



PROJECT ANTHRACITE

Sunchon Area

DPRK's Chemical Facilities: Site Profile 7

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Executive Summary

This report on the Suncheon area is the seventh site profile exploring chemical production facilities throughout North Korea. Project Anthracite seeks to use open-source information to map out the North Korean chemical industry and its potential links to a chemical weapons programme.

The Suncheon area has historically been associated with a dual-use capacity to contribute to such a programme, but it has seen significant reconstruction over the past decade, including of the Suncheon Phosphatic Fertiliser Plant and the Suncheon C1 Chemical Facility. Both sites replaced portions of the old Suncheon Vinalon Complex, a site which from review of open sources seems to have produced many of the same materials using similar processes to those at the 8th February Vinalon Complex. In addition, this report analyses the Suncheon Pharmaceutical Factory and the Suncheon Chemical Complex.

The features and areas of the Suncheon Phosphatic Fertiliser Plant are consistent with the large-scale production of phosphatic fertilisers using both a wet and dry process. This yields lower purity phosphorus, of use primarily for agricultural fertiliser, and higher purity white phosphorus, of use for consumables but also of dual-use relevance for organophosphorus chemistry in relation to nerve agent production.

The features and areas of the Suncheon C1 Chemical Facility are consistent with the use of coal gasification to generate a wide range of hydrocarbons, including large quantities of methanol for conversion to gasoline. Yet, large areas of the site remain under construction as of February 2026.

The Suncheon Chemical Complex, as referred to in North Korean sources, appears to encompass both the Songyong Paints Factory and a Nutrient Solution Factory. The two facilities are located on different sites. The Nutrient Solution Factory is co-located with the Suncheon Pharmaceutical Plant, and its processes appear consistent with the possible provision of growth medium for antibiotic production at the Pharmaceutical Plant. The Songyong Paints Factory has features inconsistent with its reported purpose, including a higher level of security than the other chemical sites analysed in this report, and a probable helipad. It is reported to produce acrylic acid via oxidation of propylene, but a small change to this process could yield significant amounts of hydrogen cyanide (HCN).

No evidence of production related to chemical warfare agents was identified. Yet, the Suncheon area remains relevant for dual-use chemistry, including large-scale synthesis of discrete organic chemicals (DOCs) and phosphorous chemistry, despite the transition from the former Vinalon Complex to the current industry. The materials available from the Suncheon area could be of relevance to the production of nerve agents, given the close proximity of facilities producing phosphorus and DOCs, although chlorine was not identified as a product of any of the sites analysed. Additionally, the presence of methanol and ammonia at the C1 Plant and Suncheon Phosphatic Fertiliser Complex, respectively, could support the production of HCN and nitrogen mustards.

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Project Background

North Korea has long been assessed by many countries as having a chemical weapons (CW) programme. In 2006, a South Korean defence ministry white paper estimated that between 2,500 and 5,000 tons of chemical warfare agents (CWAs) were stored in facilities across the country.¹ This figure is reiterated in a more recent white paper from 2022.²

The 2017 assassination of Kim Jong Un's half-brother Kim Jong Nam with the nerve agent VX,³ in an attack that was widely accepted as orchestrated by North Korea,⁴ served as a reminder of the long-standing North Korean CW programme. Furthermore, it highlighted how little is known about it, in contrast to the international attention paid to North Korea's missile and nuclear programmes.⁵

In an attempt to identify means to bridge that gap, the Royal United Services Institute (RUSI) published a feasibility study in partnership with the Defence Science and Technology Laboratory in March 2022 which concluded that open-source tools could help in understanding North Korea's chemical industry, allowing hypotheses about CW production to be developed and refined.⁶ The study formed part of a multi-year project on North Korean weapons of mass destruction (WMD) in cooperation with the Verification Research, Training and Information Centre (VERTIC) and the James Martin Center for Nonproliferation Studies.

One of the conclusions of the feasibility study was that:

Future work will need to consider industrial capability as a network; looking at single sites in isolation will leave knowledge gaps. Although this approach as applied to a single site will help inform assessments of activity taking place there, it will not support a holistic understanding of a CW capability. This is

1. South Korean Ministry of Defence, *2006 Defense White Paper*, https://www.files.ethz.ch/isn/155726/SouthKorea_English2006.pdf, accessed 23 February 2023.
2. South Korean Ministry of Defense, *2022 Defense White Paper*, https://www.mnd.go.kr/user/mndEN/upload/pblicitn/PBLICTNEBOOK_202307280406019810.pdfhttps://www.mnd.go.kr/user/mnd/upload/pblicitn/PBLICTNEBOOK_202303070948465300.pdf, accessed 21 October 2024.
3. Organisation for the Prohibition of Chemical Weapons (OPCW), "Statement by H.E. Ambassador Ahmad Nazri Yusof, Permanent Representative of Malaysia to the OPCW at the Eighty-Seventh Session of the Executive Council", EC-87/NAT.14, 14 March 2018, https://www.opcw.org/sites/default/files/documents/EC/87/en/ec87nat14_e_.pdf, accessed 4 January 2024.
4. Hannah Ellis-Petersen and Benjamin Haas, "How North Korea Got Away with the Assassination of Kim Jong-nam", *The Guardian*, 1 April 2019, <https://www.theguardian.com/world/2019/apr/01/how-north-korea-got-away-with-the-assassination-of-kim-jong-nam>, accessed 2 May 2024.
5. Nuclear Threat Initiative (NTI), 'The CNS North Korea Test Database', 28 April 2023, <https://www.nti.org/analysis/articles/cns-north-korea-missile-test-database/>, accessed 7 May 2023; Hans M. Kristensen and Matt Korda, "Nuclear Notebook: How Many Nuclear Weapons Does North Korea Have in 2022?", *Bulletin of the Atomic Scientists*, 8 September 2022, <https://thebulletin.org/premium/2022-09/nuclear-notebook-how-many-nuclear-weapons-does-north-korea-have-in-2022/>, accessed 7 May 2023.
6. Cristina Varriale and Sarah Clapham, "Remote Assessment of North Korea's Chemical Weapons: Feasible or Not?", *RUSI Occasional Paper*, March 2022.

because it is unlikely that an individual facility is responsible for start-to-finish production of CW.⁷

Based on the feasibility study and with the support of Global Affairs Canada, RUSI initiated a three-year project to use open-source tools and remote-sensing technologies to provide a networked overview of North Korea's chemical industry. This was done initially by profiling sites and seeking to understand their role in North Korea's chemical industry as well as establishing any links they might have to CW production.

CW production programmes have always had their roots in the chemical industry, from research into new pesticides to the supply of raw materials and intermediates. Many chemicals which have formed part of historic CW programmes worldwide have been included in the Annex on Chemicals, which forms part of the Chemical Weapons Convention (CWC).⁸ This annex defines the basis for allocating one of three schedules to some chemicals. The basis of the three schedules depends on aspects such as toxicity, quantity of use for purposes not prohibited by the CWC, and whether it has been used as a CW or identified as a precursor. For completeness, it should be noted that a chemical can be classed as a CW without being in any of the schedules.

Site Selection

The city of Suncheon occupies a central place in North Korea's chemical-industrial ecosystem, combining favourable geography, legacy infrastructure and sustained regime investment. Located in South Pyongan Province, Suncheon sits along one of the country's most developed industrial corridors, with good rail and road connectivity, linking it to Pyongyang, Nampo Port, the coal and mineral districts of western and central DPRK (Democratic People's Republic of Korea) and major downstream industrial centres such as Hamhung. The area is close to several anthracite coal mines⁹ and limestone and phosphate-bearing¹⁰ raw materials, and there is well-established power generation and water access. Together, these features represent an ideal environment that could support large-scale carbide chemistry, coal to chemical (C1) aspirations and pharmaceutical manufacture. Within the Suncheon area, there are four principal chemical sites: (i) the Suncheon Phosphatic Fertiliser Factory; (ii) the Suncheon C1 Chemical Facility, which is under construction; (iii) the Suncheon Chemical Complex; and (iv) the Suncheon Pharmaceutical Factory. This report analyses these four sites (see Figure 1).

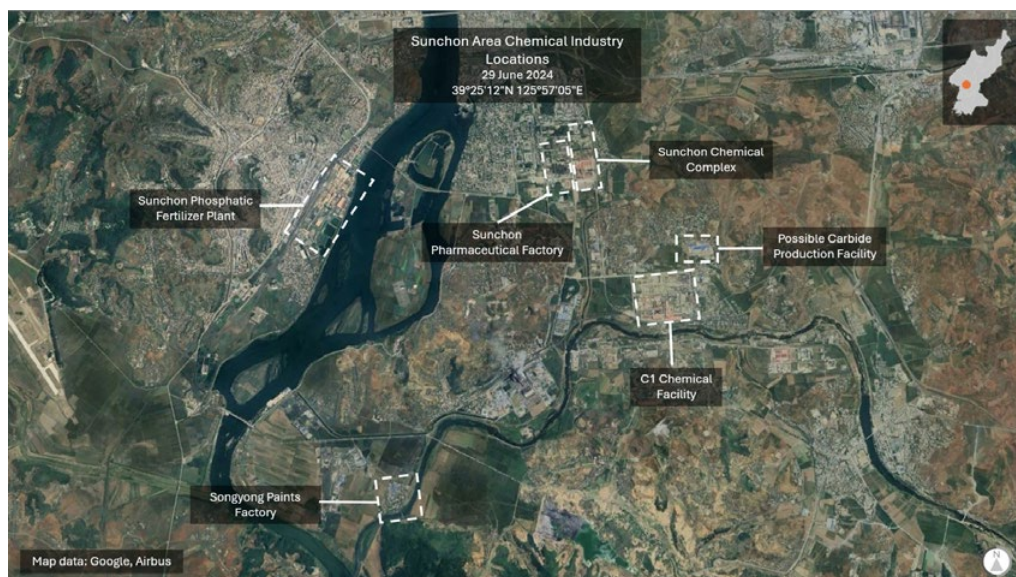
7. *Ibid.*

8. OPCW, 'Annex on Chemicals', <https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/annex-chemicals>, accessed 3 May 2023.

9. Sang-Mo Koh, Bum Han Lee and Otgon-Erdene Davaasuren, 'Situation of Geological Occurrences and Utilization, and Research Trends of North Korean Coal Resources', *Economic and Environmental Geology*, Vol. 57, No. 3, 2024, pp. 281–292. Lignite coal would also be available. United States Geological Survey, *2017–2018 Minerals Yearbook: North Korea*, 2023, <https://pubs.usgs.gov/myb/vol3/2017-18/myb3-2017-18-north-korea.pdf>, accessed 2 May 2026.

10. Jinkon Ju, Yunsong Kim and Mansik Gang, 'Characteristics of Carbonatites from the Northern Part of the Korean Peninsula: A Perspective from Distribution, Geology and Geochemistry', *Geoscience Frontiers*, Vol. 12, No. 1, January 2021, pp. 173–181.

Figure 1: Overview of chemical industry in the Suncheon area



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Methodology

The Project Anthracite team reviewed open-source information with the assistance of 38 North. This report features satellite imagery and ground-level imagery released by the DPRK as primary sources. Declassified government intelligence and think-tank analyses served as secondary sources.

RUSI used the formalised, well-established satellite imagery analytical approach as trained and adopted by the military imagery analysis community. This approach considers eight factors: location; size; shape; shadow; tone/colour; texture; pattern; and associated features. The information was analysed by an expert consultant. The analysis was subsequently reviewed within the team (which includes satellite imagery experts). The imagery cut-off date for the Suncheon Phosphatic Fertiliser Factory was 25 September 2025, whereas it was 3 November 2025 for the Suncheon C1 Chemical Facility, Suncheon Chemical Complex and Suncheon Pharmaceutical Factory.

This report outlines the most likely process descriptions and associated chemistry used at the site, as assessed by chemists and chemical engineers based on research into potential processes and information on the sites found in open-source documentation. Stills from Korea Central Television (KCTV), North Korea's state television broadcaster, feature in the report. These videos were accessed through databases of saved KCTV footage provided by 38 North.

The report was also externally peer reviewed, with inputs included as appropriate. The satellite imagery analysis was coupled to the assessment of all of the other information to provide overall evaluation of the sites.

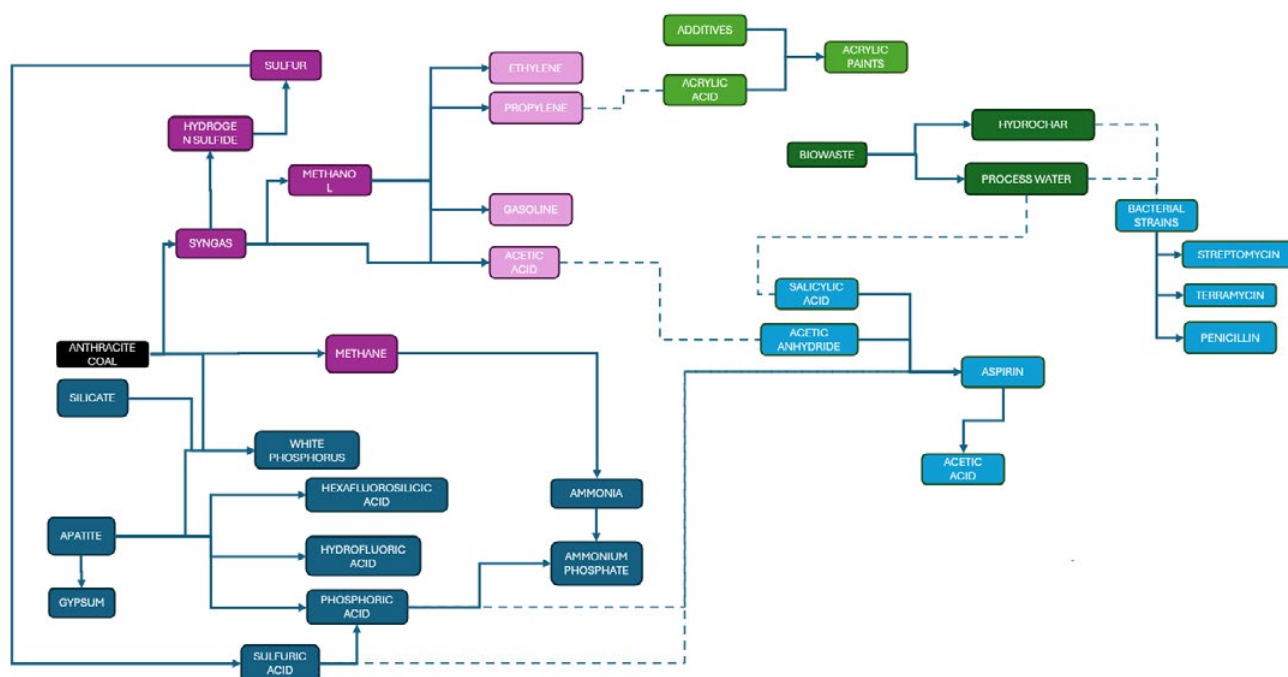
Overview of Processes

Understanding the Suncheon facilities requires a high-level appreciation of the principal chemical processes likely to be in use. These processes are well established in global industry and form the basis for both fertiliser production and coal-to-chemicals pathways.

