team).

204 See Fourth IIT Report, Annex 3 (Summary of Contacts with Representatives of the Syrian Arab Republic and Other States Parties Relevant to the Current Investigations of the Investigation and Identification Team).

205 NV/ODG/564/24 (dated 24 June 2024).

3. Pending a response from the Syrian Arab Republic, the IIT thoroughly reviewed and assessed notes verbales transmitted by the Syrian Arab Republic to the Secretariat, as well as other communications and statements[206] issued by the Syrian Arab Republic that it deemed to be potentially relevant to its investigation, and duly took relevant information and leads into account. Eventually, the note verbale remained unanswered.

4. On 8 December 2024, the then-President of the Syrian Arab Republic, [REDACTED], fled the country, leaving his Prime Minister to transfer power to new authorities.[207] Through Note Verbale No. NV/ODG-636/24 (dated 9 December 2024), the Secretariat reminded the Syrian Arab Republic of its continued obligations under the Convention, and requested that it fulfil these obligations.

5. On 8 February 2025, the OPCW Director-General, accompanied by a delegation from the Secretariat, visited Damascus to meet with the Syrian Arab Republic's (then-interim) President and (then-caretaker) Foreign Minister. The delegation included—for the first time on the territory of the Syrian Arab Republic—a member of the IIT. During the visit, the President committed, among other things, to providing full support and unfettered access for the investigations conducted by the OPCW FFM and IIT.[208]

6. On 22 May 2025, a letter from the IIT Chief Coordinator was transmitted to the Point of Contact of the Syrian Arab Republic with the OPCW.[209] In the letter, the Chief Coordinator reiterated the request for cooperation that had already been conveyed to the former authorities of the Syrian Arab Republic in Note Verbale No. NV/ODG/564/24, and shared a series of outstanding questions relevant to the perpetrators of the incident in Kafr Zeita.[210]

7. In the course of two subsequent deployments to the Syrian Arab Republic (from 11 to 18 June and from 17 to 22 September 2025), members of the IIT held meetings with relevant Syrian authorities.[211] The request made by the IIT for cooperation and information in relation to its ongoing investigation featured prominently in the discussions. During the latter deployment, Syrian Government representatives shared relevant information and primary documentation with the IIT, marking the first instance of cooperation by the Syrian Arab Republic with an IIT investigation.

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206 See, for example, identical letters dated 11 March 2019 from the Permanent Representative of the Syrian Arab Republic to the United Nations addressed to the Secretary-General and the President of the Security Council (S/2019/250, 22 March 2019); Statement by H.E. Ambassador Bassam Sabbagh, Permanent Representative of the Syrian Arab Republic to the OPCW at the Twenty-Fourth Session of the Conference (C-24/NAT.40); Statement by H.E. Ambassador Milad Atieh, Permanent Representative of the Syrian Arab Republic to the OPCW, at the Ninety-Ninth Session of the Council (EC-99/NAT.78).

207 See Note by the Secretariat "The Situation in the Syrian Arab Republic in Relation to the Syrian Chemical Weapons Programme and the Way Forward" (S/2376/2025, dated 26 February 2025), para. 6.

208 Ibid., para. 15.

209 L/ODG-281/25 (dated 22 May 2025).

210 Ibid.

211 See Report by the Director-General "Progress in the Elimination of the Syrian Chemical Weapons Programme" (EC-110/DG.5, dated 25 August 2025), para. 39.

OPCW
Organisation for the Prohibition of Chemical Weapons

NV/ODG/564/24

Request for cooperation under Article VII of the Chemical Weapons Convention

The Technical Secretariat (hereinafter referred to as the "Secretariat") of the Organisation for the Prohibition of Chemical Weapons (hereinafter referred to as the "OPCW") presents its compliments to the Permanent Representation of the Syrian Arab Republic of the OPCW.

Reference is made to the work of the Investigation and Identification Team (IIT), established pursuant to paragraph 10 of the Decision adopted by the Conference of the States Parties to the Chemical Weapons Convention on 27 June 2018 (C-SS-4/DEC.3).

Following the issuance of its first four reports (S/1867/2020 dated 8 April 2020, S/1943/2021 dated 12 April 2021, S/2125/2023, dated 27 January 2023, and S/2255/2024, dated 22 February 2024), the IIT is progressing with its investigations and, as mandated by the Conference of the States Parties, reaches out to States Parties in order to gather information and conduct investigations and analysis on those incidents under its scope.

