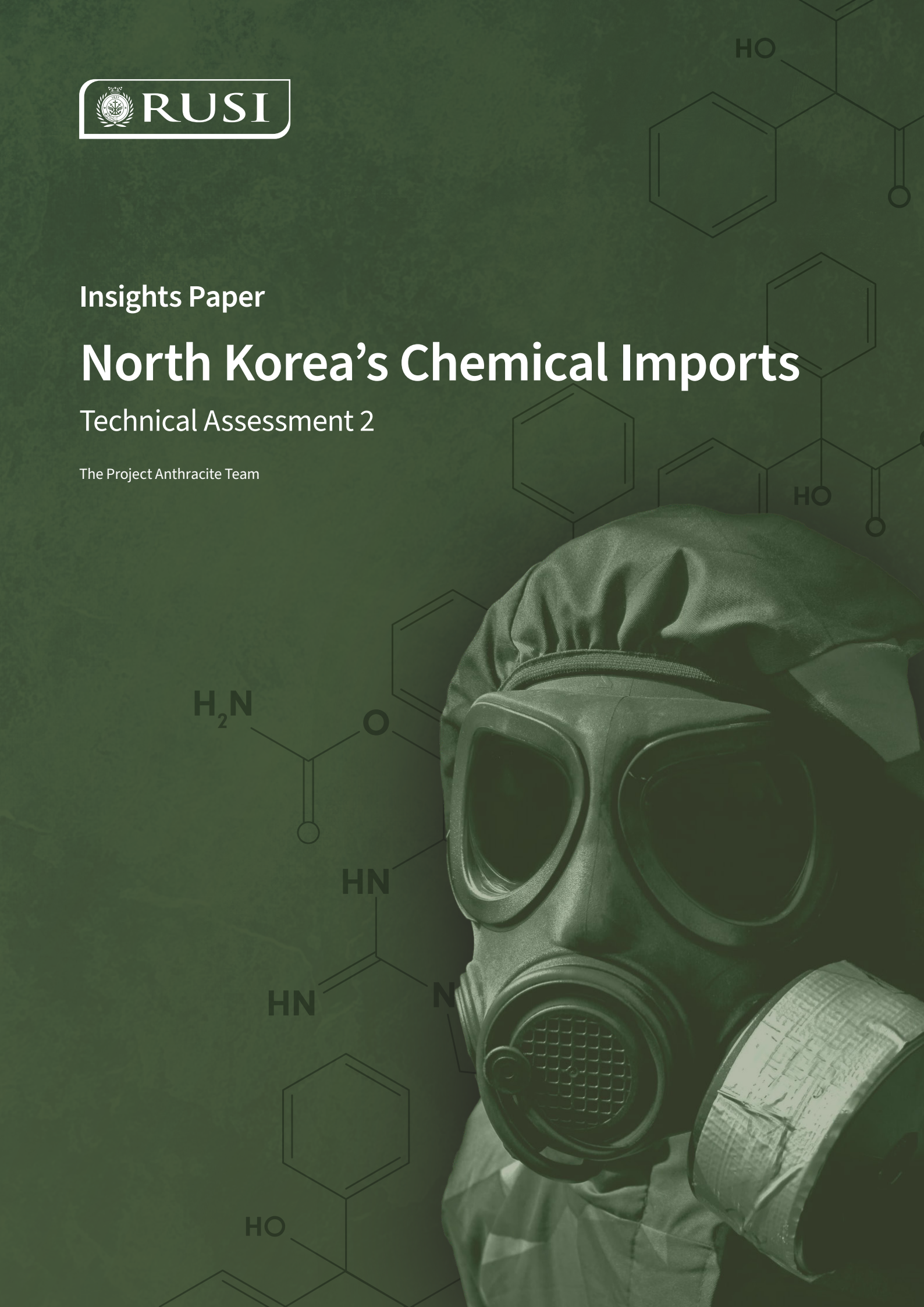
RUSI

Insights Paper

North Korea's Chemical Imports

Technical Assessment 2

The Project Anthracite Team



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The purpose of this report is to show and analyse what chemicals and related equipment appear in mirrored North Korean import data. To achieve this purpose, the report names companies and entities that appear in the trade data as a consignor or consignee. For the avoidance of doubt, RUSI does not impute any allegations of wrongdoing on the part of these companies and entities and makes no representations or assertion that these companies and entities have any involvement in any sanctions evasion-related activity in relation to these goods and materials or are involved in directly or indirectly supplying North Korean customers in breach of any international (or their own domestic) laws or regulations restricting or prohibiting such action.

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Executive Summary

This report assesses shipment-level trade data for imports of chemicals and equipment into North Korea that could be used to produce chemical warfare agents (CWAs). It is impossible to ascertain the uses of the imports this report analyses. However, two chemical imports from China do have particular relevance to the development of CWAs: sodium fluoride and disodium sulfate. The former appears on the Australia Group (AG) Export Control List of Chemical Weapons Precursors, while the latter can be readily converted into sodium sulfide – yet another AG-listed precursor.[1] Similarly, one chemical exported from India to North Korea in 2017, phosphorus trichloride, is scheduled by the Chemical Weapons Convention and was banned in 2006 by the UN Security Council Resolution 1718 Committee for export into North Korea.

Beyond these three chemicals, UN Comtrade reports that from January 2015 to December 2024 North Korea imported at least 667,820 tonnes of chemicals and 2,124 tonnes of relevant machinery, plant or laboratory equipment that could be of particular relevance for producing CWAs.[2] Additionally, in the same period, Project Anthracite has determined that North Korea imported at least another 37 shipments of goods across these same HS codes from Russia and India. These wide-ranging codes include many dual-use chemicals, goods and materials capable of sustaining or progressing North Korea's CWA production capabilities.[3]

This data could reveal domestic demands and important trade relationships for North Korea's chemical industry needs, caused by a lack of capability, efficiency or priority. Specifically, this report identifies a dependency on Chinese exports, minimal crossovers between Russian and Indian companies and the types of goods they export into North Korea, possible indications of a lack of industry ability for some basic chemical production processes, and unreliability in countries' reporting of exports to North Korea.

North Korea does not publish its trade records. Thus, the trade data discussed here is mirrored import data as reported by the exporting countries, which is dependent on those countries' willingness to provide records of their trade with North Korea. As such, quantity specifics, item descriptions and consignee information were often missing from shipment details, limiting the potential findings of Project Anthracite's analysis.

Because countries are unlikely to want to be seen as supporting or sustaining anything resembling a North Korean capacity for CWA production, it is possible that the data analysed in this report could have been redacted, obfuscated or misreported, and the mirrored imports identified in this report alone are highly unlikely to satisfy North Korea's import requirements for its chemical industry. Therefore, it is likely that the results presented in this report are minimum shipments for the goods that do appear in the data.