The main product of the Sunchon Phosphatic Fertiliser Plant is ammonium phosphate, which is produced from the isolation of elemental phosphorus from deposits in apatite and its conversion to phosphoric acid, followed by the reaction of phosphoric acid with ammonia. Phosphoric acid can be produced either by burning phosphate rock with silica and carbon to yield elemental phosphorus which is then dissolved in water, or by reacting phosphate rock with sulfuric acid. The former is known as the dry process, and the latter as the wet process. Then, phosphoric acid reacts with ammonia to form ammonium phosphate, which can be dried and pelletised for use as fertiliser.

The C1 Chemical Facility takes its name from C1 chemistry, which involves the conversion of small carbon-containing compounds such as carbon monoxide and methanol into heavier fuels and organic chemicals. It is an alternative pathway to chemicals which conventionally have come from petroleum refining; in the DPRK, coal gasification serves as the source of single carbon compounds for C1 chemistry. Other facilities within the Sunchon Chemical Complex produce acrylic acid, nutrient solution for either pharmaceutical or agricultural use, single-molecule pharmaceuticals and antibiotics. Figure 2 summarises the probable process flows within the Sunchon area, which are discussed in further detail in their respective sections below.

Figure 2: Simplified potential overall process flow between facilities in the Sunchon area



Author generated.¹¹ Purple denotes chemicals produced at the Sunchon C1 Chemical Facility (light purple indicates processes which may not yet be operational); navy blue denotes chemicals produced at the Sunchon Phosphatic Fertiliser Plant; light green denotes chemicals produced at the Songyong Paints Factory; dark green denotes chemicals produced at the Nutrient Solution Factory within the Sunchon Chemical Complex; and light blue denotes chemicals produced at the Sunchon Pharmaceutical Factory. Black highlights raw material input (anthracite coal).

11. Sources: methanol to isobutane: G.J. Hutchings et al., 'The conversion of methanol and other O-compounds to hydrocarbons over zeolite β ', *Journal of Catalysis*, Vol. 147, No. 1, May 1994, pp. 177–185; VX pathway additions: Georgios Pampalakis and Stavroula Kostoudi, "Chemical, Physical, and Toxicological Properties of V-Agents", *International Journal of Molecular Sciences*, Vol. 24, No. 10, Article Number: 8600, 2023, <https://doi.org/10.3390/ijms24108600>; methanol to olefins: Peng Tian, Yingxu Wei, Mao Ye and Zhongmin Liu, "Methanol to Olefins (MTO): From Fundamentals to Commercialization", *ACS Catalysis*, Vol. 5, No. 3, 2015, pp. 1922–1938, DOI: 10.1021/acscatal.5b00007.

Theoretical Pathways to Chemical Warfare Agents

Chemical industry in the Suncheon area has evolved from its earlier vinalon configuration into a modernised industrial cluster centred on the Suncheon Phosphatic Fertiliser Plant, a newly prioritised coal-to-chemicals complex at the Suncheon C1 Chemical Facility, and supporting fabrication (Suncheon Chemical Complex) and pharmaceutical facilities (Suncheon Pharmaceutical Factory). This reconfiguration has shifted the area's material flows towards phosphate-derived streams, a reported white/yellow phosphorus capability, syngas-derived methanol, and a range of acid inventories. These are all legitimate industrial products, yet they also feature prominently in open-source precursor maps for several CWA families.

The Suncheon Phosphatic Fertiliser Plant's dry-process line—comprising phosphorus feedstock tanks, furnace operations, desulfurisation towers, and large-scale acid handling—introduces upstream materials relevant to organophosphorus chemistry. White phosphorus¹² contains trace arsenic impurities, and phosphate-processing residues can generate fluorine-bearing byproducts such as fluorosilicic acids and hydrogen fluoride.¹³ These are common in fertiliser manufacture but also appear in open-source retrosynthetic pathways for G-series phosphorofluoridates.¹⁴ Collocation with methanol capability at the Suncheon C1 Chemical Facility further enhances dual-use potential: methanol can be reacted with ammonia to produce methylamine and dimethylamine,¹⁵ precursors associated with nitrogen mustards and tabun, while syngas-derived intermediates support broader methylation and animation chemistry.¹⁶ White phosphorus itself is also used extensively by militaries as a smokescreen and an incendiary weapon but is generally not classified as a CW unless used for its toxic properties.¹⁷

Historical references to the former Suncheon Vinalon Complex and its calcium-cyanamide production suggest that some earlier cyanamide-dependent pathways may have diminished, implying a shift rather than a simple expansion of precursor availability. Nonetheless, the contemporary configuration restores or enhances other pathways. Coal gasification and low-temperature carbonisation can yield ethylene, acetylene and ammonia liquors rich in nitrogenous compounds, supporting legitimate industrial chemistry but also appearing in open-source diagrams for vesicants such as sulfur mustard and for amine precursors relevant to VX via diisopropylamine.

12. David R. Corbin, Stephan Schwarz and George C. Sonnichsen, "Methylamines Synthesis: A Review", *ACS Catalysis Today*, Vol. 37, No. 2, 1997, pp. 71–102.
13. Rodney Gilmour, "Phosphorus", 26 March 2019, <https://doi.org/10.1002/0471238961.1608151902182113.a01.pub3>, accessed 2 May 2026.
14. Jared Ledgard, *A Laboratory History of Chemical Warfare Agents*, Second Edition, 2006, ISBN: 9780615136454.
15. David R. Corbin, Stephan Schwarz and George C. Sonnichsen, "Methylamines Synthesis: A Review", *ACS Catalysis Today*, Vol. 37, No. 2, 1997, pp. 71–102.
16. North Korea, *CBRN Production Capabilities*, Jane's CBRN Assessments, 25 May 2017, <https://janes.ihs.com/>; Kyoung-Soo Kim, "North Korea's CB Weapons: Threat and Capability", *Korean Journal of Defense Analysis*, Vol. XIV, No. 1, Spring 2002, pp. 69–95; Yonhap News Agency, *North Korea Handbook*, 2003, pp. 711–712; "DPRK Factories Suspected of Producing Chemical Agents", *Kitachosen Jinmingun no Zensho*, 17 December 1996, p. 127; "North Korea Major Producer of Biochemical Weapons", *Vantage Point*, November 1992, pp. 23–26.
17. Paul Reynolds, "White Phosphorus: Weapon on the Edge", BBC News, 16 November 2005, <http://news.bbc.co.uk/2/hi/americas/4442988.stm>, accessed 2 May 2026.

Retrosynthetic analysis of Sunchon Phosphatic Fertiliser Plant’s feedstocks indicates that certain Schedule 3 chemicals—such as phosphorus oxychloride and phosphorus trichloride—could theoretically be produced from ammonium phosphate in a small number of steps, although there is no evidence that such chemistry is occurring. These intermediates are widely used in civilian industry but also serve as precursors for G- and V-series nerve agents. Their theoretical accessibility underscores the importance of monitoring acid-handling infrastructure, tall distillation columns, furnace signatures, and fabrication-yard activity, while recognising that imagery alone cannot demonstrate illicit production.

Overall, the Sunchon area appears less a collection of dedicated networks of CWA facilities and more an industrially-resilient node whose legitimate production streams overlap with several precursor families identified on open-source process maps. The area’s modernisation has not eliminated dual-use risk; instead, it has redistributed and, in some respects, amplified it by placing bulk phosphorus, methanol, and fabrication capability in closer proximity. The appropriate analytical framing is therefore one of capacity and plausibility, supported by corroborative evidence-building across imagery, procurement, and supply-chain indicators, rather than drawing operational conclusions from individual signatures.

Table 1 highlights selected Sunchon area chemicals that could, in principle, serve as starting materials or intermediates for CWA-related chemistry, illustrating how legitimate industrial inventories can overlap with precursor families identified on open-source process maps, and the theoretical production of CWA for the Sunchon area is shown in Figure 3. The absence of chlorine chemistry limits the production of multiple CWA and precursors, without shipment from outside the region.

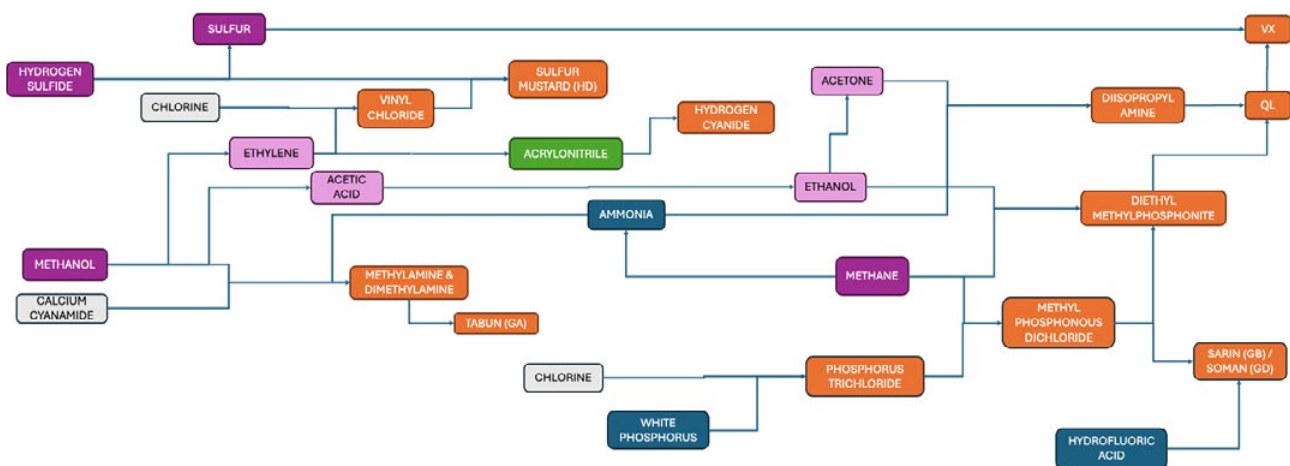
Table 1: Selected Sunchon chemicals that could be utilised for CWA production

Chemical available in the Sunchon region	Scheduled chemical precursor CWA starting material (number of synthetic steps from chemical manufactured in the Sunchon area)	CWA (number of synthetic steps from starting material)
Ammonia (<i>Phosphatic Fertiliser Plant</i>)	Methylamine / Dimethylamine (1-2 steps)	Nitrogen mustards; Tabun (2-3 steps); HCN
Methanol (<i>C1 Plant</i>)	Methylamine / Dimethylamine (1-2 steps)	Nitrogen mustards; Tabun (2-3 steps)
Ethanol (<i>C1 Plant</i>)	Ethylamine (1-2 steps)	Nitrogen mustards (2-3 steps)
Coal-derived syngas (<i>C1 Plant</i>)	Ethylene / Acetylene (1-2 steps)	Sulfur mustard; Lewisite (2-3 steps)

White/yellow phosphorus (Phosphatic Fertiliser Plant)	Phosphorus trichloride (PCl ₃) / Phosphorus oxychloride (POCl ₃) (2–3 steps)	G-series; V-series (2–5 steps)
Ammonium phosphate / phosphoric acid (Phosphatic Fertiliser Plant)	Phosphorus trichloride (PCl ₃) / Phosphorus oxychloride (POCl ₃) (2–3 steps)	G-series; V-series (2–5 steps)
Sulphur dioxide / sulphuric acid (Phosphatic Fertiliser Plant)	Thiodiglycol precursors (2–3 steps)	Sulfur mustard (1–2 steps)
Apatite / fluorine-bearing residues (Phosphatic Fertiliser Factory)	Fluorosilicic acids / HF streams (1–2 steps)	G-series (1–2 steps)
Ammonia liquors (Phosphatic Fertiliser Factory)	Amines (1–2 steps)	Tabun; nitrogen mustards; VX (2–5 steps)

Source: author derived.

Figure 3: Theoretical CW production pathways from Sunchon area feedstocks



Source: derived by the authors.¹⁸ Purple denotes chemicals produced at the Sunchon C1 Chemical Facility (light purple indicates processes which may not yet be operational); navy denotes chemicals produced for processes at the Sunchon Phosphatic Fertiliser Plant; light green denotes chemicals produced at the Songyong Paints Factory; and orange theoretically denotes possible production of CWC scheduled chemicals or their immediate precursors. Grey indicates chemicals probably not produced in the Sunchon area.

18. VX pathway additions: G. Pampalakis and S. Kostoudi, "Chemical, Physical, and Toxicological Properties of V-Agents", *International Journal of Molecular Sciences*, Vol. 24, No. 10, Article No.: 8600, 2023, <https://doi.org/10.3390/ijms24108600>.

Detailed Site Discussion

The following subsections go into detail on the sites analysed in the Sunchon area. They provide more explanation of how conclusions were drawn about which materials, equipment and expertise might be available at each site.

1) Sunchon Phosphatic Fertiliser Plant

The Sunchon Phosphatic Fertiliser Plant was opened under its current name by Kim Jong Un on 1 May 2020.¹⁹ Constructed over a four-year period, the facility received significant senior leader and media attention over that timespan. The complex is located at 39°25'19"N, 125°56'23"E, next to the Taedong River in the city of Sunchon, South Pyongan Province.

The site is served by road and rail. A rail branch-line connects the complex directly, while the main lines running through Sunchon connect to Hamhung, Man'po, Nampo and Pyongyang. The main access points by road appear to be at 39°25'35"N, 125°56'32"E and 39°25'9"N, 125°56'12"E. Both have physical access controls. Access by rail is also physically controlled, with a probable guardhouse on the factory rail spur at 39°25'11"N, 125°56'10"E.

Based on remarks made by Kim Jong Un in January 2020, the primary purpose of the factory is to “[mass-produce] high concentration ammonium phosphate fertiliser”, relying only on indigenous raw materials, technology and human resources.²⁰

The likely basic raw materials for the site are apatite, coke, silica, methane, air and water. Between them, they provide the elements of phosphorus, oxygen, silicon, carbon, nitrogen and hydrogen, which are used to produce other chemicals on site. There are likely also small amounts of other elements such as fluorine and arsenic present in the raw materials.

There are various mines in the area which may supply raw materials to the factory, including the Songsan Mine and the Jiktong Youth Coal Mine.²¹ From Kim Jong Un's remarks, it appears that apatite mines are the primary suppliers of the raw materials to the factory.²² The following processes are referenced in North Korean sources:²³

19. Olli Heinonen and 38 North, “Does the Sunchon Phosphatic Fertiliser Plant Produce Uranium: Not Likely”, 1 July 2020, <https://www.38north.org/2020/07/oheinonen070120/>, accessed 2 September 2025.
20. “Supreme Leader Kim Jong Un Gives Field Guidance to Sunchon Phosphatic Fertiliser Plant under Construction”, Kim Il Sung University, 7 January 2020, <https://exploredprk.com/press/supreme-leader-kim-jong-un-gives-field-guidance-to-sunchon-phosphatic-Fertiliser-factory-under-construction%E2%80%8B/>, accessed 13 January 2026.
21. 38 North, “DPRK Digital Atlas”, <https://www.stimson.org/project/38-north/dprk-digital-atlas/>, accessed 13 March 2026.
22. “Supreme Leader Kim Jong Un Gives Field Guidance to Sunchon Phosphatic Fertiliser Plant under Construction”, Kim Il Sung University, 7 January 2020, <https://exploredprk.com/press/supreme-leader-kim-jong-un-gives-field-guidance-to-sunchon-phosphatic-Fertiliser-factory-under-construction%E2%80%8B/>, accessed 13 January 2026.
23. “Supreme Leader Kim Jong Un Cuts Tape for Completion of Sunchon Phosphatic Fertiliser Plant”, Kim Il Sung University, 2 May 2020, <https://kcnawatch.org/newstream/1588377969-811058370/supreme-leader-kim-jong-un-cuts-tape-for-completion-of-sunchon-phosphatic-Fertiliser-factory/>, accessed 13 January 2026.