As was the case with the letters addressed by the Director-General of the OPCW to the Deputy Foreign Minister for Foreign Affairs and Expatriates of the Syrian Arab Republic dated 19 December 2019, 3 July 2020, 16 October 2020, and the notes verbales addressed by the Secretariat to the Permanent Representation of the Syrian Arab Republic to the OPCW dated 22 December 2021 and 14 February 2023, a Note is hereby attached seeking the cooperation of the Syrian Arab Republic on these activities as mandated by paragraph 7 of Article VII of the Chemical Weapons Convention.

The Technical Secretariat of the Organisation for the Prohibition of Chemical Weapons avails itself of this opportunity to renew to the Permanent Representation of the Syrian Arab Republic to the OPCW the assurances of its highest consideration.

The Hague, 24 June 2024

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS · THE HAGUE ·

Permanent Representation of the Syrian Arab Republic
to the OPCW
President Kennedylaan 19
2517 JK The Hague

Request for cooperation under Article VII of the Chemical Weapons Convention

This note follows the correspondence related to the work of the OPCW Technical Secretariat through the Investigation and Identification Team (IIT), established pursuant to the Decision of the Conference of the State Parties entitled "Addressing the Threat from Chemical Weapons Use" (C-SS-4/DEC.3, dated 27 June 2018).

Pursuant to paragraph 7 of Article VII of the Convention, each State Party undertakes to cooperate with the Organisation in the exercise of all its functions and in particular to provide assistance to the Secretariat.

As highlighted in the Note of the Technical Secretariat dated 28 June 2019 (EC-91/S/3, para. 10), when a State assumes an obligation in an international agreement, this expresses a legally binding undertaking.

Accordingly, and further to EC-91/S/3, the Director-General, during his opening statement to the Council at its Ninety-First Session, requested all States Parties concerned to provide their full cooperation to the IIT (para. 21 of EC-91/DG.25, dated 9 July 2019). In September 2019, communications requesting assistance were sent to all States Parties, reiterating calls for assistance and specifically requesting information potentially relevant to establish the origin of the chemical weapons used in the nine identified incidents and useful to identify perpetrators.

In light of the above, and with specific reference to the incident in Kafr Zeita (1 October 2016)[1], the Secretariat hereby requests any concrete information the authorities of the Syrian Arab Republic may be able to share potentially relevant to establishing the origin of the chemical weapons used in that instance, and useful to identify the relevant perpetrators. That may include information on delivery methods; background information related to actors that might have the capabilities to develop, produce, stockpile and use such weapons; evidence suggesting or contradicting attribution to certain actors as the perpetrators; as well as any element related to the relevance, probative value, and reliability of such information and to the credibility of the relevant source(s). The Technical Secretariat would also welcome the opportunity to access, review and discuss the findings of any investigations or scientific or technical studies undertaken by the authorities of the Syrian Arab Republic in relation to the incident.

In particular, as with other incidents, the Secretariat is interested in receiving any concrete information and sources (including videos, photographs, witness statements and GPS coordinates) that the authorities of the Syrian Arab Republic may have in their possession, including specific details on relevant subjects, command and control structures and locations of interest.

With specific reference to Notes Verbale no. 10, dated 20 February 2017, and Note Verbale no. 15, dated 7 March2017, addressed by the Syrian Arab Republic to the Secretariat, the Secretariat hereby further reiterates the IIT's willingness and availability to conduct any interviews with witnesses present at the time and site of the incident that the Syrian Arab Republic may be in the position to facilitate.

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[1] Ref: Note by the Technical Secretariat, Report of the OPCW Fact-Finding Mission in Syria Regarding the Incident of the Alleged Use of Chemicals as a Weapon in Kafr Zeita, Syrian Arab Republic – 1 October 2016, S/2020/2022 (dated 31 January 2022).

In addition, the Secretariat is seeking the Syrian Arab Republic's cooperation in securing access to locations relevant to the incident in Kafr Zeita for relevant members of the IIT, including through the issuance of entry visas to the Syrian Arab Republic.

With specific reference to paragraph 1 of Article VII of the Convention, the Secretariat would further welcome any information that the Syrian Arab Republic may be able to provide on any criminal investigation and/or proceedings undertaken in relation to the use of chemical weapons in Kafr Zeita on 1 October 2016, as well as on the relevant penal legislation.

As the examination of the available information concerning the use of chemical weapons in the aforementioned incident continues, the Secretariat once again reiterates the value of the IIT engaging with representatives of the Syrian Arab Republic based in both The Hague and the Syrian Arab Republic, at the latter's convenience, whether in The Netherlands, Damascus or at any other location of their choosing, to discuss the progress of its investigation as well as the provision of any information and access to relevant locations that the authorities of the Syrian Arab Republic may be able to facilitate.

Annex 4

REDACTED PARAGRAPHS

This Annex has been classified as "OPCW Highly Protected" and is available to all States Parties in document IIT/HP/006 (dated 21 January 2026).

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