1. Australia Group (AG), 'Export Control List: Chemical Weapons Precursors', 21 November 2023, <https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/precursors.html>, accessed 13 July 2025.
2. UN Comtrade Database, <https://comtradeplus.un.org/>, accessed 8 May 2025.
3. Trade data provided by a third-party commercial supplier.

Project Background

North Korea has long been assessed by many countries as having a chemical weapons (CW) programme. In 2006, a Republic of Korea defence ministry white paper estimated that between 2,500 and 5,000 tons of CWAs were stored in facilities across the country.[4] This figure has been reiterated in later documents, including a 2022 white paper.[5]

The 2017 assassination of Kim Jong-un's half-brother Kim Jong-nam with the nerve agent VX,[6] in an attack that was widely accepted as being orchestrated by North Korea,[7] served as a reminder of the longstanding North Korean CW programme and to highlight that very little is known about it, in contrast to the international attention paid to North Korea's missile and nuclear programmes.[8]

In an attempt to identify means to bridge that gap, RUSI published a feasibility study in partnership with the Defence Science and Technology Laboratory (Dstl) in March 2022, which concluded that open source tools could help to increase understanding of North Korea's chemical industry, allowing hypotheses about CW production to be developed and refined.[9] The study formed part of a multi-year project on North Korea's WMD in cooperation with the Verification Research, Training and Information Centre (VERTIC) and the James Martin Center for Nonproliferation Studies.[10]

CW production programmes invariably have their origins in the chemical industry, from research into new pesticides to the supply of raw materials and intermediates. Many chemicals that have formed part of historical global CW programmes have been included in the Organisation for the Prohibition of Chemical Weapons' 'Annex on Chemicals',[11] which forms part of the Chemical Weapons Convention (CWC).[12] The Annex defines the basis for giving one of three schedules to certain chemicals as depending 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.[13]

4. Ministry of National Defense, Republic of Korea, '2006 Defense White Paper', p. 26, <https://www.files.ethz.ch/isn/155726/SouthKorea_English2006.pdf>, accessed 23 February 2023.
5. Ministry of National Defense, Republic of Korea, '2022 Defense White Paper', <https://www.mnd.go.kr/user/mnd/upload/pblictn/PBLICTNEBOOK_202303070948465300.pdf>, accessed 20 August 2025. Paper in Korean.
6. 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.
7. Hannah Ellis-Petersen and Benjamin Haas, 'How North Korea Got Away with the Assassination of Kim Jong-nam', *The Guardian*, 1 April 2019.
8. 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*, 20 August 2025, <https://thebulletin.org/premium/2022-09/nuclear-notebook-how-many-nuclear-weapons-does-north-korea-have-in-2022/>, accessed 20 August 2025.
9. Cristina Varriale and Sarah Clapham, 'Remote Assessment of North Korea's Chemical Weapons: Feasible or Not?', *RUSI Occasional Papers* (March 2022), <https://www.rusi.org/explore-our-research/publications/occasional-papers/remote-assessment-north-koreas-chemical-weapons-feasible-or-not>, accessed 20 August 2025.
10. Verification Research, Training and Information Centre, 'Building Trust Through Verification', <https://www.vertic.org/>, accessed 25 July 2024; James Martin Center for Nonproliferation Studies, 'About', <https://nonproliferation.org/>, accessed 25 July 2024.
11. OPCW, 'Annex on Chemicals', <https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/annex-chemicals>, accessed 22 August 2025.
12. OPCW, 'Chemical Weapons Convention', <https://www.opcw.org/chemical-weapons-convention>, accessed 20 August 2025.
13. OPCW, 'Annex on Chemicals'.

Based on the feasibility study and with the support of Global Affairs Canada, RUSI has initiated a three-year project to use open source tools and remote-sensing methods to provide a networked overview of North Korea's chemical industry, initially by profiling associated sites and then seeking to understand their role in North Korea's chemical industry, as well as any links they might have to CW production.[14]

Methodology

This report relies on the World Customs Organization (WCO) 2022 nomenclature, which 'is used worldwide for the uniform classification of goods traded internationally', for HS (Harmonized System) chapters and subheadings.[15] Although the changes between the WCO's 2012 nomenclature and the 2022 edition expanded and amended some subheadings in chapters 28 (inorganic chemicals) and 29 (organic chemicals),[16] the headings themselves remained unchanged and cast a wide enough net for the smaller changes to not affect the relevance of the identified shipments in this report. The HS codes reported in the shipment overview tables are therefore reflected as they were reported at the time of shipment. Sometimes, searches in the trade data using these HS4 codes return shipments from before 2022 with HS6 codes that do not exist in the 2022 nomenclature, but the HS4 components of those codes are unchanged from the 2022 nomenclature. Therefore, these shipments are still included in the research findings.

In HS nomenclature, the first six digits are internationally standardised. However, most countries have their own system for the remaining digits, meaning an item's HS8 code may change from country to country, even while its HS4 and HS6 codes are consistent internationally.

Project Anthracite analysed shipments under WCO chapters 28 and 29 because they would include chemicals and select precursors outlined in CWC schedules and sanctioned by the UN Security Council Committee established pursuant to Resolution 1718.[17]

Similarly, the project team also analysed shipments under HS4 code 8419 because it covers a range of plant and laboratory equipment for processes that involve a change of temperature. This HS code will include potential dual-use equipment required to produce CWAs. The Australia Group (AG) lists certain equipment for export control, but this is dependent on the materials of construction. For a CW programme, corrosion resistant materials are of the greatest concern due to their ability to withstand contact with CWAs and their precursors, many of which are highly corrosive.[18] However, HS codes do not capture materials of construction, which makes it difficult to determine

14. For further background and information, see RUSI, 'Toxic Inheritance', <https://rusi.org/explore-our-research/projects/assessing-north-koreas-chemical-weapons-capability/toxic-inheritance>, accessed 8 March 2023.
15. HS codes are internationally standardised numerical codes used to classify traded goods for customs and statistical purposes. See World Customs Organization (WCO), 'HS Nomenclature 2022 Edition', <https://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2022-edition/hs-nomenclature-2022-edition.aspx>, accessed 7 February 2025.
16. WCO, 'Correlation Tables HS 2012–2017', 6 May 2015, <https://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2017-edition/correlation-tables-hs-2012-to-2017.aspx>, accessed 22 August 2025.
17. UN Security Council (UNSC), 'Security Council Committee Established Pursuant to Resolution 1718 (2006): Work and Mandate', <https://main.un.org/securitycouncil/en/sanctions/1718/panel_experts/work_mandate>, accessed 15 January 2025.
18. AG, 'Australia Group Common Control List Handbook: Volume I. Chemical Weapons-Related Common Control Lists', Revision 8, January 2024, <https://www.dfat.gov.au/sites/default/files/australia-group-common-control-list-handbook-volume-i.pdf>, accessed 3 June 2025.

whether shipments under code 8419 specifically violate any trade controls.