- Raw material processing
- Yellow phosphorus production process
- Ammonium phosphatic fertiliser production process
- Packing process

Figure 4: Overview of the Sunchon Phosphatic Fertiliser Plant



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

The facility is broadly divided into two primary areas: an administrative and support area and a processing/production area, although they are not separately secured or otherwise delineated. There is also an embedded electricity transformer yard, a series of six water-settling ponds and an adjacent rail-marshalling yard.

There appears to be a logical flow with regard to the main manufacturing areas, moving from the rail spur, where the raw material is delivered, before branching to either the dry or wet phosphorus production areas, and then, finally, to the western packing area with another rail spur. Other manufacturing areas are also located to the north of these areas and may be involved in the production of other chemicals used on site such as ammonia. Figure 5 offers an overview of the different production areas of the Sunchon Phosphatic Fertiliser Plant.

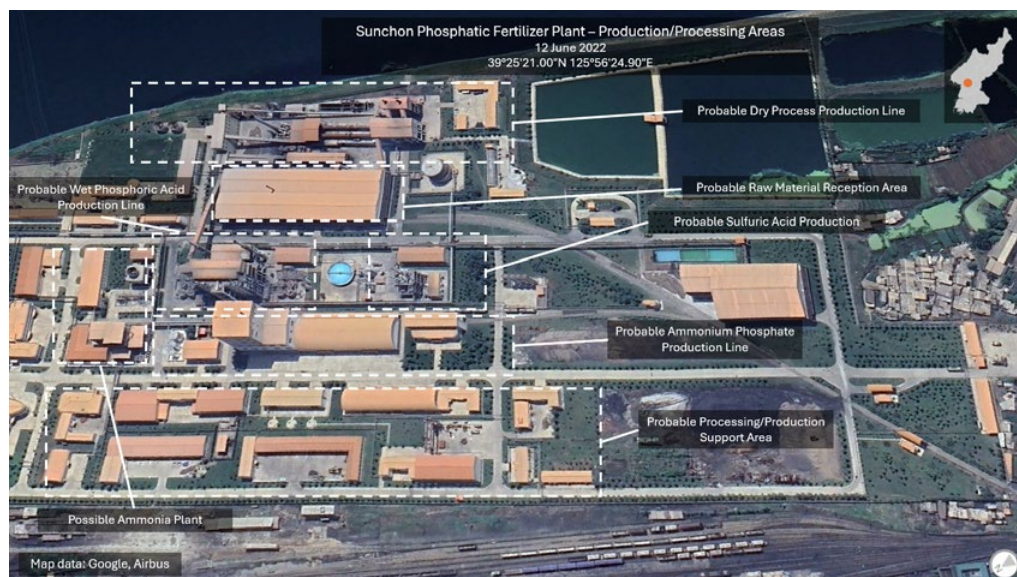
It has not been possible, in all cases, to correlate the likely individual processes with a particular area at the plant site. In these instances, processes and areas at the plant site are described separately.

The previous facility on this site, the Sunchon Vinalon Complex, was demolished in 2018.²⁴ By the end of November 2019, significant progress had been made on constructing the new facility as it appears today.²⁵

24. Google Earth (Maxar), 1 September 2018, 39°25'22.54"N, 125°56'25.61"E.

25. Google Earth (Airbus), 29 November 2019, 39°25'22.54"N, 125°56'25.61"E.

Figure 5: Overview of processing and production areas at the Suncheon Phosphatic Fertiliser Plant



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

Probable Raw Material Reception and Processing Area

There is a probable reception and processing area for raw materials at 39°25'20"N, 125°56'29"E, at the end of the eastern branch of the rail spur (see Figure 6). This rail spur leads into the processing building, indicating that raw materials may be distributed by rail.

Material processing in this area may involve screening, sorting and grinding of various phosphate-containing rocks. Various DPRK officials, including Kim Jong Un, have associated apatite mining with the Suncheon Phosphatic Fertiliser Factory. Apatite is found in all classes of rock²⁶ and has three varieties: hydroxyapatite (chemical formula $\text{Ca}_5(\text{PO}_4)_3\text{OH}$); fluorapatite ($\text{Ca}_5(\text{PO}_4)_3\text{F}$); and chlorapatite ($\text{Ca}_5(\text{PO}_4)_3\text{Cl}$). While all can be used to produce phosphoric acid, fluorapatite and chlorapatite produce hydrofluoric acid and hydrochloric acid, respectively, as byproducts.

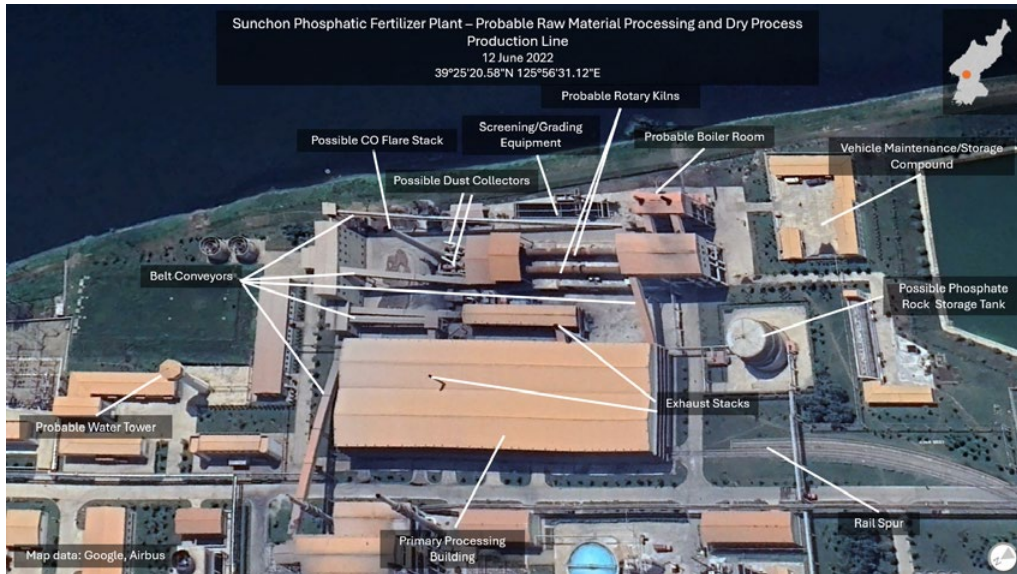
A recent article by North Korean geologists about prospecting apatite deposits in biotite and granite gneiss at the Yongyu Mine (South Pyongan) might indicate efforts to find raw materials for the factory.²⁷ Although Yongyu is not the only mine which has been connected in DPRK media to the phosphate fertiliser industry, it is located in the same province as Suncheon.

The particle size of apatite has a significant impact on the reaction rate for the wet process (and therefore the production rate). Thus, this area likely grinds apatite to a specific size before it is fed to other areas and may combine it with phosphoric acid or another solute to form a slurry.

26. Kathy Feick, "Apatite", University of Waterloo, <https://uwaterloo.ca/earth-sciences-museum/resources/detailed-rocks-and-minerals-articles/apatite>, accessed 3 September 2025.

27. Yon-Ho Kim and Kwang-U Choe, "Three-Dimensional Prospectivity Modeling Based on Fuzzy Logic and Geometric Average: A Case Study from Sansong District, Yongyu Apatite Deposit, DPR Korea", *Arabian Journal of Geosciences*, Vol. 17, Article No. 117, March 2024, <https://doi.org/10.1007/s12517-024-11920-9>.

Figure 6: Probable raw material reception and processing and dry process areas at the Suncheon Phosphatic Fertiliser Plant



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

Probable White Phosphorus Production Area

A probable dry process area for phosphorus production is located immediately to the east of the probable raw material reception and processing building. The layout of infrastructure near the eastern perimeter of the manufacturing area is consistent with the dry process of phosphate production. Identified equipment includes two probable horizontal rotary kilns, possible dust collectors, a probable boiler room, several belt conveyors, and screening/grading equipment (see Figure 6).

Unlike the wet process, the dry process (also known as the thermal route) yields elemental phosphorus of high purity for use in pharmaceuticals and consumables. This kind of phosphorus is often referred to as yellow or white phosphorus, owing to its appearance.

It is produced by the thermal decomposition of phosphate rock in the presence of silica and coke. The combination breaks down at high temperature (roughly 1,500°C) to yield elemental phosphorus, calcium silicate and carbon monoxide.²⁸

During Kim Jong Un's visit to the factory opening, he was shown two sets of boards with process flow diagrams for the yellow phosphorus production and ammonium phosphate production lines. Although these diagrams were blurred in the video, they were not completely obscured.

One visible element is the notation SiO_2 (see Figure 7, top left). Because silica is expected in the dry process but not the wet process, this makes it probable that the process shown behind Kim Jong Un in Figure 7 is the dry process for elemental phosphorus production. And while the equipment is blurred, there remain some distinctive shapes, such as two horizontal cylinders (in red, Figure 7, bottom) one of which is labelled as a drying

28. Nanda Kishore, "Lec 18: Phosphorus Industries – Phosphorus and Phosphoric Acid Production", 2023, https://www.youtube.com/watch?v=_bzLSI4EHR0&t=758s, accessed 3 September 2025.

furnace with a capacity of 10 tonnes per hour (Figure 7, top right). The photographs of the process diagram were taken at approximately 39°25'18"N, 125°56'28"E.

Figure 7: Unblurred portions of video from 1 May 2020 which reveal details on the dry process at the Sunchon Phosphatic Fertiliser Complex



Source: KCTV.²⁹

The segments of the process shown in the blurred video are consistent with a dry process for elemental phosphorus production.³⁰ In such a process, the screened and crushed phosphate rock likely comes from the receiving area, along with coke and silica. The large tank at 39°25'17.04"N, 125°56'28.09"E in Figure 6 may hold the phosphate rock. From this tank, it can be fed to the rotary kilns for calcination. The two kilns may be for calcining the phosphate rock and the coke separately, or for increasing capacity.

After calcination, phosphate rock, coke and silica are fed to an electric arc furnace operating at roughly 1,500°C, in which the reaction shown above takes place.³¹ The carbon monoxide product may be used in the calcination process. The phosphorus goes through downstream processing before storage, under water for safety.

Probable Phosphoric Acid Production Area

The wet process for phosphoric acid is the more common of the two methods discussed in this report and is used worldwide for fertiliser production. The process entails the

29. KCTV, "Daily Broadcast", 2 May 202, <https://kcnawatch.org/kctv-archive/073877d786c521c6c836c8506b0a/>, accessed 12 February 2026.

30. For more detail and an illustration of the process, see Rodney Gilmour, "Phosphorus", 26 March 2019, <https://doi.org/10.1002/0471238961.1608151902182113.a01.pub3>, accessed 2 May 2026.

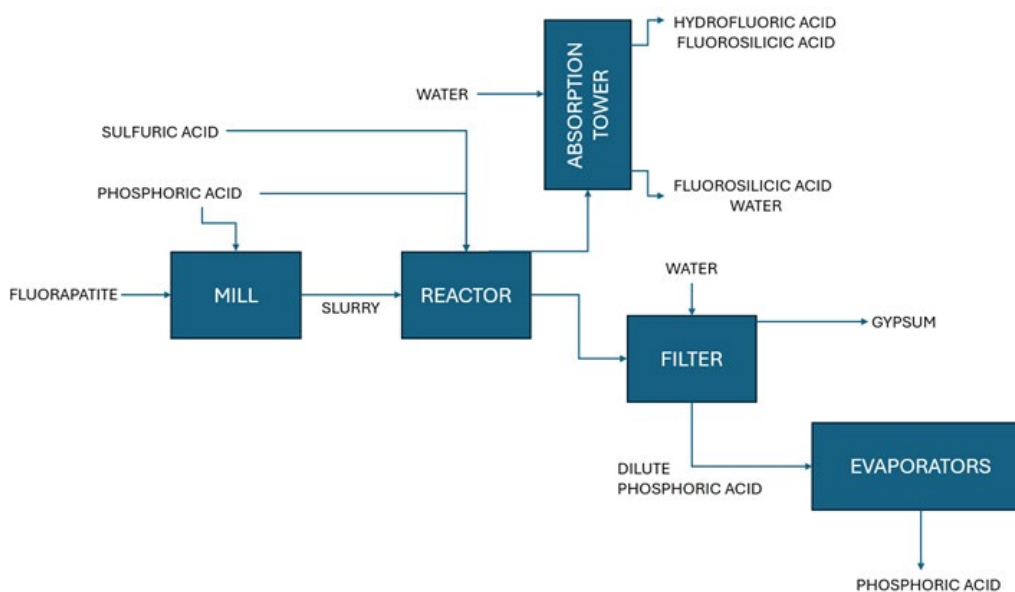
31. *Ibid.*

reaction of phosphate rock (in this case, probably apatite) with sulfuric acid, which yields phosphoric acid and other byproducts. The reaction itself usually takes place in a large reactor with an agitator, at temperatures of less than 100°C and at atmospheric pressure.³² It often occurs in the presence of phosphoric acid, as an excess of sulfuric acid can lead to over-formation of gypsum crystals and underreaction of phosphate particles.³³ After the reaction, phosphoric acid must be separated from the byproducts, a mixture of solid precipitate and other acids.

Apatite comes in various forms, with various impurities. Depending on the type of apatite used at Sunchon, there will be different byproducts: hydrofluoric acid for fluorapatite, hydrochloric acid for chlorapatite, or water for hydroxyapatite. If impurities of silicate are present in fluorapatite (as is common), they react to form fluorosilicic acid as another byproduct.³⁴

Figure 8 shows a possible process diagram for the wet process production area if fluorapatite is the predominant source of phosphate rock. Further work to determine which types of apatite are most prevalent in the DPRK would be of use for increased understanding of this site's contribution to domestic sources of fluorine or chlorine.

Figure 8: Simplified depiction of process steps in the wet process for phosphoric acid production



Author generated. Source: Obaida, Yara et al.³⁵

32. Yara Obaida, Ola Ibrahim, Amira Ayyash and Mohanad Alshimi, *A Report on the Design of Phosphoric acid Plant via Di-hydrate Method*, submitted in partial fulfilment of the graduation project (ChE 592) course, Chemical Engineering Department, Jordan University of Science & Technology, 2021, https://www.researchgate.net/publication/364379865_Full_Design_of_Phosphoric_Acid_Production_Plant, accessed 14 January 2026.
33. Tariq F. Al-Fariss, Hilmi Ö. Özbelge and Hassan S.H. El-Shall, "On the Modelling of Phosphate Rock Acidulation Process", *Journal of King Saud University – Engineering Sciences*, Vol. 5, No. 2, 1993, pp. 243–255, [https://doi.org/10.1016/S1018-3639\(18\)30583-X](https://doi.org/10.1016/S1018-3639(18)30583-X).
34. *Ibid.*
35. Yara Obaida, Ola Ibrahim, Amira Ayyash and Mohanad Alshimi, *A Report on the Design of Phosphoric acid Plant via Di-hydrate Method*, submitted in partial fulfilment of the graduation project (ChE 592) course, Chemical Engineering Department, Jordan University of Science & Technology, 2021, https://www.researchgate.net/publication/364379865_Full_Design_of_Phosphoric_Acid_Production_Plant, accessed 14 January 2026.