Table 1 summarises the specific HS codes flagged by the Project Anthracite team as encompassing many of the scheduled or dual-use chemicals that could be used to produce CWAs and relevant machinery, plant or laboratory equipment. If goods of direct relevance to CWA production were imported by North Korea (and reported correctly), the Project Anthracite team assessed that they are probably captured within this set of flagged codes.

Table 1: Chemicals and Equipment of Particular Relevance to CWAs

HS Code	WCO Description	Relevance to CWAs
2802	Sulfur, sublimed or precipitated; colloidal sulfur	Includes sulfur, a base precursor for the blister agent sulfur mustard (HD)
2811	Other inorganic acids and other inorganic oxygen compounds of non-metals	Includes hydrogen cyanide and precursors for synthesis of vesicants
2812	Halides and halide oxides of non-metals	Includes most chlorinating agents and key phosphorus-containing compounds used for nerve agent synthesis
2813	Sulfides of non-metals	Includes key sulfur-containing compounds used for CWA synthesis
282619	Other fluorides	Includes fluorinating agents that can be used in the production of CWAs
2830	Sulfides; polysulfides	Includes key sulfur-containing compounds used for CWA synthesis
283311	Disodium sulfate	Can readily be converted to sodium sulfide, a vesicant precursor for CWAs
2904	Sulfonated, nitrated or nitrosated derivatives of hydrocarbons	Includes chloropicrin and its key precursor chemicals
2905	Acyclic alcohols and their halogenated, sulfonated, nitrated or nitrosated derivatives	Includes chlorohydrin, a precursor for HD
2920	Esters of other inorganic acids of non-metals and their salts	Includes key precursors for A-series, V-series and G-series nerve agents
2921	Amine-function compounds	Includes the amine side chains required for V-series nerve agent synthesis
2922	Oxygen-function amino-compounds	Includes key precursors for nitrogen mustard synthesis
2930	Organo-sulfur compounds	Includes key sulfur-containing compounds used for synthesis of nerve agents and vesicants
2931	Other organo-inorganic compounds	Includes key precursors for G-series and V-series nerve agent synthesis
2933	Heterocyclic compounds with nitrogen hetero-atom(s) only	Includes precursors to fentanyl-type compounds

HS Code	WCO Description	Relevance to CWAs
8419	Machinery, plant, or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing, or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric	Includes most specialised equipment that would be of use to the production of CWAs, including reactors, and distillation and drying apparatus

Sources: World Customs Organization (WCO), 'HS Nomenclature 2022 Edition', <https://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2022-edition/hs-nomenclature-2022-edition.aspx>, accessed 7 February 2025, OPCW, 'Annex on Chemicals', <https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/annex-chemicals>, accessed 22 August 2025; author industry experience, such as ToxSyn, Wisconsin Project on Nuclear Arms Control.

North Korea does not publish its own import data, so this report relies on the published data from other countries on their own exports into North Korea, creating what is called 'mirrored import data'. The project uses UN Comtrade mirrored import data for North Korea, and, when possible, also compares the UN Comtrade data with national statistical agencies' data. Because these agencies vary in their timelines for available data, the trade data analysed in this report is scoped to between January 2015 and December 2024 for consistency. Where discrepancies exist in data between UN Comtrade and national statistical agencies, the latter is used for further analysis.

In some cases, the report also analyses mirrored shipment-level trade data because it offers a more granular level of detail. Details such as consigner, consignee and product descriptions can be used to map trade networks and distinguish characteristics of shipments that might identify them as included under the AG CW-related Common Control List[19] and lists of goods pursuant to the UN Security Council Resolution (UNSCR) 1718 (2006) ban on trade with North Korea that might support the regime in 'conducting nuclear tests or launching ballistic missiles'.[20]

The mirrored shipment-level trade data was bought from a third-party commercial supplier that obtains this data directly from national governments which reported exports to North Korea.[21] The data was exported and processed to remove shipments destined for the Republic of Korea. The criteria for this determination were either the recorded port of unloading being in the Republic of Korea, or the consignee having a non-North Korean name or address and online presences confirming it was a legitimate non-North Korean company. To glean as much information as possible about North Korea's chemical industry procurements beyond China, all these confirmed legitimate exports into North Korea are analysed in full in this report, irrespective of whether they meet the HS codes in Table 1.

19. The AG list is more comprehensive that the CWC Annex on Chemicals and includes more chemicals and equipment.
20. UNSC, 'S/RES/1718 (2006)', 14 October 2006, <http://unscr.com/en/resolutions/doc/1718>, accessed 13 July 2025.
21. Trade data provided by a third-party commercial supplier.

Analysis of Mirrored Import Data

From January 2015 to December 2024, North Korea imported at least 15,861 tonnes of inorganic chemicals, 651,959 tonnes of organic chemicals, and 2,124 tonnes of machinery, plant and laboratory equipment and related parts that could be used to produce CWAs.[22]

The following subsections divide the analysed trade data by HS code, and then by country of export, to show the specific goods imported by North Korea. Because the shipment-level export data also includes names of consignees and consignors, some subsections also include relevant summaries of these companies.

Chapter 28: Inorganic Chemicals

According to UN Comtrade, from January 2015 to December 2024, North Korea imported at least 15,861 tonnes of inorganic chemicals that are of particular relevance for potential CWA production.[23] Table 2 breaks down this total at the HS4 level.

Table 2: North Korea's Total Chapter 28 Imports (2015–24)

HS4 Code	WCO HS4 Code Description	Total Quantity Imported (kg)
2802	Sulfur, sublimed or precipitated; colloidal sulfur	4,495,024
2811	Other inorganic acids and other inorganic oxygen compounds of non-metals	3,360,163
2812	Halides and halide oxides of non-metals	168,000
2826	Fluorides; fluorosilicates, fluoroaluminates and other complex fluorine salts	40,331
2830	Sulfides; polysulfides, whether or not chemically defined	50,391
2833	Sulfates; alums; peroxosulfates (persulfates)	7,747,641

Sources: WCO, 'HS Nomenclature 2022 Edition'; UN Comtrade Database, <https://comtradeplus.un.org/>, accessed 8 May 2025.

By aggregating UN Comtrade data with nationally-reported trade data, this report identifies six countries as exporting these chemicals into North Korea across different periods of 2015–24: China, India, Russia, Bosnia and Herzegovina, Germany and Brazil. The following subsections further examine the relevant exports of each country by order of export quantities.

According to shipment-level trade data, Russia exported goods under another three HS6 codes identified by Project Anthracite as not of particular relevance for CWA production. However, they are still included in the below analysis because their shipment-level details offer insights into North Korea's wider chemical procurement patterns.

Imports from China

Between January 2015 and December 2024, UN Comtrade reports that China exported at least 15,641 tonnes of inorganic chemicals of particular relevance for CWA production

22. UN Comtrade Database, <https://comtradeplus.un.org/>, accessed 8 May 2025.
23. *Ibid.*

into North Korea.[24] However, the General Administration of Customs of the People's Republic of China reports exporting at least 16,792 tonnes of those chemicals into North Korea within that same timeframe that fall under eight HS codes:[25]

Table 3: North Korea's Chapter 28 Imports of Interest from China (2015–24)

Chinese HS8 Code	Chinese HS8 Code Description	Total Quantity (kg)
28020000	Sulfur, sublimed or precipitated; colloidal sulfur	5,086,030
28111990	Other inorganic acids, nes	60,000
28112210	Silica gel	2,503,858
28112290	Other silicon dioxide	796, 856
28112900	Other inorganic oxygen compounds of non-metals, nes	97,480
28261920	Fluorides of sodium	2,500
28309090	Other sulfides & polysulfides, nes	42,200
28331100	Disodium sulfate	8,203,280

Sources: WCO , 'HS Nomenclature 2022 Edition'; General Administration of Customs of the People's Republic of China, 'Customs Statistics', <http://stats.customs.gov.cn/indexEn>, accessed 7 May 2025.

From these shipments, two chemicals are of particular interest: sodium fluoride and disodium sulfate.

Sodium fluoride appears on the AG's general Export Control List of Chemical Weapons Precursors and can be used in the production of some G-series agents, such as soman and sarin.[26] The description in the Chinese export data for the Chinese HS8 code 28261920 suggests that North Korea imported 2.5 tonnes of disodium sulfate from April 2015 to June 2024.[27]

Although disodium sulfate is not directly a CW precursor, it can readily be converted to sodium sulfide,[28] which does appear on the AG Export Control List as a vesicant precursor.[29] The Chinese export data for the Chinese HS8 code 28331100 suggests that North Korea imported 8,203 tonnes of disodium sulfate from December 2015 to November 2016.[30]

The OPCW's 'Handbook on Chemicals', which covers chemicals relevant to CW production in the CWC Annex on Chemicals, lists over 750 chemicals under the HS6 code for the 'other sulfides & polysulfides' in Table 3,[31] but the Chinese trade data description for the corresponding HS8 code does not clarify which sulfides or polysulfides were in these shipments.[32]

24. *Ibid*.
25. General Administration of Customs of the People's Republic of China, 'Customs Statistics', <http://stats.customs.gov.cn/indexEn>, accessed 7 May 2025.
26. AG, 'Export Control List: Chemical Weapons Precursors'; R M Black and J M Harrison, 'The Chemistry of Organophosphorus Chemical Warfare Agents', in Frank R Hartley (ed.), *The Chemistry of Organophosphorus Compounds: Ter- and Quinque-Valent Phosphorus Acids and Their Derivatives* (Hoboken, NJ: John Wiley and Sons, 1996), pp. 781–840.
27. General Administration of Customs of the People's Republic of China, 'Customs Statistics'.
28. Chemical Iran, 'Sodium Sulfide Manufacturing Methods and Applications', 8 September 2023, <https://www.chemicaliran.com/sodium-sulfide-manufacturing-methods-and-applications/>, accessed 20 June 2025.
29. AG, 'Export Control List'.
30. General Administration of Customs of the People's Republic of China, 'Customs Statistics'.
31. OPCW, 'Handbook on Chemicals', <https://www.opcw.org/resources/declarations/handbook-chemicals, accessed 22 August 2025.
32. *Ibid*.

Imports from India

UN Comtrade reports that from 2015 to 2017 India exported at least 206.1 tonnes of inorganic chemicals into North Korea that fall under three HS codes of particular relevance for CWA production.

Table 4: North Korea's Chapter 28 Imports of Interest from India (2015–17)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
281119	Inorganic acids; other than hydrogen fluoride	100
282619	Fluorides; other than of aluminium	38,000
281213	Phosphorus trichloride	168,000

Source: UN Comtrade Database.

Although India's Ministry of Commerce and Industry technically reports its own export data through its Department of Commerce,[33] the reported data lacks HS codes and weight values, making it difficult to discern any discrepancies between national statistical reporting and the UN Comtrade data.

Phosphorus trichloride is scheduled by the CWC, meaning that, along with additional supplementary information, North Korea would need to have provided India with an assurance that the chemical was not going to be used for CWC-prohibited purposes or re-exported. Additionally, phosphorus trichloride exports to North Korea were also banned in 2006 by the UNSC 1718 Committee,[34] making the export of these 168 tonnes of the chemical particularly interesting. Although phosphorous trichloride is also on the AG Common Control List, India joined the AG in 2018, so AG restrictions would not have applied to the above shipments.

The same UNSC 1718 Committee document that applies sanctions to phosphorus trichloride exports to North Korea also includes several fluorides – potassium bifluoride, sodium fluoride, potassium fluoride, ammonium bifluoride and sodium bifluoride – which are covered by the HS6 code 282619, but the trade data description does not clarify which specific fluorides were exported.[35]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[36]

Imports from Russia

Although UN Comtrade does not report any exports of chapter 28 items from Russia into North Korea between 2015 and 2024, four chapter 28 items appear in shipment-level trade data provided by a third-party commercial supplier (under five HS codes) across 11 mirrored North Korean imports from Russia between January 2015 and December 2024.[37]

33. Ministry of Commerce and Industry's Department of Commerce of the Government of India, 'System on Monthly Foreign Trade Statistics of India', <https://tradestat.commerce.gov.in/ftspcc/export_commodity_xcountry_wise_annual>, accessed 20 May 2025.
34. UNSC, 'S/RES/1718 (2006)'.
35. OPCW, 'Handbook on Chemicals'.
36. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea Pursuant to Security Council Resolution 1718 (2006)', <https://main.un.org/securitycouncil/en/sanctions/1718/prohibited-items>, accessed 4 February 2024; AG, 'Australia Group Common Control List Handbook: Volume 1'.
37. *Ibid*.

Table 5: North Korea's Chapter 28 Imports from Russia (2015–24)

HS6 Code	Shipment Description in Trade Data	Shipments	Total Quantity (kg)
280700	Electrolyte for acid batteries	1	N/A
281122	Silica gel	3	N/A
283620	Baking soda, bicarbonate	2	1,008[38]
283630	Sodium hydrocarbonate (sodium bicarbonate)	3	1,500[39]
285300	Compressed air cylinders	2	N/A

Sources: WCO, 'HS Nomenclature 2022 Edition'; trade data provided by a third-party commercial supplier.

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[40] Almost all these shipments were delivered to the city of Rason, North Korea.[41]

The shipments designated with HS codes 283620 (sodium carbonate) and 283630 (sodium hydrogen carbonate) both describe their shipments as 'baking soda'.[42] Because the shipments using the former code were sent by the same consignor, and the product descriptions name the shipment as 'Baking soda, bicarbonate (chemical name: sodium hydrocarbonate)',[43] this conflation is probably a data reporting error. Table 6 outlines the differences between the two compounds.