Both phosphoric acid and single superphosphate are produced from the reaction of ground phosphate rock and sulfuric acid. However, these processes diverge depending on the ratio of sulfuric acid to phosphate rock, as well as the separation processes following the reaction; phosphoric acid can be used to make triple superphosphate. For phosphoric acid generation, the reaction would typically take place in the presence of both sulfuric acid and phosphoric acid.

Much of the rhetoric from DPRK sources emphasises the production of ammonium phosphate, with little reference to superphosphate. It is unclear from satellite imagery analysis whether it is indeed deprioritised in favour of phosphoric acid production for reaction with ammonia; the plant is likely at least capable of single superphosphate production. Many superphosphate fertilisers are a mixture of gypsum and superphosphate. As it uses more sulfuric acid, a limited supply of sulfuric acid might be a constraint on superphosphate production, thus driving the plant towards phosphoric acid and ammonium phosphate production. It is also possible that difficulty in removing fluoride contamination from single superphosphate if fluorapatite is the main raw material is great enough to discourage the process.³⁶

On the west side of the probable raw material reception and processing area is a probable area for the production of phosphoric acid via the wet process. It is centred on a probable reactor at 39°25'22"N, 125°56'26"E (see Figure 9).

Figure 9: Probable wet process production area at the Sunchon Phosphatic Fertiliser Plant



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

A belt conveyor connects to the raw material processing area. The wet production line comprises possible absorption and desulfurisation towers, a probable waste gas settling pool, and two sets of feedstock tanks, possibly for pulverised phosphate rock (although they could also house sulfuric and phosphoric acid), all linked to a probable reactor structure. Imagery, from November 2019 during construction, shows probable footings for a large

36. Lokeshkumar P. Ramteke, Dilip D. Sarode, Yogesh S. Marathe and Pushpito K. Ghosh, "Removal of Fluoride Contaminant in Phosphate Fertilisers through Solid State Thermal Treatment", *Journal of Fluorine Chemistry*, Vol. 241, January 2021, <https://doi.org/10.1016/j.jfluchem.2020.109693>.

reactor within the structure. Two possible chimney stacks for a desulfurisation tower and two sets of four vertical separation/absorption towers are connected to the reactor area. A rail spur runs adjacent to the production line, and rail tank cars are routinely seen along it.

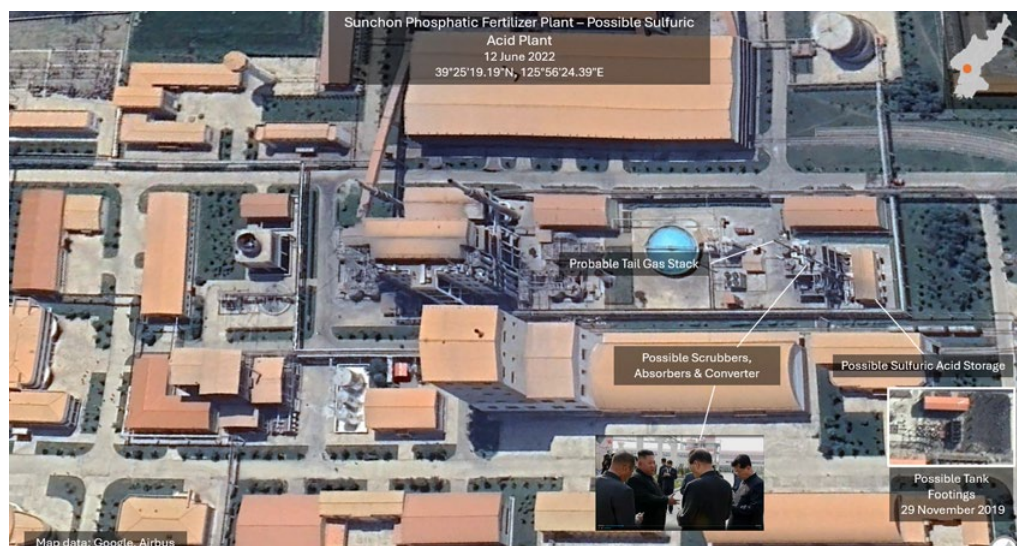
Possible Sulfuric Acid Plant

Sulfuric acid is produced from burning sulfur, air and excess oxygen in a furnace to form sulfur dioxide, then passing this with oxygen through a catalytic converter to form sulfur trioxide. Sulfur trioxide is then fed to columns where it is absorbed into sulfuric acid, forming oleum, to which water is added to dilute the oleum and form sulfuric acid. Some sulfuric acid is sent out of the loop as product, while the rest is recycled to the absorbers.³⁷ Tail gas from the process is usually scrubbed and then released through a tail gas stack.³⁸

Given that the wet process for phosphoric acid production requires sulfuric acid, it makes sense for some to be produced on site. The raw material sulfur needed for the process can often be produced as a byproduct of the oil and gas industries.³⁹ It may be that the Sunchon Phosphatic Fertiliser Factory intends to use sulfur acquired from the desulfurisation of hydrocarbons at the C1 Plant, and this might explain why the two factories were constructed around the same time. However, given the delays that the C1 Plant has experienced (see below for further discussion), the sulfur may be sourced from elsewhere in the country at present.

Imagery from November 2019, taken during the construction of the factory, shows possible footings for sulfuric acid storage tanks in the building at 39°25'18.89"N, 125°56'23.79"E. The towers are also pictured in the background of a video still from the KCTV broadcast, showing possible scrubbers or absorbers at 39°25'19.19"N, 125°56'24.39"E. The possible sulfuric acid plant is shown in Figure 10.

Figure 10: Possible sulfuric acid plant at the Sunchon Phosphatic Fertiliser Plant



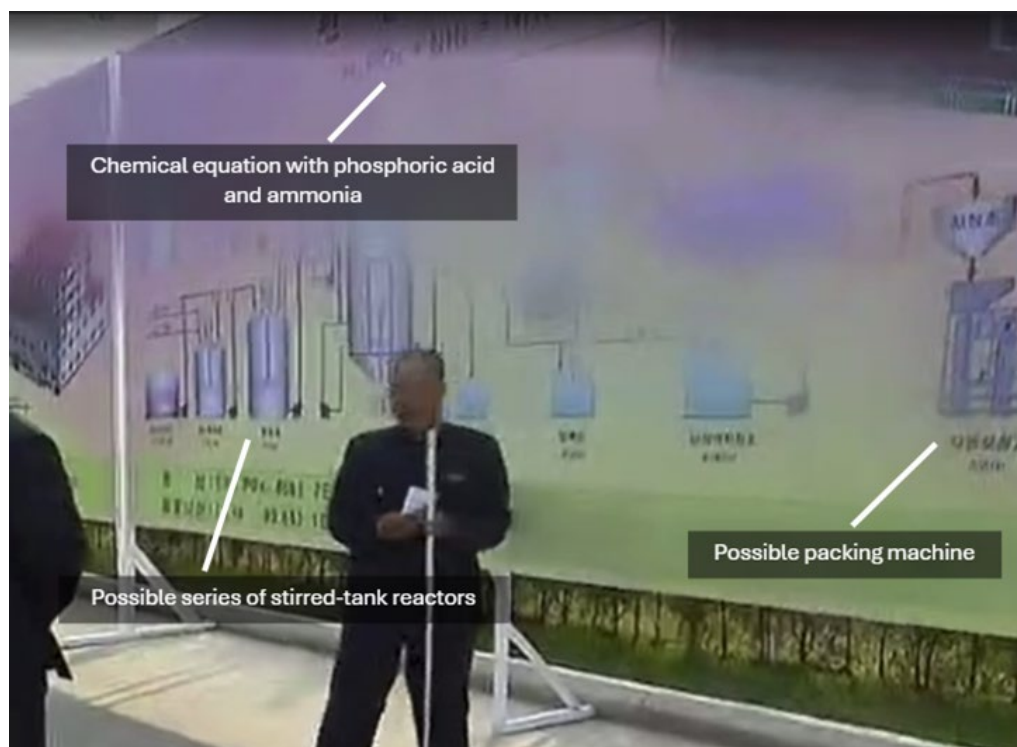
Annotated by the authors. Source: Google Earth (CNES/Airbus), 12 June 2022. Inset (bottom): KCTV, 2 May 2020. Inset (bottom right): Google Earth (CNES/Airbus), 29 November 2019.

37. Royal Society of Chemistry, "Sulfuric Acid Production", YouTube, 2012, <https://www.youtube.com/watch?v=mym1rRPX6F4>, accessed 20 January 2026.
38. HORIBA, "Sulfuric Acid Production", <https://www.horiba.com/int/process-and-environmental/industries/sulfuric-acid-production/>, accessed 20 January 2026.
39. Royal Society of Chemistry, "Sulfuric Acid Production", YouTube, 2012, <https://www.youtube.com/watch?v=mym1rRPX6F4>, accessed 20 January 2026.

Probable Ammonium Phosphate Plant

Ammonium phosphate is produced by reacting phosphoric acid with ammonia in a series of reactors. The product is then typically concentrated and purified, with the unreacted solution recycled back into the process.⁴⁰ It is usually further dried and pelletised; ground-level imagery of a partially blurred process flow diagram and of the probable packaging area corroborates this assessment that the ammonium phosphate leaves the factory in dry form (see Figure 11).

Figure 11: Partially blurred video still showing a chemical equation with phosphoric acid and ammonia as reagents, a series of reactors, and a possible packing machine which bears resemblance to that shown in the inset in Figure 12



Source: KCTV Central Broadcast, 2 May 2020.

A third main production line is located immediately parallel to the wet process line (see Figure 12). Characterised by a two-tier, multi-storey probable ammonium phosphate production building, connected to a large, curved-roofed probable packaging building, it is collocated with a possible reception/finishing building that has a rail spur entering its southern end.

At the northern end of the production line are three probable storage tanks in a compound with raised sides, indicating that they may contain volatile or toxic material (possibly phosphoric acid). The production line appears to be supported by a possible ammonia production plant, connected via a pipeline.

At the southern end of the production/processing area is a separate compound with four unidentified possible vertical processing towers. These appear to be connected to the wet process and ammonium phosphate process via a pipeline.

40. Chemiworld, "Production of Ammonium Phosphate", YouTube, 2023, <https://www.youtube.com/watch?v=qmuEmYA54ug>, accessed 17 January 2026.

Rail tank cars are routinely located next to this compound, indicating that the towers may contain gaseous or liquid compounds to feed the processes. The banded probable storage tanks may indicate concentrated phosphoric acid inventories. A rail spur leads into the processing building, indicating that finished products may be distributed by rail.

Figure 12: Probable ammonium phosphate production line and possible ammonia plant at the Suncheon Phosphatic Fertiliser Plant



Annotated by the authors. Google Earth (Airbus), 12 June 2022. Inset: KCTV, 2 May 2020.

Possible Ammonia Plant

Ammonia is typically produced via the Haber process, wherein nitrogen and hydrogen are reacted over an iron-based catalyst to form ammonia. The Haber process is exothermic, so the cooling tower along with the horizontal storage tanks (a common method of storing ammonia in smaller quantities) are consistent with ammonia production. Chemical processes are commonly exothermic, and many chemicals are stored horizontally; these alone are not strong indicators of ammonia production. The possible ammonia plant is also connected to the probable ammonium phosphate production area by pipeline. A hydrogen source may be supplied to this area from off site; the other raw materials for the process are water and air.⁴¹

To the north of the probable ammonium phosphate production plant is a possible ammonia production area, shown in Figure 12. This would be a reasonable location, putting both phosphoric acid and ammonia production adjacent to the process line where they are used for fertiliser production.

Probable Administrative and Support Area

The support area likely comprises a mixture of headquarters, administrative, domestic, research and propaganda buildings, as would be expected of this type of facility. The extent of activity observed in this area, since construction was completed in late 2019, has been very limited. Activity, such as people transiting the compound on foot and the occasional vehicle, appeared to be at a peak in late 2019 when the production/processing area was still under construction. Several people were observed in this compound again

41. Royal Society of Chemistry, "Ammonia", YouTube, 2012, https://www.youtube.com/watch?v=wiwl4eoHbig&list=PLlnAFJxOjzZs8uuljB_7T4otrip_evaVz&index=9, accessed 16 January 2026.

on imagery from 1 April 2023. Subsequently, large groups of personnel were not observed again until early 2025. The pattern of dispersal seen on the imagery suggest that these people may have been transiting from outside of the facility and heading towards the Ideology Study Hall. Footfall appears to have increased slightly since early 2025, although this is a low-confidence assessment owing to the availability of imagery. There is no evidence on imagery that the accommodation blocks on site have been or are permanently occupied.

Figure 13: Overview of the administrative and support areas at the Suncheon Phosphatic Fertiliser Plant

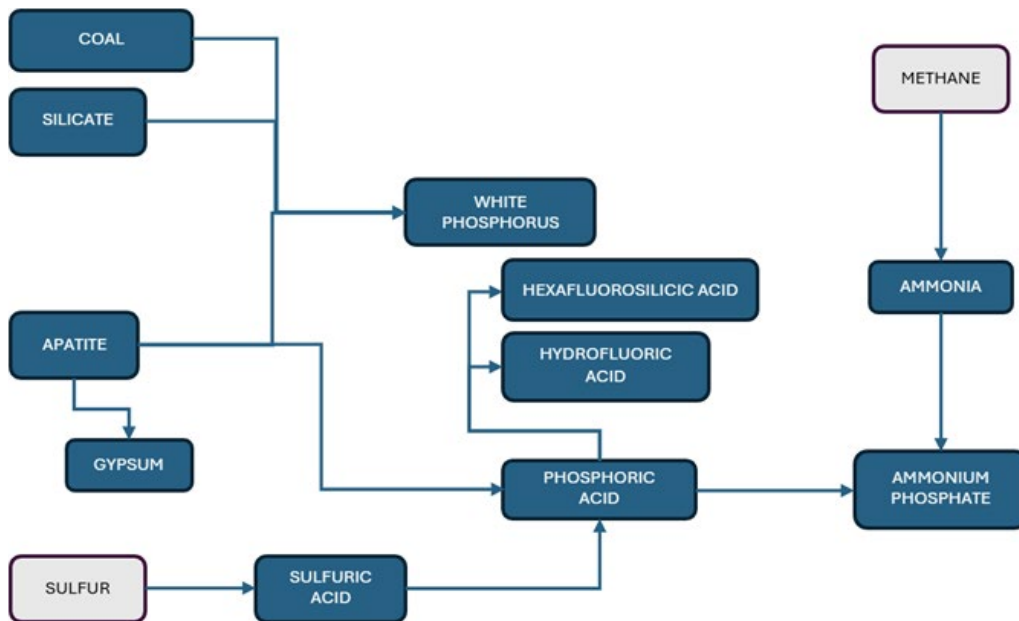


Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

Site Process Flow Diagram

Figure 14 demonstrates how these processes might fit together within the Suncheon Phosphatic Fertiliser Plant for the production of ammonium phosphate fertiliser.