Table 6: Comparison of Sodium Carbonate and Sodium Bicarbonate

HS Code	Chemical Formula	Chemical Name	CAS Registry Number	Common Names	Common Uses
283620	Na_2CO_3	Sodium Carbonate	497-19-8	• Soda ash • Washing soda • Disodium carbonate • Baked baking soda	• Glass manufacturing • Cleaning detergents • Batteries • Metallurgy • Food and pharmaceuticals • Acid neutralisation

38. This quantity is only for one shipment; the quantity for the other shipment is not included in the trade data provided by a third-party commercial provider.
39. *Ibid*.
40. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
41. Trade data provided by a third-party commercial supplier.
42. *Ibid*.
43. *Ibid*.

HS Code	Chemical Formula	Chemical Name	CAS Registry Number	Common Names	Common Uses
283630	$NaHCO_3$	Sodium Hydrogen Carbonate	144-55-8	• Baking soda • Baking powder • Sodium bicarbonate • Sodium hydrocarbonate • Bicarb	• Food preparation • Cleaning detergents and odour treatment • Animal feed additive • Textile dyeing • Rubber and plastics manufacture • Fire extinguishers • Haemodialysis • Acid neutralisation

Sources: Bell Chem, 'The Many Uses of Sodium Bicarbonate', 21 September 2018, <https://www.bellchem.com/news/the-many-uses-of-sodium-bicarbonate>, accessed 20 August 2025; AGC Chemicals, 'Sodium Bicarbonate', <https://www.agc-chemicals.com/jp/en/products/detail/index.html?pCode=JP-EN-C010>, accessed 20 August 2025; Beroil Energy, 'Exploring Lesser-Known Uses of Sodium Bicarbonate', 25 January 2024, <https://beroilenergy.com/exploring-lesser-known-uses-of-sodium-bicarbonate/>, accessed 20 August 2025; Essential Chemical Industry, 'Sodium Carbonate', last amended 27 November 2018, <https://www.essentialchemicalindustry.org/chemicals/sodium-carbonate.html>, accessed 20 August 2025; Eti Soda, 'Soda Ash', <https://www.etisoda.com/en/soda-ash-used/>, accessed 20 August 2025.

These shipments might indicate that North Korea had a limited capacity or temporary inability to produce sodium hydrogen carbonate (hereinafter referred to as bicarbonate), at least between 2015 and 2018.

For at least the last century, sodium carbonate has been produced through the (Solvay) ammonia–soda process, replacing the inefficient Leblanc process that produced a large amount of waste.[44] The Solvay process uses coal/coke, brine, limestone and ammonia to produce sodium bicarbonate as the penultimate step in the production of sodium carbonate.[45] Given the abundance of coal, limestone and brine in North Korea,[46] along with facilities that produce ammonia, imports of any amount of sodium bicarbonate are surprising. The reasons for these imports, then, could include:

- The quality of sodium bicarbonate produced in North Korea is too low quality for certain purposes (for example, use in food), requiring the import of higher-quality sodium bicarbonate.
- Production plants were non-operational at the time of these imports. This would also mean there is no production of sodium carbonate. Given the need for glass in North Korea (for example, for construction), it is unlikely that sodium carbonate would not be available in the country.

44. David M Kiefer, 'Soda Ash, Solvay Style', *Today's Chemist at Work* (February 2002).
45. Hamed Rahimpour, Ahmad Fahmi and Sahar Zinatloo-Ajabshir, 'Toward Sustainable Soda Ash Production: A Critical Review on Eco-Impacts, Modifications, and Innovative Approaches', *Results in Engineering* (Vol. 23, September 2024).
46. Peter Makowsky et al., 'North Korea's Cement Industry: More Than Meets the Eye', *38 North*, 14 May 2021, <https://www.38north.org/2021/05/north-koreas-cement-industry-more-than-meets-the-eye/>, accessed 4 February 2025.

- North Korea uses a different process from the Solvay process to produce sodium carbonate, such as a potentially new process at Namhung Youth Chemical Complex, which uses glauberite to produce carbonate.[47]

Although carbonate and bicarbonate have no direct utility in CWA synthesis and preparation, they can be used more broadly in chemical synthesis as bases and buffers.[48]

Shipment-level trade data also includes information about shipment consignees and consignors. An analysis of the companies exporting and importing the above shipments from Russia is included below.

Consignees

Three consignees appear for these shipments:[49]

1. JV RasonConTrans (all electrolyte for acid batteries, compressed air cylinder and silica gel shipments).
2. Sonbong Soya Milk Processing Factory (one sodium bicarbonate shipment in 2017).
3. White Stone JVC (two sodium bicarbonate shipments in 2015 and two in 2018 on behalf of Olive Three International, OTI).

Little information about Sonbong Soya Milk Processing Factory appears in open source information searches.

JV RasonConTrans, founded in 2008, is a joint Russia–North Korea venture based in Rason and owned by the sanctioned and Federal Security Service-licensed Russian Railways JSC.[50] JV RasonConTrans has an exemption from UNSC sanctions and was created by Moscow in a bid to set up a port-and-rail transhipment hub with Pyongyang.[51] All JV RasonConTrans exports also list JV RasonConTrans as the consignee.[52]

In the shipments that list White Stone JVC as the consignee, the declarant is listed as the Russian company White Stone LLC (INN: 2511090738),[53] the owners and managers of which appear to be Korean names transliterated into Cyrillic.[54] Additionally, the exporter contact details in these shipments include email addresses using the domain 'v-lazer.com'.[55] V Lazer appears to be a group of manufacturing and trade companies, one of which is TLC VL Logistic LLC – one of the consignors listed below.[56]

47. Naenara, 'Large Chemical Industry Base Increases Production', *KCNA Watch*, 13 October 2024, <https://kcnawatch.org/newstream/1728795840-315087960/large-chemical-industry-base-increases-production/>, accessed 4 February 2025; Jong Hwa Sun, 'Big Efforts Put into Chemical Industry Building', *Pyongyang Times*, 23 May 2020, <https://archive.org/details/pyongyang_times_2020.05.23/mode/1up?q=glauberite>, accessed 4 February 2025.
48. Michal Fedorynski et al., 'Reactions of Organic Anions. 86. Sodium and Potassium Carbonates: Efficient Strong Bases in Solid-Liquid Two-Phase Systems', *Journal of Organic Chemistry* (Vol. 43, No. 24, November 1978), pp. 4682–84.
49. Trade data provided by a third-party commercial supplier.
50. Colin Zwirko, 'Russian Firm Restarts Coal Project in North Korea After Over 4-Year Suspension', *NK News*, 16 April 2024, <https://www.nknews.org/pro/russian-firm-restarts-coal-project-in-north-korea-after-over-4-year-suspension/>, accessed 16 January 2025; *Intelligence Online*, 'Isolated Moscow Revives Industrial and Academic Relations with Pyongyang', 19 July 2022, <https://www.intelligenceonline.com/international-dealmaking/2022/07/19/isolated-moscow-revives-industrial-and-academic-relations-with-pyongyang,109800378-art>, accessed 10 February 2025.
51. *Ibid*.
52. Trade data provided by a third-party commercial supplier.
53. *Ibid*.
54. Sayari, <https://sayari.com/>, accessed 13 July 2025.
55. Trade data provided by a third-party commercial supplier.
56. V Lazer website, archived via the Wayback Machine 22 January 2025, <https://web.archive.org/web/20250122193931/http://v-lazer.com/>, accessed 22 January 2025.

Additionally, two of White Stone's imports are on behalf of the allegedly Seoul-based[57] Russian company OTI, which was registered on 15 May 2014, although no record of OTI exists in the Korean corporate registry,[58] and there is no evidence of OTI at its registered address.[59]

Consignors

Three consignors made these shipments:[60]

1. JV RasonConTrans (all electrolyte for acid batteries and compressed air cylinder shipments).
2. RentFormGroup LLC (two sodium bicarbonate shipments in 2015).
3. TLC VL Logistic LLC (all silica gel shipments on behalf of NordStokServis LLC, and three sodium bicarbonate shipments across 2017 and 2018 on behalf of Element Trade LLC).

In addition to the aforementioned JV RasonConTrans, three new Russian companies were consignors of these shipments. Curiously, RentFormGroup LLC's website claims the company exclusively produces and sells timber products,[61] which does not explain its bicarbonate shipments in 2015.

TLC VL Logistic LLC exported its shipments on behalf of two other Russian companies: NordStokServis LLC and Element Trade LLC/Rukotorg LLC. Little open source information exists about NordStokServis; it was founded in 2001 in Moscow and claims its official industry as non-specialised wholesale trade.[62] Curiously, although the trade data lists TLC VL Logistic's sodium bicarbonate exports as being on behalf of 'Element Trade LLC', the shipments list their declarant and contractor as Rukotorg, a Vladivostok-based company that specialises in wholesale trade of food, beverages and tobacco.[63]

While none of these entities appear to have violated sanctions or trade controls with these exports to North Korea, the above information might show the kinds of routes North Korea uses to import goods and materials.

Imports from Bosnia and Herzegovina

UN Comtrade reports that from 2019 to 2022 Bosnia and Herzegovina exported at least 13.6 tonnes of inorganic chemicals that fall under two HS codes. Eurostat, the official EU's statistical reporting body, confirms these amounts:[64]

57. OTI's Seoul address is Republic of Korea, Seoul, kannam-gu, apgujong-ro 79-gil, 29, 402 (jongdam-dong); Sayari.
58. DART (Repository of Korea's Corporate Filings), <https://englishdart.fss.or.kr>, accessed 31 January 2025.
59. Sayari.
60. Trade data provided by a third-party commercial supplier.
61. RentFormGroup, archived via the Wayback Machine 3 February 2025, <https://web.archive.org/web/20250203173549/https://sibforest.1c-umi.ru/>, accessed 12 February 2025.
62. Sayari.
63. *Ibid*.
64. UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6', last updated 18 August 2025, <https://ec.europa.eu/eurostat/databrowser/view/ds-059341__custom_17210134/default/table?lang=en>, accessed 9 September 2025.

Table 7: North Korea's Chapter 28 Imports of Interest from Bosnia and Herzegovina (2019–22)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
281122	Silicon dioxide	3,600
283090	Sulfides and polysulfides; whether or not chemically defined, other than sulfides of sodium	10,000

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6', last updated 18 August 2025, <https://ec.europa.eu/eurostat/databrowser/view/ds-059341__custom_17210134/default/table?lang=en>, accessed 9 September 2025.
Note: None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[65]

Imports from Germany

UN Comtrade and Eurostat report that from 2015 to 2018 Germany exported at least 30 kg of inorganic chemicals under the HS6 code 281122, which covers 'Silicon dioxide'.[66]

Silicon dioxide is not prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[67]

Imports from Brazil

UN Comtrade reports that in 2017 Brazil exported at least 4.6 kg of inorganic chemicals under the HS8 code 28261990, which covers 'Other fluoride'.[68] It is worth noting that, while UN Comtrade reports that Brazil exported this amount, the national statistical reporting system Comex Stat does not report any amount of exports to North Korea under this HS code.[69]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[70]

Chapter 29: Organic Chemicals

According to UN Comtrade, from January 2015 to December 2024 North Korea imported at least 651,959 tonnes of organic chemicals that are of particular relevance for potential CWA production. Table 8 breaks down this total at the HS4 level.

Table 8: North Korea's Total Chapter 29 Imports (2015–24)

HS4 Code	WCO HS4 Code Description	Total Quantity Imported (kg)
2904	Sulfonated, nitrated or nitrosated derivatives of hydrocarbons, whether or not halogenated	138,914
2905	Acyclic alcohols and their halogenated, sulfonated, nitrated or nitrosated derivatives	517,373,740

65. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
66. UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.
67. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
68. UN Comtrade Database.
69. Ministry of Development, Industry, Trade and Services, Government of Brazil, 'Comex Stat', <https://comexstat.mdic.gov.br/en/home>, accessed 14 July 2025.
70. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.

HS4 Code	WCO HS4 Code Description	Total Quantity Imported (kg)
2920	Esters of other inorganic acids of non-metals (excluding esters of hydrogen halides) and their salts; their halogenated, sulfonated, nitrated or nitrosated derivatives	3,771,254
2921	Amine-function compounds	311,070
2922	Oxygen-function amino-compounds	125,748,792
2930	Organo-sulfur compounds	3,344,480
2931	Other organo-inorganic compounds	39,024
2933	Heterocyclic compounds with nitrogen hetero-atom(s) only	1,231,891

Sources: WCO, 'HS Nomenclature 2022 Edition'; UN Comtrade Database.

By aggregating UN Comtrade data with nationally-reported trade data, this report identifies 14 countries as exporting these chemicals into North Korea across different periods of 2015–24: Trinidad and Tobago, China, Saudi Arabia, India, Malaysia, Russia, Germany, Thailand, Singapore, Brazil, the UK, Austria, the Netherlands, and Turkey. The following subsections further examine the relevant exports of each country by order of export quantities.

According to shipment-level trade data, Russia and India exported additional chapter 29 goods under another two HS6 codes, and although they do not match the HS codes identified by Project Anthracite as being of particular relevance for CWA production, they are included in the below analysis because their shipment-level detail offers insights into North Korea's wider chemical procurement patterns.

Imports from Trinidad and Tobago

UN Comtrade reports that from 2015 to 2024 Trinidad and Tobago exported at least 493,293 tonnes of organic chemicals into North Korea under the HS code 290511, which covers 'Alcohols; saturated monohydric, methanol (methyl alcohol)'.[71] Although Trinidad and Tobago's Ministry of Planning and Development technically reports its own export data through its Central Statistical Office,[72] the unwieldy nature of the reporting website makes it difficult to discern any discrepancies between national statistical reporting and the UN Comtrade data.