Figure 14: Possible overall process flow within the Suncheon Phosphatic Fertiliser Plant for production of ammonium phosphate fertiliser and white phosphorous products with additional byproducts



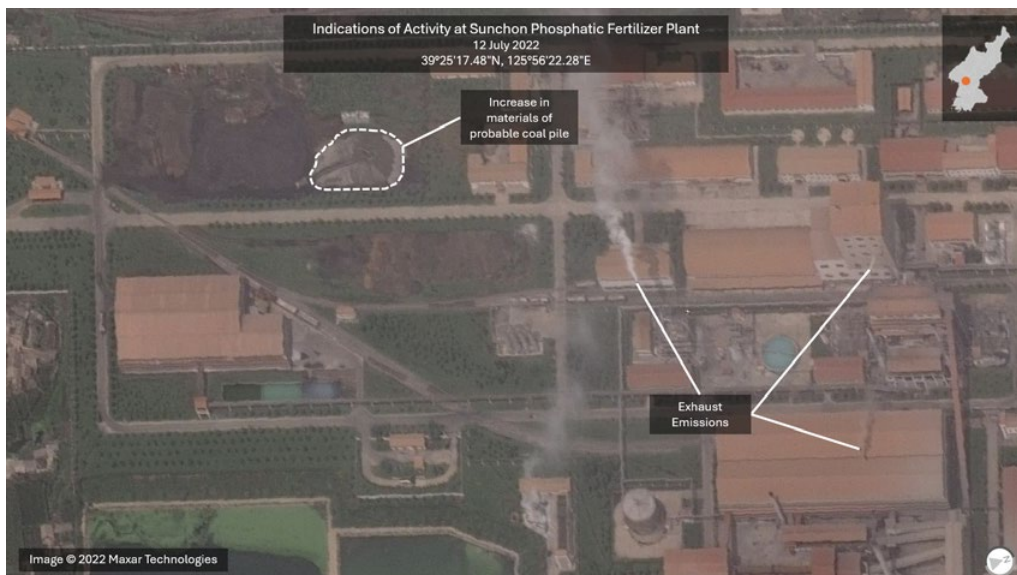
Author generated. Blue boxes denote probable raw materials, intermediates, and products at the factory; grey boxes denote chemicals that are likely to be sourced from elsewhere.

Is the Site Operational?

There has been a significant amount of reporting questioning the output of the Suncheon Phosphatic Fertiliser Plant since its completion, with much speculation that the site has failed to live up to expectations.⁴² This assessment is based on low levels of activity observed on imagery since its opening, and a lack of state media reporting on its production given the high-profile nature of the facility.

There has been, however, a discernible increase in activity on imagery since mid-2022. Imagery from 19 July 2022 (see Figure 15) shows exhaust gases emitting from the probable raw material reception building, the possible sulfuric acid plant and the probable phosphoric acid plant, the first such evidence of activity on available imagery since the plant was completed. The presence of a lighter-coloured raw material (possibly calcium silicate or gypsum) was also observed for the first time next to a probable coal pile over the same period.

Figure 15: Indications of activity at the raw material processing building, the probable phosphoric acid plant and the possible sulfuric acid plant



Annotated by the authors. Source: Maxar Technologies, 19 July 2022.

Imagery from 21 March 2024 showed the presence of a second pile of light-coloured raw material, possibly apatite or gypsum,⁴³ in an adjacent open area. This was coincident with the first observed presence of exhaust gases emitting from the exhaust stack in both the possible sulfuric acid and probable elemental phosphorus production lines (see Figure 16).

42. See, for example: Martyn Williams, Peter Makowsky, Olli Heinonen and 38 North, “The Suncheon Phosphatic Fertiliser Plant Is One Year Old, but Is It Operating?”, 30 April 2021, <https://www.38north.org/2021/04/the-suncheon-phosphatic-fertiliser-plant-is-one-year-old-but-is-it-operating/>, accessed 26 September 2025.

43. Limestone can often contain high levels of phosphates. Margaret Croy, “Dual Use in the DPRK: Uranium Extraction from Phosphate Fertiliser Factories”, *CNS Occasional Paper*, No. 47, April 2020, <https://www.nonproliferation.org/wp-content/uploads/2020/04/Dual-Use-in-the-DPRK.pdf>, accessed 23 September 2025.

Figure 16: Indications of activity at the probable elemental phosphorus plant and possible sulfuric acid plant



Annotated by the authors. Source: Maxar Technologies, 14 May 2024.

This increased activity appears to have continued to the present, with imagery from 12 September 2025 showing continued build-up of the lighter-coloured raw material and exhaust emissions from the probable phosphoric acid plant and possible sulfuric acid plant (see Figure 17).

Figure 17: Indications of activity at the phosphoric acid plant and sulfuric acid plant



Annotated by the authors. Source: Maxar Technologies, 12 September 2025.

A cursory analysis of the rail-marshalling yards next to the facility reveals significant variation in the numbers and types of rail cars over time; however, these yards almost certainly serve the entire city of Sunchon and are therefore probably not indicative of activity at the Sunchon Phosphatic Fertiliser Plant. Yet, the numbers and locations of rail cars on the facility's rail spur, both tanks and gondolas, demonstrate wide variation over the past 12 months, providing a further indication of activity within the facility.

2) Sunchon C1 Chemical Facility

To the southeast of the city of Sunchon at coordinates 39°24'40"N, 125°59'20"E is a major chemical facility that is under construction (see Figure 18). It is at the same location as a previous chemical industrial site, which formed part of the Sunchon Vinalon Complex and has seen a significant amount of development, demolition and reconstruction throughout its history.⁴⁴

Figure 18: Overview of the C1 Chemical Facility under construction



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

The project has been frequently referred to in North Korean media as the C1 Chemical Industry, based on coal gasification and closely associated with Juche principles.⁴⁵ It has even been referred to as the “core of the chemical industry”.⁴⁶ C1 industry likely refers to the process of coal gasification to produce synthesis gas, and from there methanol production and downstream organics such as olefins. Imagery analysis of the site supports this assessment.

The site is linked to the other chemical industrial sites in the wider Sunchon area, all of which are connected by an extensive rail and road network. The rail network in particular links the Sunchon C1 Chemical Facility to many of these sites and also to the South Pyongan Ore Processing Plant and the Sunchon Limestone Mine. The Sunchon cement complex is linked to the latter by an extensive, covered conveyor system and indirectly to an active coalmine to the north of Sunchon. The latter is connected to the ore processing plant through another substantial conveyor, and to the rest of the Sunchon chemical facilities by rail. The C1 site is also close to a water treatment plant and the Sunchon thermal power plant.

44. For further discussion of the former Vinalon Complex and its dismantlement, see: North Korean Economy Watch, “The Short Life of the Sunchon Vinalon Complex area”, 2011, <https://www.nkeconwatch.com/2010/05/25/the-short-life-of-the-sunchon-vinalon-complex/>, accessed 23 September 2025.

45. KCNA, “DPRK Concentrates Efforts on Establishing C1 Chemical Industry”, 29 December 2016, <http://kcna.co.jp/item/2016/201612/news29/20161229-16ee.html>, accessed 12 February 2026.

46. *Pyongyang Times*, “We’ll Push the Establishment of C1 Chemical Industry”, 5 January 2018, <https://assets.korearisk.com/uploads/sites/5/2018/10/20180106.pdf>, accessed 18 February 2026.

Figure 19: Overview of surrounding facilities and infrastructure of the Sunchon C1 Chemical Facility



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

The facility under construction has the potential to be a significant addition to North Korea's industrial hydrocarbon production capability. This is particularly the case when considered in conjunction with other chemical-related facilities within the greater Sunchon area and the close proximity to power, treated water, and an extensive communications network and ready power supply.

The site has seen significant redevelopment since 2019, particularly the probable methanol production plant, which appears externally complete. However, there is no evidence on imagery that any part of the site is operational, and progress on the construction of many of the buildings and functional areas appears to have stalled. Furthermore, a significant proportion of the site has yet to be redeveloped. This is consistent with several North Korean reports that indicate challenges with the domestic production of relevant specialist equipment and construction delays.⁴⁷ There have been very few reports on the project in North Korean media since 2020.

The facility currently comprises several functional areas at various stages of construction and demolition. The following processes and materials are referenced in North Korean sources:

- Waste gas setting vat⁴⁸
- Superstructure [for] methanol synthetic tower⁴⁹

47. *Pyongyang Times*, "Premier Kim Inspects Various Economic Sectors", 4 March 2021, accessed via KCNA Watch, <https://kcnawatch.org/newstream/1614852057-270402851/premier-kim-inspects-various-economic-sectors/>, accessed 13 March 2026; *DPRK Today*, "Pak Pong Ju and Kim Tok Hun Inspect Construction Site of Project for Establishing C1 Chemical Industry", 26 August 2020, <https://koreaisone.wordpress.com/2020/08/26/pak-pong-ju-and-kim-tok-hun-inspect-construction-site-of-project-for-establishing-c1-chemical-industry/>, accessed 18 February 2026.

48. KCNA, "Project for C1 Chemical Industry Progresses Apace in DPRK", 14 May 2019, <https://oannews.org/content/news/general/project-establishing-c1-chemical-industry-progresses-apace-dprk>, accessed via OANA News, 12 February 2026.

49. *Ibid.*

- Catalyser for acetic acid composition⁵⁰
- Additive for suspension of anthracite used to generate gas for methanol synthesis⁵¹
- Pumping station⁵²; circulation-water pumping station⁵³
- Desalted water station⁵⁴
- Power distribution station⁵⁵
- Pillars of⁵⁶ slag depository⁵⁷
- Coal depot⁵⁸
- Fractionating tower⁵⁹
- Methanol-loading platform⁶⁰
- Methanol tank with a capacity of “thousands” of cubic metres⁶¹
- Oxygen separator⁶²
- Underground pipeline network⁶³

The basic raw materials for the site are coal, water and air. Between them, they provide the elements of carbon, hydrogen, oxygen and nitrogen, which are used to produce other chemicals on site. The likely principal product at the site is methanol formed from coal gasification.

As of the imagery cut-off date of 3 November 2025, the facility comprises the areas detailed below.

Probable Raw Material Reception, Handling and Initial Processing Area

Historically, an extensive covered conveyor system fed the plant and the (now removed) chemical facility to the south. This conveyor system was removed in 2016, although it appeared to be in poor condition and at least partially unserviceable as early as 2011. The quality of available imagery precludes a high-confidence assessment of the role of this conveyor; however, there were two possible vertical mine shafts at intervals along the conveyor and large quantities of soil spread along the length of the conveyor prior to 2016, indicating that the system may have been used to convey mined raw materials to the site.

Within the C1 Chemical Facility, the conveyors that fed an adjacent processing plant are now also derelict and have been partially removed, and the plant itself has been

50. *Rodong Sinmun*, “Hot Wind of Development and Creation for Establishing C1 Chemical Industry”, 15 February 2020, available via KCNA Watch, <https://kcnowatch.org/newstream/1581754316-812075173/hot-wind-of-development-and-creation-for-establishing-c1-chemical-industry/>, accessed 13 March 2026.

51. *Ibid.*

52. KCNA, “Project for Establishing C1 Chemical Industry Progresses Apace in DPRK”, 11 June 2019.

53. Uriminzokkiri, “Project for C1 Chemical Industry Brisk in DPRK”, 17 November 2018, available via KCNA watch, <https://kcnowatch.org/newstream/1594854364-883846930/Project-for-Building-C1-Chemical-Industry-Makes-Headway-in-DPRK>, accessed 18 February 2026.

54. *Ibid.*

55. KCNA, “Project for Establishing C1 Chemical Industry Progresses Apace in DPRK”, 11 June 2019.

56. KCNA, “Projects for Creation of C1 Chemical Industry Progress Apace”, 25 May 2018.

57. Uriminzokkiri, “Project for C1 Chemical Industry Brisk in DPRK”, 17 November 2018.

58. *Ibid.*

59. *Ibid.*

60. KCNA, “Projects for Creation of C1 Chemical Industry Progress Apace”, 25 May 2018.

61. *Ibid.*

62. KCNA, “Creation of C1 Chemical Industry Progresses Apace in DPRK”, 6 March 2018.

63. *Pyongyang Times*, “We’ll Push the Establishment of C1 Chemical Industry”, 5 January 2018.

demolished. The framework of a very large warehouse-type building (approximately 160 metres long by 50 metres wide) parallel to the derelict conveyors has been under construction since at least mid-2016, although little progress has been made since July 2017 and its role is currently undetermined (see Figure 20).

Figure 20: Raw material reception area at the C1 Chemical Facility



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Probable Methanol and Possible Methanol-to-Hydrocarbons Plant

Consistent with other C1 industries, a majority of the methanol produced at the plant was likely intended for conversion to hydrocarbons, including gasoline and olefins. It is unclear whether these processes are operating but some possibilities include:

The methanol-to-gasoline (MTG) process, which typically involves the reaction of methanol over a catalyst within a fluidised bed reactor and regenerator. This reaction generates olefins which further react into a mixture of paraffins, naphthenes and aromatics which combine to form gasoline. The gasoline is further refined, treated and blended before it becomes a finished product.⁶⁴

The methanol-to-olefins (MTO) process, which also uses a fluidised bed reactor and regenerator to convert methanol to a mixture of olefins, although in this case, the light olefins ethylene and propylene are the primary products.⁶⁵

The methanol-to-aromatics (MTA) process is another potential conversion of methanol to hydrocarbons. This process is still in development for use at an industrial scale, however,⁶⁶ making it less likely to be present at this C1 Plant.

64. ExxonMobil, "Methanol to Gasoline (MTG) Technology Process", <https://www.exxonmobilchemical.com/en/catalysts-and-technology-licensing/methanol-to-gasoline-technology>, accessed 27 January 2026.

65. Peng Tian, Yingxu Wei, Mao Ye, and Zhongmin Liu, "Methanol to Olefins (MTO): From Fundamentals to Commercialization", *ACS Catalysis*, Vol. 5, No. 3, 2015, pp. 1922–1938, DOI: 10.1021/acscatal.5b00007.

66. Ning Wang, Huiqiu Wang, Hao Xiong, Wenlong Song and Weizhong Qian, "Methanol-to-Aromatics Compounds (MTA) Process", *Industrial Arene Chemistry: Markets, Technologies, Sustainable Processes and Case Studies of Aromatic Commodities*, Wiley-VCH GmbH, 2023, <https://doi.org/10.1002/9783527827992.ch18>.

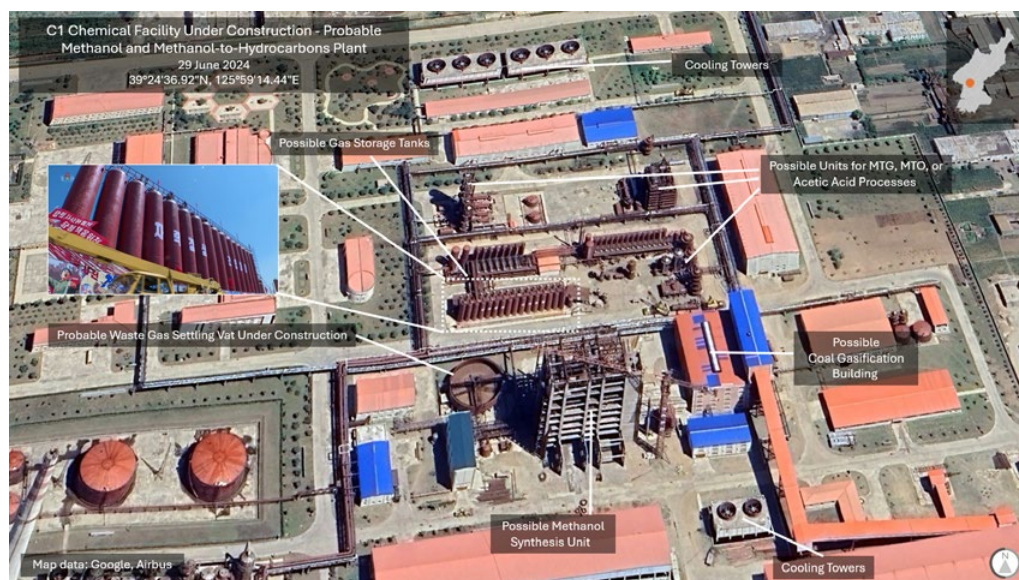
The mention of a catalyser for acetic acid production in North Korean media⁶⁷ indicates that acetic acid is produced from methanol by catalytic carbonylation of methanol.

Multiple areas of this site are consistent with the equipment that would be needed for the MTG, MTO and acetic acid processes (see Figure 21). Without further ground-level imagery, though, it is difficult to distinguish these processes with high confidence based on satellite imagery alone.

The southwest quadrant of the facility is the most developed, with most construction occurring between late 2017 and late 2022. By then, much of the infrastructure appeared externally complete; however, from June 2022 to the latest available image in November 2025, very little further development is evident and there are no visible signs of active production.

Connected to the restored raw material warehouse via covered belt conveyors is a substantial lattice tower structure, at least ten storeys high with two approximately 8.5 metre-wide entrances. This has been under construction since at least June 2022. In imagery from 3 November 2025, the building has a roof and may be externally complete, however a gantry crane remains on site. The function of this building is unclear; although its size and layout relative to the rest of the site indicate possibly a gasification unit and/or methanol synthesis tower. The area directly north of this structure comprises an area with probable gas storage tanks for oxygen, nitrogen and gaseous hydrocarbons and possible distillation and absorption towers. There is also a bank of six cooling towers, which are consistent with the exothermic nature of methanol production and conversion to other hydrocarbons.

Figure 21: C1 Chemical Facility under construction: probable methanol and possible methanol-to-hydrocarbons plant



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

67. Rodong Sinmun, “Hot Wind of Development and Creation for Establishing C1 Chemical Industry”, 15 February 2020, available via KCNA Watch, <https://kcnawatch.org/newstream/1581754316-812075173/hot-wind-of-development-and-creation-for-establishing-c1-chemical-industry/>, accessed 13 March 2026.

An extensive pipework system connects each element of the processing area and leads back to the possible carbide production facility. Snow-covered imagery from January 2025 indicates that there may be an element of heating in this area, but this is speculative and there is nothing on imagery to indicate it is functional.

Figure 22: Snowmelt visible around probable methanol synthesis plant



Source: Maxar Technologies, 29 January 2025.

Probable Methanol Storage and Syngas Treatment Plant

To the west of this area is a tank farm collocated with a substantial vent stack that in turn is connected to a possible manufacturing plant (see Figure 23). The plant is connected via a possible control room to the gasometer farm, although it is not possible from imagery to identify whether the contents of the storage tanks are intended as an input or an output. Adjacent to the plant, however, are a possible covered unloading bay and a second covered building that has pipework leading directly from it to the plant, indicating a source of possible feedstocks. Each processing building within the area is connected by an extensive pipework network leading from the probable carbide plant.

Figure 23: Probable methanol storage and possible syngas treatment plant



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

The size of these tanks indicates that at least one is likely for methanol storage based on remarks made about a methanol tank with “thousands” of cubic metres of capacity.⁶⁸ Some of the equipment visible in Figure 23 is consistent with sulfur handling, and its location next to a large exhaust flume stack would seem to indicate that it is involved in the treatment of the syngas generated at the adjacent gasification and methanol production site.

Probable Former Gasification Plant

The northeast quadrant of the facility comprises a probable gasification plant in the process of being dismantled. It was operational as late as September 2018, but most of the infrastructure had been demolished by September 2019. There is no evidence on the latest available imagery to indicate that this plant is undergoing reconstruction, or that the land is being repurposed (see Figure 24).

Figure 24: Site of the former probable gasification plant in 2015



Annotated by the authors. Source: Maxar Technologies, 1 January 2015.

Figure 25: Site of the former probable gasification plant in 2024



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

68. KCNA, “Projects for Creation of C1 Chemical Industry Progress Apace”, 25 May 2018.

Possible Carbide Production Facility

Linked to the C1 site under construction is a possible carbide production facility. Like the C1 site, this has undergone significant reconstruction over its lifetime. On an image from 2004, four probable furnace structures were seen outside of the main processing building. By 2006, one of these had been removed; and another by mid-2009. In early 2018, there was evidence on imagery of a new probable furnace building in the early stages of construction; externally completed by September. By June 2022, however, all had been demolished, even the newly constructed one, and there was significant reconstruction under way on the whole site, including an extension to the main processing building.

The reconstruction of the facility was externally completed by mid-2024, although there is no evidence on imagery that the site is operational. Unusually for a carbide production facility, there is no evident stockpile of raw material, nor an obvious means by which raw material is transported to the site. However, there is a 200-metre-long dogleg structure that could either be a pipeline or possibly a conveyor covered by an environmental shelter linking the site to a large tower to the northeast. There is nothing in the imagery to indicate the function of this structure, but it is feasible that there is a mine shaft within the tower.

Figure 26: Possible carbide production facility



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Cleared Area Under Construction

The northwestern quadrant of the facility has been largely demolished, although the shells of several buildings remain, in various states of dismantlement. This part of the facility was at its most developed from at least March 2004, the date of the first available imagery on Google Earth, until the end of 2006. By mid-2009, much of the infrastructure had been dismantled, and by September 2018, the area had been almost completely cleared, apart from a compound probably associated with clearance activities and a cooling tower stack that was later demolished.

By June 2022, signs of new reconstruction were evident on imagery, in the form of building materials, tracked plant and building footings. Since then, several new buildings

and structures have been or are in the process of being built, although the rate of construction is slow and none of the new construction appears to be complete or functioning on imagery. The quality of available imagery precludes positive identification of much of the new construction; however, it includes a tank farm, a probable chemical processing plant, two multi-storey, possible support or manufacturing buildings that appear externally complete, the external framework of a possible warehouse building, and the shell of a possible processing/manufacturing building adjacent to three vent stacks (see Figure 27). This area has not been attributed to any product.

Figure 27: Cleared area under construction at the C1 Plant.



Annotated by the authors. Source: Maxar Technologies, 3 November 2025.

Support Areas

Immediately adjacent to the processing and production area are a clutch of support and/or manufacturing buildings (see Figure 28). In common with the processing and production area, construction of most of the existing buildings here commenced in mid-2017 and they were externally complete by mid-2022, although two of them have endured since at least 2009. Two of the newer buildings have a configuration consistent with manufacturing, owing to their size and the presence of large entrances that can comfortably accommodate large vehicles, and others have the appearance of generic support/administrative buildings. Two of the buildings have possible rotundas, which could indicate lecture theatres or meeting rooms, and could therefore be linked to education or research and development.

Figure 28: Probable support area for C1 Chemical Facility

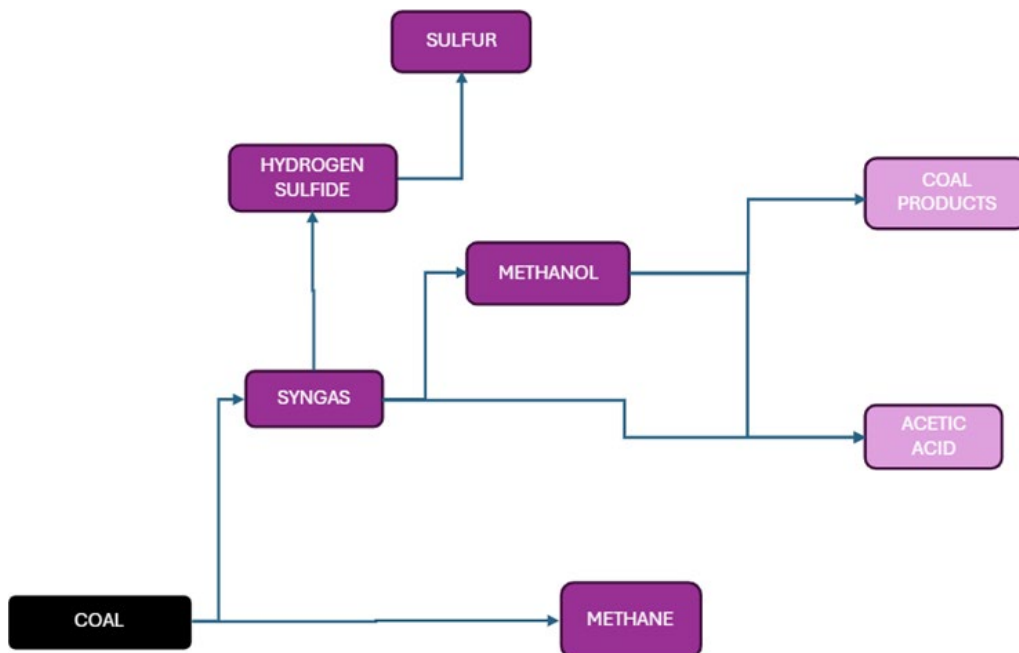


Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Site Process Flow Diagram

Figure 29 demonstrates how these processes might fit together within the C1 Chemical Facility. The main raw material is most likely anthracite coal, which is converted to syngas and then to methanol. Sulfur and other impurities might be filtered out of the syngas and either disposed of or stored and shipped for use in other processes. The methanol may be converted to acetic acid, gasoline or light olefins; however, it is unclear whether those conversions are taking place or whether they are part of the apparent difficulties in the start-up of plant operations.

Figure 29: Possible overall process flow within the C1 Chemical Facility

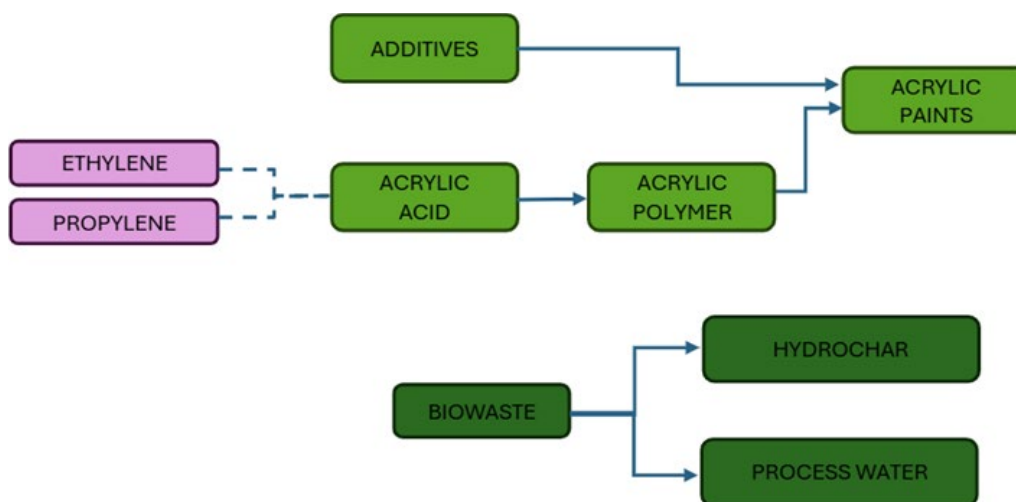


Source: derived by the authors. Light purple denotes possible products; dark purple denotes probable products. The coal products, such as gasoline, propylene and ethylene, may be produced in the carbide facility that was under construction on available imagery.

3) Sunchon Chemical Complex

The Sunchon Chemical Complex is a term used by DPRK sources to refer to several sites, confusing to external researchers who have attempted to pin the name down to a single location. Take, for example, what was once referred to as the “Sunchon Chemical Complex Process for Production of Acrylic Paints” which is now known as the Songyong Paints Factory.⁶⁹ Both the Songyong Paints Factory and the Nutrient Solution Factory are described as components of the Sunchon Chemical Complex, yet they are located at sites roughly 4.5 kilometres apart. In contrast, the Sunchon Phosphatic Fertiliser Plant is not referred to as a constituent part of the Sunchon Chemical Complex. The C1 Chemical Facility’s opening ceremony was reported in DPRK sources as taking place at the Sunchon Chemical Complex (geolocated to the courtyard south of the Sunchon Pharmaceutical Factory) yet it appears less closely associated with the Complex than the Nutrient Solution Factory or the Songyong Paints Factory. These two factories do not appear to have interconnected processes. Figure 30 shows possible products of each facility based on details released by DPRK sources.

Figure 30: Possible production flows at the Songyong Paints Factory and Nutrient Solution Factory



Source: generated by the authors. Light green denotes products at the Songyong Paints Factory, dark green denotes products at the Nutrient Solution Factory, and light purple denotes feedstocks from the C1 Plant if its conversion process for methanol to light olefins is operational.

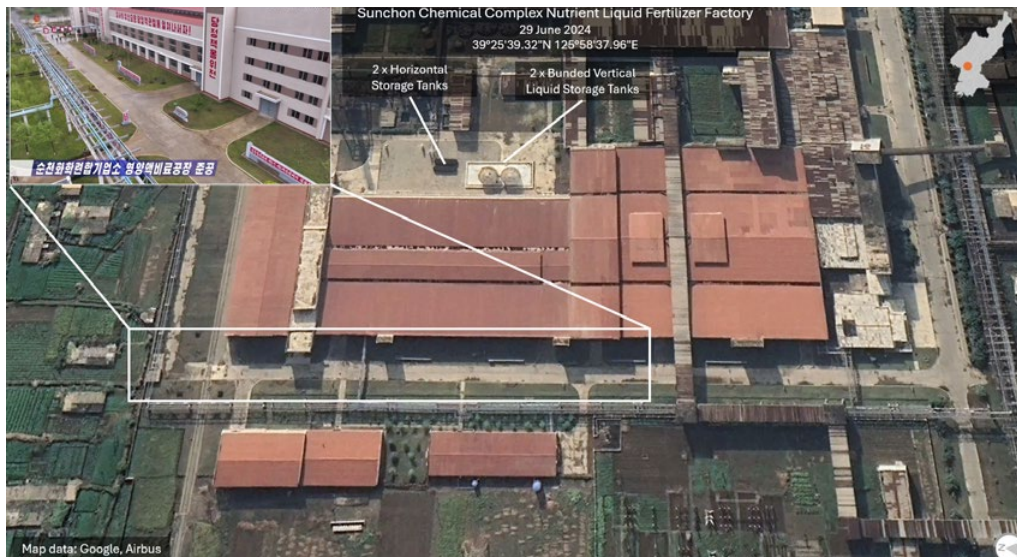
Nutrient Liquid Fertiliser Factory/Nutrient Solution Factory

North Korean media reported on the construction of a new Nutrient Solution Fertiliser Factory in 2023 (see Figure 31).⁷⁰ It is unclear whether slight changes in name by DPRK sources (from Nutrient Liquid Fertiliser to Nutrient Solution) indicates an adjustment to the purpose of the product from the site. It may be intended for use in the nearby Sunchon Pharmaceutical Factory as a growth medium for bacterial cultures in the production of antibiotics; however, it is also possible that the product could be used as agricultural fertiliser.