Methyl alcohol is not prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[73]

Imports from China

UN Comtrade reports that from 2015 to 2024 China exported at least 153,526 tonnes of organic chemicals of particular relevance for CWA production into North Korea.[74] However, the General Administration of Customs of the People's Republic of China reports exporting at least 155,359 tonnes of those chemicals into North Korea within that same timeframe across 77 HS codes:[75]

71. UN Comtrade Database.
72. Ministry of Planning and Development Central Statistical Office, Government of Trinidad and Tobago, <http://csottwebtext.gov.tt/>, accessed 20 May 2025.
73. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
74. UN Comtrade Database.
75. General Administration of Customs of the People's Republic of China, 'Customs Statistics'.

Table 9: North Korea's Chapter 29 Imports of Interest from China (2015–24)

Chinese HS8 Code	Chinese HS8 Code Description	Total Quantity (kg)
29041000	CH derivatives with only sulfo groups, their salts/ethyl esters	6,895
29042090	Hydrocarbon derivatives with only nitro/nitroso groups, nes	2,000
29049011	o-Nitrochlorobenzene	17,500
29051100	Methanol (methyl alcohol)	6,291,813
29051220	Propan-2-ol (isopropyl alcohol)	235,900
29051300	Butan-1-ol (n-butyl alcohol)	3,005,332
29051410	Isobutyl alcohol	4,980
29051420	Secbutyl alcohol	68,460
29051430	Tertiary butanol	155
29051690	Octanol and isomers thereof, excl. n-octanol	18,030
29051700	Dodecan-1-ol, hexadecan-1-ol & octadecan-1-ol	100,550
29051990	Saturated monohydric alcohols, nes	74,935
29052230	Linalool	400
29052900	Unsaturated monohydric alcohols, nes	105
29053100	Ethylene glycol (ethanediol)	1,067,346
29053200	Propylene glycol (propane-1,2-diol)	330,235
29054200	Pentaerythritol	12,900
29054300	Mannitol	14,450
29054400	D-glucitol (sorbitol)	2,410,764
29054500	Glycerol	5,685,098
29054910	Xylitol	25,325
29054990	Other polyhydric alcohols	3,100
29055900	Hal./sul./nit./nits. derivs of acyclic alcohols, nes	1,200
29201900	Thiophosphoric esters, their salts and derivatives,nes	4,069,080
29209090	Esters of other inorganic acids, salts and derivatives, nes	19,230
29211100	Methylamine, di- or trimethylamine and their salts	8,515
29211990	Acylic monoamines and their derivatives, nes; salts thereof	126,180
29212110	Ethylenediamine	330
29212190	Ethylenediamine salts	8,000
29212290	Hexamethylenediamine and its salts, nes	300
29212900	Acyclic polyamines & their derivatives, nes; salts thereof	17,010
29213000	Cyclanic, cyclenic /cycloterpenic mono- or polyamines; derivs; salts thereof	5,560
29214110	Aniline	41,000
29214200	Aniline derivatives & their salts	2,325

Chinese HS8 Code	Chinese HS8 Code Description	Total Quantity (kg)
29214400	Diphenylamine & its derivatives; salts thereof	3,900
29214920	Dimethylaniline	300
29214990	Aromatic monoamines & their derivatives, nes; salts thereof	1,382
29215190	m-, p-Phenylenediamine, diaminotoluenes; thr derivs; salts thereof	70
29215900	Aromatic polyamines & their derivatives, nes; salts thereof	2,193
29221100	Monoethanolamine and its salts	23,825
29221200	Diethanolamine & its salts	11,300
29221910	Ethylamino butanol (Ethambutol)	2,125
29221921	N, N-Dimethylaminoethanol & protonated salts	1,440
29221940	Salts of methyldiethanolamine	650
29221990	Amino-alcohols, their ethers & esters; salts, nes	9,145
29222990	Aminona- & amino-phenols, with one oxygen function; ether/ester/salt, nes	29,850
29223990	Other amino-aldehydes, ketones quinones, 1 oxygen function; salts thereof	250
29224110	Lysine	94,200
29224190	Lysine esters & salts	1,130,971
29224210	Glutamic acid	752,056
29224220	Sodium glutamate	125,131,778
29224911	Tranexamic acid	55
29224919	Amino-acids, nes	3,031
29224991	Procaine	100
29224999	Amino-acids esters, 1 oxygen function; salts thereof, nes	62,375
29225090	Amino-alcohol/acid-phenols; amino-compounds with oxygen functn, nes	19,205
29302000	Thiocarbamates and dithiocarbamates	2,730
29303000	Thiuram mono-, di- or tetrasulfides	78,865
29304000	Methionine	1,090,886
29309020	Dithiocarbonates (xanthates)	1,830,415
29309090	Other organo-sulfur compounds, nes	517,126
29319000	Organo-inorganic compounds, nes	2
29319090	Organo-inorganic compounds, nes	10,315
29331100	Phenazone (antipyrin) and its derivatives	20
29331920	Analgin	4,675
29331990	Compounds containing an unfused pyrazole ring in the structure, nes	10,965
29332100	Hydantoin and its derivatives	175

Chinese HS8 Code	Chinese HS8 Code Description	Total Quantity (kg)
29332900	Compounds containing an unfused imidazole ring in the structure, nes	29,264
29333990	Compounds with an unfused pyridine ring in the structure, nes	66,875
29334900	Other compounds containing a quinoline or isoquinoline ring-system (whether or not hydrogenated), not further fused	2,848
29335300	Allobarbital, amobarbital, barbital, butobarbital (INN); salts thereof	25
29335920	Ciprofloxacin	25,620
29335990	Compounds with a pyrimidine or piperazine ring, nes	195,569
29336100	Melamine	3,875
29336922	Trichloroisocyanurate acid	1,000
29336929	Other dichloroisocyanurate	186,216
29336990	Compounds with unfused triazine ring in the structure, nes	330,700
29337900	Lactams (excl. epsilon-caprolactam)	5,771
29339900	Heterocyclic compounds with nitrogen hetero-atom(s) only, nes	10,624

Sources: General Administration of Customs of the People's Republic of China, 'Customs Statistics'.

Of these shipments, no chemicals are relevant enough to CWA development to warrant mention. However, several of the 'other' HS code categories could potentially include CWA-relevant chemicals.

For example, the OPCW's Handbook on Chemicals lists hundreds of chemicals that appear under the 292219, 293090, 293190 and 293339 codes and HS6 codes in Table 9 that act as 'catch all' categories for 'other' groups of chemicals. (The list of HS6 codes acts as an umbrella for several HS8 codes in the table that share the first six digits in their HS code.)[76] However, the Chinese trade data description for the corresponding HS8 codes do not name specific chemicals, inhibiting further analysis into whether any of these North Korean imports could be relevant to CW production.[77]

Imports from Saudi Arabia

UN Comtrade reports that from 2015 to 2018 Saudi Arabia exported at least 3,957 tonnes of organic chemicals into North Korea under three HS codes.