69. *Foreign Trade of DPR Korea*, 2017, No. 1, <https://www.nknews.org/pro/north-korea-company-database/details/sunchon-chemical-complex/>, accessed 2 May 2026.

70. Colin Zwirko, “North Korea Renovates Long Abandoned Factory in Quest to Address Food Shortages”, *NKPro Analysis*, 6 October 2023, <https://www.nknews.org/pro/north-korea-renovates-long-abandoned-factory-in-quest-to-address-food-shortages/>, accessed 2 May 2026.

Figure 31: The Nutrient Liquid Fertiliser/Nutrient Solution Factory



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

One DPRK news article mentions “neutralization, concentration and cooling” in its coverage of the factory;⁷¹ another shows equipment labelled as carbonisation and reduction reactors.⁷² These suggest that hydrothermal carbonisation (HTC) might be the primary process taking place at the factory. HTC uses wet biowaste to produce hydrochar rich in nitrogen, phosphorus, and potassium and which can be used as an alternative to coal as a fuel source or gasification feedstock. It also produces process water which is rich in organic compounds such as acetic acid, phenols, amino acids, sugars and alcohols, as well as nitrogen and phosphorous. The composition of nutrients and organic chemicals within the HTC products varies depending on the biowaste feedstock. Both the hydrochar and process water can have applications as feedstock for fermentation and agricultural fertiliser.⁷³

Imagery from 2004 of the area where the Nutrient Solution Factory is now situated indicates an extensive and diverse site with several processing and production facilities. By mid-2014, imagery showed deterioration of the complex, most notably at the current site of the factory. On imagery from 5 July 2014, for instance, elements of the roof and internal infrastructure are clearly absent. However, efforts to refurbish the site began in late 2022. Sometime between September 2022 and March 2023, the missing roof structure had been replaced, and additional roof elements were in the process of being replaced

71. KCNA, “Increased Production at Nutrient Solution Factory under Suncheon Chemical Complex”, 3 October 2024.
72. Colin Zwirko, “North Korea Renovates Long Abandoned Factory in Quest to Address Food Shortages”, *NKPro Analysis*, 6 October 2023, <https://www.nknews.org/pro/north-korea-renovates-long-abandoned-factory-in-quest-to-address-food-shortages/>, accessed 2 May 2026.
73. Nicholas A. Silva and Sage R. Hiibel, “Nutrient Recovery of the Hydrothermal Carbonization Aqueous Product from Dairy Manure Using Membrane Distillation”, *Environmental Technology*, Vol. 44, No. 8, 2023, pp. 1135–1144, <https://doi.org/10.1080/09593330.2021.1995785>; Nancy N. Boamah and Shakirudeen A. Salaudeen, “Process Water from the Hydrothermal Carbonization of Biomass: A Review on the Characterization, Applications, and Potential for Future Work”, *Journal of Water Process Engineering*, Vol. 77, September 2025, Article No. 108531, <https://doi.org/10.1016/j.jwpe.2025.108531>; Giovanni Ciceri, Marisa Hernandez Latorre, Maneesh Kumar Mediboyina and Fionnuala Murphy, *Hydrothermal Carbonization (HTC): Valorisation of Organic Waste and Sludges for Hydrochar Production of BioFertilisers*, IEA Bioenergy: Task 36, October 2021, <https://www.ieabioenergy.com/wp-content/uploads/2021/10/HTC-Valorisation-of-organic-wastes-and-sludges-for-hydrochar-production-and-biofertilizers-Full-Report.pdf>, accessed 2 May 2026.

by April 2023. By September 2023, this work had been completed, and the entire roof structure had been replaced.

This activity is consistent with the timing of North Korean media reports on the construction of a new Nutrient Solution Fertiliser Factory. While there is nothing on imagery to confirm the function of the building, images from North Korean media indicate that many of the processes involved are internal. The site is not served by rail but is accessible by several roads, with the probable main entrance to the wider complex in which it is situated at 39°25'30.26"N, 125°58'17.12"E. Other probable access control points are at:

- 39°25'21.79"N, 125°58'18.68"E
- 39°25'21.08"N, 125°58'33.46"E
- 39°25'26.26"N, 125°58'45.06"E
- 39°25'54.59"N, 125°58'40.56"E
- 39°25'52.58"N, 125°58'15.79"E

Probable Water Storage and Purification Plant

In addition to the refurbishment of the Suncheon Pharmaceutical Factory, the only other part of the facility that has seen any significant development is the probable water storage/purification plant, currently under construction (see Figure 32). It comprises eight probable water tanks under construction and six more that appear to be complete. Adjacent to each are probable treatment buildings. There is also a multi-compartmented building under construction that could possibly be associated with electrolysis or desalination.

Construction of the water tanks commenced between July and September 2021, but construction appears to have stalled between June 2024 and November 2025. This water purification plant could serve both the Pharmaceutical Factory, which would need purified water for formulation of injections and solutions, and the Chemical Complex. It is adjacent to a series of historic settling ponds and associated venturi cooling towers that have been converted to agricultural use.

Figure 32: Probable water storage and purification plant for the Suncheon Chemical Complex and/or Pharmaceutical Factory



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Unidentified Chemical Manufacturing Area

Directly to the west of the Nutrient Liquid Fertiliser Factory, within the wider complex, is a substantial Chemical Manufacturing Area. This is linked to the rest of the facility through an extensive raised pipe network and includes a variety of equipment related to storage, probable distillation units and scrubbers. The generic nature of the equipment present, and the lack of visible raw materials precludes high-confidence identification of the specific outputs from this area. There is nothing on imagery to confirm the operational status of this area; however, the dilapidated state of many of the buildings and general lack of activity suggest that the main processing functions are inactive (see Figure 33). It is possible that this is one of the last remaining areas of the former Sunchon Vinalon Complex to be dismantled.

Figure 33: Unidentified chemical processing area at the Sunchon Chemical Complex



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

Songyong Paints Factory

The Songyong Paints Factory is located approximately 3.5 kilometres to the south of the city of Sunchon, at the end of a bespoke tree-lined metalled avenue that directly serves the facility. The northern end of the road is connected to the main east-west highway, skirting the south of the city. At the junction are two buildings which may serve as reception and administrative areas. Although there is no visible barrier to provide control of access, the avenue leads only to the facility and associated domestic and agricultural area (see Figure 34).

The facility comprises a walled compound, with a single gated entrance to the northeast, with a probable guard room. The accommodation/domestic area is controlled by a guard post to the southeast of the compound. Of note, imagery from between July 2017 and September 2022 shows the markings for a possible temporary helicopter landing site in the administrative area, which would be consistent with a facility of strategic interest to the North Korean leadership. There are also two guard posts (the northern one is a

Figure 34: Region of the Songyong Paints Factory



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

tower) located at the western corners of the compound (see Figure 35). While the facility itself was in existence until at least 2004 when the first imagery was available, the northern guard tower was constructed between September 2018 and November 2019, and the southern guard post between November 2019 and June 2022. This indicates an increase in security at the site. While controlled access to industrial facilities in North Korea is not unusual, the presence of guard towers is indicative of a sensitive site.

Figure 35: Songyong Paints Factory guard towers and electricity substation



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

Throughout 2015, the facility was subject to significant development, during which time there was an extension of the probable mixing and synthesis hall, the construction of distillation towers and the development of a storage and distribution compound containing a probable finishing and packaging building. The administrative compound was also expanded during this time. This expansion is consistent with reports that Kim Jong Un toured a newly-built process for acrylic paint production at the Sunchon Chemical Complex

in August 2016.⁷⁴ According to DPRK sources, the process was established using only domestic materials and equipment for the synthesis and rectification of acrylic acid and the production of water- and oil-based paints.⁷⁵ Ground-level imagery released in 2021 is consistent with the exterior of the probable mixing and synthesis hall and appears to show stainless steel-jacketed reactor vessels and a possible shell and tube heat exchanger.⁷⁶ Reports in 2025 announced a newly-built epoxy resin paint production line at the factory.⁷⁷

Figure 36: Ground-level imagery at the Songyong Paints Factory



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022. Inset: KCTV (2021);⁷⁸ Kim Jong Un visiting the Facility on 13 August 2016 (KCNA/Rodong Sinmun).⁷⁹

A second key feature of the functional area is a steel-framed multi-storey processing tower with multiple vertical columns and a heat exchanger. This is consistent with small-/medium-scale distillation or separation and may comprise a continuous processing unit. It is connected by raised pipework to the mixing and synthesis hall.

74. *Rodong Sinmun*, “Kim Jong Un Goes Round Process for Production of Acrylic Paints Newly Built at Sunchon Chemical Complex”, 13 August 2016, available via KCNA Watch, <https://kcnawatch.org/newstream/1530455155-459340511/kim-jong-un-goes-round-process-for-production-of-acrylic-paints-newly-built-at-sunchon-chemical-complex/>, accessed 26 February 2026.
75. Ministry of Foreign Affairs, “Product of Self-Reliance – Acrylic Paint Production Process”, 12 August 2021, accessed via KCNA Watch, <https://kcnawatch.org/newstream/1691825510-714095037/product-of-self-reliance-%e2%80%93-acrylic-paint-production-process/>, accessed 26 February 2026.
76. Supersuhui, “July 20 2021 20:00 Central Television Report”, YouTube, 21 July 2021, https://www.youtube.com/watch?v=xJd5Fk_C8cE, accessed 26 February 2026.
77. “The high-quality epoxy resin paint is used to paint various kinds of machineries and devices, electronic appliances and household goods and the floors of foodstuff factories and pharmaceutical factories. The establishment of epoxy resin paint makes it possible to satisfy the demand for chemical products”. KCNA, “Epoxy Resin Paint Production Line Built in DPRK”, 26 June 2025, <http://www.kcna.kp/en/article/q/64e900f5bd0353837ca02d7babce3ada08ac64eaf721dc65f85e94bd9fb69451afa96195f9b303902490a126ab7285f.kcmsf>, accessed 27 February 2026.
78. Supersuhui, “July 20 2021 20:00 Central Television Report”, YouTube, 21 July 2021, https://www.youtube.com/watch?v=xJd5Fk_C8cE, accessed 26 February 2026.
79. North Korea Leadership Watch, “Kim Jong Un’s Last Observed Appearance was Visit to the January 18 General Machine Factory”, 13 August 2016, <https://nkleadershipwatch.wordpress.com/2016/08/13/kim-jong-un-visits-sunchon-chemical-complex/>, accessed 27 February 2026.

The third key feature is a possible scrubber column with an associated demister or top vent cap, adjacent to which is a probable centrifugal pump assembly. This infrastructure is consistent with solvent-based resin production or many other industrial chemical processes.

Other features of the functional area of the facility include a small tank farm feeding the mixing and synthesis hall, likely to contain solvent and other liquids (plasticisers, surfactants, acids and resins) to support the processes, and larger liquid storage tanks feeding the processing building adjacent to the possible scrubber.

Lastly, an adjacent compound connected to the western edge of the functional area was constructed between the end of 2015 and mid-2016, containing a large warehouse, support area and concrete apron. This is a possible finishing, packaging and distribution area.

Figure 37: Equipment and layout of the Songyong Paints Factory



Annotated by the authors. Source: Google Earth (Airbus), 12 June 2022.

Acrylic acid can be produced from propylene, acetylene or ethylene. The propylene route is the most common worldwide since it is typically a more affordable feedstock than acetylene or ethylene.⁸⁰ Propylene is typically produced through steam cracking of hydrocarbons.⁸¹ Yet, steam cracking equipment is rare in the DPRK.⁸² Propylene can also be produced via coal gasification and the MTO process, although the acrylic acid plant was operating before the construction of the C1 Chemical Facility, so how propylene was supplied before that time is unclear. A DPRK article on the Songyong Paints Factory describes the manufacture of acrylic acid from propylene via two-stage oxidation.⁸³ Whereas the latter is a well-established process and yields acrylic acid, propylene can

80. Chemical Book, "Acrylic Acid Synthesis", 2016, <https://www.chemicalbook.com/synthesis/acrylic-acid.htm>, accessed 2 February 2026.

81. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, *Some Industrial Chemicals*, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 60., 1994, <https://www.ncbi.nlm.nih.gov/books/NBK507483/>, accessed 2 May 2026.

82. For further discussion of steam cracking in the DPRK, see: Lennie Phillips, Gianguseppe Pili and Sean Corbett, *Ponghwa Chemical Factory: North Korea's Chemical Facilities: Site Profile 1*, 11 May 2023, <https://www.rusi.org/explore-our-research/publications/special-resources/pongghwa-chemical-factory-north-koreas-chemical-facilities-site-profile-1>, accessed 2 May 2026.

83. *Pyongyang Times*, "Quality Paints Produced", 7 August 2018, available via KNCA watch, <https://kcnawatch.org/newstream/1533643343-493497203/quality-paints-produced/>, accessed 16 February 2026.

also be converted in a single step to acrylonitrile and HCN using the same catalyst if ammonia is added to the reaction.⁸⁴

An analysis of available imagery supports open-source reporting that this facility produces acrylic paints; however, this does not exclude a capability to produce HCN – a CWC Schedule 3 chemical – or small-scale dual-use precursors. Furthermore, the combination of the facility’s relatively remote location within the wider Suncheon industrial complex, its enhanced security features and high-profile visits by the North Korean leadership make it of particular interest.

4) Suncheon Pharmaceutical Factory

The Suncheon Pharmaceutical Factory is collocated immediately to the west of the main Suncheon Chemical Complex site (39°25'47.19"N, 125°58'07.47"E) and it is historically reported to produce aspirin, streptomycin, terramycin and penicillin.⁸⁵ It also seems capable of formulating medicines into various dosage forms such as injections, capsules and tablets.⁸⁶ The Suncheon Pharmaceutical Factory is likely a different facility to the Suncheon City Koryo Medicine Pharmaceutical Factory (not analysed in this report). The Koryo medicine facility is reported to produce homeopathic medicines such as “shell calcium pills and silymarin hepatitis tablets”.⁸⁷ In contrast, the Suncheon Pharmaceutical Factory appears to specialise in antibiotics (such as penicillin) and small molecule medicines (such as aspirin).

Aspirin is produced by the reaction of salicylic acid with acetic anhydride in the presence of an acid catalyst (typically either phosphoric or sulfuric acid). This produces aspirin crystals in acetic acid;⁸⁸ the crystals are then separated, dried and formulated into tablets.

Penicillin, streptomycin and terramycin are all produced via industrial fermentation of bacterial strains in nutrient-rich liquid before the resulting antibiotic is extracted, purified and formulated. This is done in batches, with the fermentation process typically taking a few days to a week; the presence of fermentation halls could be expected at the Suncheon Pharmaceutical Factory. While they would appear generic on imagery, they would likely have tall internal clearances (and therefore building height), as well as vents for exhaust air and pressure relief. While there are several multi-storey buildings on the complex (up to three storeys), no buildings are clearly identifiable as fermentation halls.

84. American Chemical Society, “Sohio Acrylonitrile Process”, 2007, <https://www.acs.org/education/whatischemistry/landmarks/acrylonitrile.html>, accessed 2 May 2026.

85. Yonhap News Agency, “N. Korean People Avoid N. Korean-Made Foods, Medicines: Report”, 8 February 2017, <https://en.yna.co.kr/view/AEN20170208003700315>, accessed 2 May 2026; Sunghui Moon, “North Korean Children Left Untreated After Tuberculous Meningitis Outbreak”, Radio Free Asia, 25 September 2015, <https://www.rfa.org/english/news/korea/outbreak-09252015150455.html>, accessed 2 May 2026; Seulkee Jang, “Spread of Tubercular Lymphadenitis Causes Alarm in S. Hwanghae Province”, *Daily NK*, 27 June 2022, <https://www.dailynk.com/english/spread-of-tubercular-lymphadenitis-causes-alarm-in-s-hwanghae-province/>, accessed 2 May 2026; Peter Ward, “Why North Korea’s Pharmacies are Unequipped to Confront COVID-19”, *NK Pro*, 26 May 2022, <https://www.nknews.org/pro/why-north-koreas-pharmacies-are-unequipped-to-confront-covid-19/>, accessed 2 May 2026.

86. ACT Alliance, “Dateline ACT North Korea: Food Aid Arrives”, 18 June 1998, <https://reliefweb.int/report/democratic-peoples-republic-korea/dateline-act-north-korea-food-aid-arrives>, accessed 2 May 2026; *Pyongyang Times*, “Achievements Made Amid Campaign to Improve Quality”, 23 December 2021.

87. Jong Hwa Sun, “Efficacious Koryo Medicines Produced”, *Naenara*, 20 June 2025.

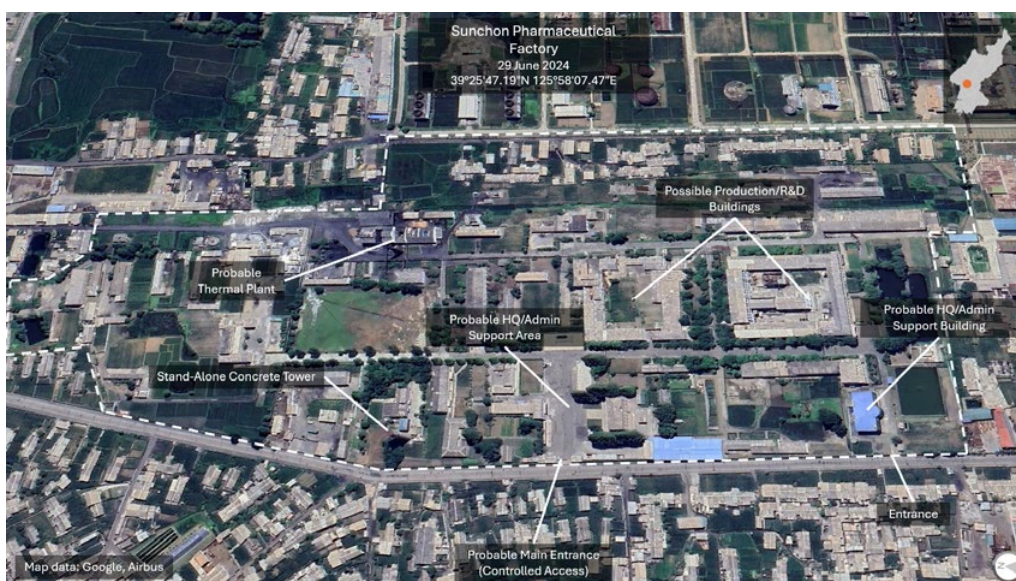
88. Synthesis of Aspirin (Experiment) is shared under a CC BY-NC-SA 4.0 licence and was authored, remixed, and/or curated by LibreTexts.

The Suncheon Pharmaceutical Factory has also been implicated in the production of “cyan[o]benzylamine”, a precursor used to make methamphetamines.⁸⁹ Cyan[o]benzylamine is not a universally-recognised name and appears to be a term used primarily in transliteration of texts regarding its production in the DPRK. However, given the standardised nature of chemical compound names and the association of ‘cyan[o]benzylamine’ with methamphetamine production via phenylacetone, we can infer that the compound in question might be benzyl cyanide, which can be converted to phenylacetone in two synthesis steps.⁹⁰

Analysis of all available imagery of this site is unable to identify any specific facilities that could be assigned to the production of aspirin, antibiotics and benzyl cyanide owing to the lack of visible external signatures. This is to be expected as volumes of materials would be small as compared to the production of bulk chemicals, the processes involved (such as fermentation and extraction) would be internal, and climate-controlled halls and clean rooms would result in minimal emissions.

Little of significance has changed in terms of building layout and construction within the facility since the first available image in 2004, with the exception of a new blue-roofed building built between the end of 2015 and mid-2016. This is located near one of the two main entrances to the facility and is likely to be an administrative or headquarters building. The site is served by road but not by rail. A 2024 image of the facility is shown in Figure 38.

Figure 38: Suncheon Pharmaceutical Factory



Annotated by the authors. Source: Google Earth (Airbus), 29 June 2024.

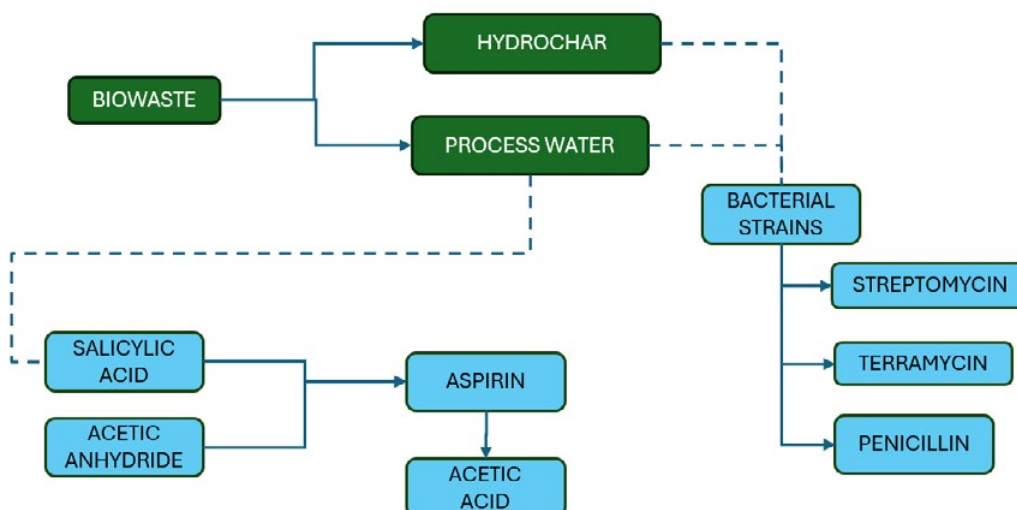
Overall, the absence of distinctive external signatures at the Suncheon Pharmaceutical Factory is consistent with legitimate pharmaceutical manufacturing, and satellite imagery

89. Jeong Seo-yeong, “N. Korea Investigates State Academy of Sciences for Possible Involvement in Manufacture of Narcotics”, Daily NK, 19 August 2021, <https://www.dailynk.com/english/north-korea-investigates-state-academy-sciences-possibly-involved-manufacture-narcotics/>, accessed 2 May 2026; Daily NK, “North Korean State Firms Turn to Drug Sales to Deal with Sanctions”, 17 August 2017, <https://www.dailynk.com/english/north-korean-state-firms-turn-to-d/>, accessed 2 May 2026.

90. Synthesis of phenylacetic acid from benzyl cyanide. Wilhelm Wenner, “Phenylacetamide”, *Org. Synth.*, Coll. Vol. 4, 1963, 760.

alone is insufficient to confirm outputs from the facility, much less any CW link. While the existence of reporting on the production of amphetamine precursors at the factory serves as a reminder of the possible misuse of legitimate equipment and materials, it also indicates a lack of centralised control over the facility that makes it less likely to be involved in a WMD programme. The possible production flows at the Sunchon Pharmaceutical Factory are shown in Figure 39.

Figure 39: Possible production flows at the Sunchon Pharmaceutical Factory and Nutrient Solution Factory



Generated by the authors. Dark green denotes chemicals produced at the Nutrient Solution Factory and light blue denotes products at the Sunchon Pharmaceutical Factory.

Relevance to the CWC

This section considers the sites assessed in this report in the context of the CWC, focusing on whether they would be declarable if North Korea were a State Party. These considerations are based on the report’s findings and may not correspond with actual site operations.

Aside from the possible production of a Schedule 3 chemical (HCN) at the Songyong Paints Factory, no other scheduled chemicals were identified as likely being produced at any of the sites. On this basis, the other sites would not be declarable under paragraphs 3–5 of Article VI of the CWC and would not be subject to the verification measures set out in Parts VI, VII and VIII of the Verification Annex (VA). Yet, plant sites may still be subject to declaration under paragraph 6 of Article VI and to the verification measures set out in Part IX of the VA, depending on whether DOCs are produced in quantities exceeding 200 tonnes in a calendar year. Each site is considered separately below.

Sunchon Phosphatic Fertiliser Plant

This report has not identified the production of DOCs at the Sunchon Phosphatic Fertiliser Plant and, therefore, based on available information, the site is not declarable.

Sunchon C1 Chemical Facility

The C1 facility produces the DOCs methanol and coal derivatives at what appears to be two separate plants. Based on the size of equipment, including bulk methanol storage, the annual production range is likely to be in excess of 10,000 tonnes. Declared product group codes could thus be 519 (methanol, ethanol, urea, formaldehyde, ethyl *tert*-butyl

ether (ETBE), methyl *tert*-butyl ether (MTBE), surfactants based on sulfonic acids and fatty acid salts) and 511 (hydrocarbons and their halogenated, sulfonated, nitrated or nitrosated derivatives) or 513 (carboxylic acids and their esters, anhydrides, acyl halides, peroxides and peroxyacids; their halogenated, sulfonated, nitrated or nitrosated derivatives and their salts).

Sunchon Chemical Complex

Songyong Paints Factory

If ammoxidation of propylene takes place in addition to oxidation of propylene at the Songyong Paints Factory, this would indicate the synthesis of HCN, included under CWC Schedule 3A(3), and would make this site subject to declaration under Article VI and to the verification measures set out in Parts VIII and IX of the VA. The product group code declared under Part IX would be 513 (carboxylic acids and their esters, anhydrides, acyl halides, peroxides and peroxyacids; their halogenated, sulfonated, nitrated or nitrosated derivatives and their salts).

The annual production range is very difficult to estimate, given that very little information is available on output from the site and that most of the equipment is not visible. The quantities of acrylic acid-derived polymers for paint manufacture likely exceed 10,000 tonnes per year. Assuming production of HCN as an intermediate, its annual production would then exceed this amount as well. Given the size of the facility, it seems unlikely that the production range of HCN would exceed 100,000 tonnes in a year. This could be a mixed plant site, with one Schedule 3 plant and only one other chemical production facility.

Nutrient Solution Factory

It is not determined what is manufactured at this facility; however, the processes most likely involve biochemical or biologically-mediated reactions. There is no clear requirement to declare such means of production for non-scheduled chemicals and therefore it is unlikely that the site would be declarable.

Unidentified Chemical Manufacturing Area

The purpose of this plant site is not clear; furthermore, it may not be operational. Consequently, no likely determination is possible regarding the declarability of this facility.

Sunchon Pharmaceutical Factory

Both benzyl chloride and aspirin are DOCs. It is difficult to ascertain how much of these might be produced in a year. It is likely that the production of aspirin would exceed 200 tonnes per year, making the site declarable. The declared product group code is expected to be 541 (medicinal and pharmaceutical products, including drug substances and active pharmaceutical ingredients other than medicaments of Group 542).

Table 2 summarises the declarations that could be made under Article VI of the CWC, should North Korea sign and ratify the treaty.

Table 2: Declarations under Article VI of the CWC for sites in the Sunchon region (based on this report's findings)

	Number of declarable plants	Likely annual production range (tonnes)	Product Group Codes	Site declarable?
Sunchon Phosphatic Fertiliser Plant	Nil	N/A	N/A	No
Sunchon C1 Chemical Facility	2 × DOC	>10,000	519 [511/513]	Yes, Part IX of the VA
Songyong Paints Factory	1 × DOC 1 × S3*	>10,000 10,000–100,000		Yes, Parts VIII* and IX of the VA
Nutrient Solution Factory	Nil	N/A	N/A	No
Unidentified Chemical Manufacturing Area	Unknown	Unknown	Unknown	Unknown
Sunchon Pharmaceutical Factory	2 × DOC	200–1,000	541	Yes, Part IX of the VA

* Depending on the production route for acrylic acid.

Conclusion

Having once housed a highly-integrated chemical industry in the form of the Sunchon Vinalon Complex, it appears that the revitalisation of the Sunchon area's chemical capability aims for integration as well, although dependencies may have been complicated by delays in the start-up of various sites. The Sunchon Pharmaceutical Factory may eventually be supplied with sulfuric and phosphoric acid from the Sunchon Phosphatic Fertiliser Plant, acetic acid from the Sunchon C1 Chemical Facility, and nutrient solution for antibiotics production and phenolic compounds in HTC process water from the Nutrient Solution Factory in the Sunchon Chemical Complex. The Songyong Paints Factory may source propylene from the Sunchon C1 Chemical Facility. Sulfur-containing compounds isolated from syngas at the C1 Chemical Facility may serve as feedstocks for sulfuric acid production at the Phosphatic Fertiliser Complex. The arrangement of these industries in close proximity thus makes sense, given the history of the area, the repurposing of equipment and land and the availability of feedstocks between the sites. However, while the Sunchon Phosphatic Fertiliser Complex appears operational, the

status of the C1 Chemical Facility is less clear. It may not be producing the various hydrocarbons, or even methanol.⁹¹

For most of the sites, the equipment and site layouts identified on satellite imagery are consistent with their reported products. The Songyong Paints Factory remains a relative unknown; given the level of attention paid to it by the leadership, and the level of security at the site, this report assesses that it is the clearest candidate site for small-scale production of chemicals for CW in the Sunchon area. Further monitoring and assessment are required.

The information analysed above does not support the premise that facilities in the Sunchon area produce CWAs. Multiple chemicals were identified that could be used in downstream processes to produce scheduled chemicals. There is an absence of chlorine chemistry in the Sunchon area precluding production of nerve and blister agents without materials from elsewhere. Yet, various sites in the area provide dual-use chemicals that are relevant to the production of nerve agents and blister agents.

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91. In 2024, the DPRK imported over 200,000 tonnes of methanol, more than 100 times what had been reported in each of the previous five years (source: UN Comtrade). Such a large shipment might indicate that anticipated domestic production capacity was far from being met.

Cover image source: Google Earth (Airbus & Maxar), 2026



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