Table 10: North Korea's Chapter 29 Imports of Interest from Saudi Arabia (2015–18)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
290519	Alcohols; saturated monohydric, n.e.c. in item no. 2905.1	3,918,000
292129	Amine-function compounds; acyclic polyamines and their derivatives, and salts thereof, n.e.c. in item no. 2921.2	39,500

76. OPCW, 'Handbook on Chemicals'.
77. General Administration of Customs of the People's Republic of China, 'Customs Statistics'.

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
292213	Amino-alcohols, other than those containing more than one kind of oxygen function; their ethers and esters; salts thereof, triethanolamine and its salts	0

Source: UN Comtrade Database.

The UN Comtrade data lists the triethanolamine shipment as occurring in 2018 but still lists 0 kg as the total weight of the amount of chemical exported.

Saudi Arabia's Open Data Platform, which provides annual export data reports from the government's Tax and Customs Authority, does not provide export data for 2017 and does not list any shipments of goods to North Korea under the HS codes in Table 10 in 2015, 2016 or 2018.[78]

One of the several chemicals covered under HS6 code 290519 is pinacolyl alcohol (also known as 3,3-Dimethylbutan-2-ol), a key precursor for the nerve agent soman.[79] It is a CWC Schedule 2 chemical and included on a control list pursuant to UNSCR 1718 (2006) and on the AG Common Control List.[80] However, the trade data lacks enough information to discern whether the goods exported under the HS6 code 290519 is pinacolyl alcohol or in violation of export controls.

Imports from India

UN Comtrade reports that from 2015 to 2024 India exported at least 835 tonnes of organic chemicals into North Korea under 32 HS codes.

Table 11: North Korea's Chapter 29 Imports of Interest from India (2015–2024)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
290410	Derivatives of hydrocarbons; containing only sulfo groups, their salts and ethyl esters, whether or not halogenated	25,013
290420	Derivatives of hydrocarbons; containing only nitro or only nitroso groups, whether or not halogenated	10,000
290490	Derivatives of hydrocarbons; n.e.c. in heading no. 2904, whether or not halogenated	10,000
290499	Derivatives of hydrocarbons n.e.c. in heading no. 2904, whether or not halogenated	10,000
290514	Alcohols; saturated monohydric, butanols excluding item no. 2905.13	3,200
290539	Alcohols; acyclic, diols, other than ethylene glycol (ethandiol) or propylene glycol (propane-1,2-diol)	21,025
290542	Alcohols; polyhydric, pentaerythritol	40,000
290544	Alcohols; polyhydric, d-glucitol (sorbitol)	22,000
292029	Esters; phosphite esters and their salts; their halogenated, sulfonated, nitrated or nitrosated derivatives, n.e.c. in heading no. 2920	21,000

78. Open Data Platform, 'Exports Data', <https://open.data.gov.sa/en/datasets/view/85cf9e71-2f2f-49ca-af8d-127b339707d7>, accessed 22 June 2025.
79. Brian J Lukey and Harry Salem, *Chemical Warfare Agents: Chemistry, Pharmacology, Toxicology, and Therapeutics* (Boca Raton, FL: CRC Press, 2007). pp. 10–13.
80. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'; OPCW, 'Annex on Chemicals: Schedule 2', <https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/schedule-2>, accessed 29 July 2025.

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
292090	Esters; other than thiophosphoric esters (phosphorothioates) and phosphite esters and their salts, their halogenated, sulfonated, nitrated or nitrosated derivatives, n.e.c. in heading no. 2920	57,949
292111	Amine-function compounds; acyclic monoamines and their derivatives, methylamine, di- or trimethylamine and their salts	14,160
292119	Amine-function compounds; acyclic monoamines and their derivatives, and salts thereof, n.e.c. in item no. 2921.1	4,250
292121	Amine-function compounds; acyclic polyamines and their derivatives, ethylenediamine and its salts	8,800
292145	Amine-function compounds; aromatic monoamines and their derivatives; 1-naphthylamine (alpha-naphthylamine), 2-naphthylamine (beta-naphthaylamine) and their derivatives; salts thereof	20,579
292159	Amine-function compounds; aromatic polyamines and their derivatives, other than item no. 2921.51	13,210
292221	Amino-naphthols and other amino-phenols, other than those containing more than one kind of oxygen function; their ethers and esters; salts thereof, aminohydroxynaphthalenesulfonic acids and their salts	3,522
292239	Amino-aldehydes, amino-ketones and amino-quinones; other than those containing more than one kind of oxygen function; salts thereof, excluding amfepramone (INN), methadone (INN), and normethadone (INN) and salts thereof	24,877
292243	Amino-acids, other than those containing more than one kind of oxygen function, and their esters; anthranilic acid and its esters; salts thereof	17,523
292249	Amino-acids, other than those containing more than one kind of oxygen function, their esters; salts thereof, excluding lysine, glutamic acid, anthranalic acid and tilidine, their esters and salts thereof	6,063.045
292250	Amino-alcohol-phenols, amino-acid-phenols and other amino-compounds with oxygen function	4,826.964
293020	Organo-sulfur compounds; thiocarbamates and dithiocarbamates	10
293090	Organo-sulfur compounds; n.e.c. in heading no. 2930	1,000
293190	Organo-inorganic compounds; other than tetramethyl lead, tetraethyl lead, tributyltin compounds, and other organo-phosphorus derivatives	16,110
293319	Heterocyclic compounds; with nitrogen hetero-atom(s) only, containing an unfused pyrazole ring (whether or not hydrogenated) in the structure, other than henazone (antipyrin) and its derivatives	2,086

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
293329	Heterocyclic compounds; with nitrogen hetero-atom(s) only, containing an unfused imidazole ring (whether or not hydrogenated) in the structure, other than hydantoin and its derivatives	526
293332	Heterocyclic compounds; containing an unfused pyridine ring (whether or not hydrogenated) in the structure, piperidine and its salts	15,680
293339	Heterocyclic compounds; containing an unfused pyridine ring (whether or not hydrogenated) in the structure, n.e.c. in 2933.3	422,537
293349	Heterocyclic compounds; containing a quinoline or isoquinoline ring-system (whether or not hydrogenated) in the structure, not further fused, other than levorphanol (INN) and its salts	2,015
293354	Heterocyclic compounds; containing a pyrimidine ring (whether or not hydrogenated) or piperazine ring in the structure, other derivatives of malonylurea (barbituric acid) and salts thereof, n.e.c. in 2933.53	319
293359	Heterocyclic compounds; containing a pyrimidine ring (whether or not hydrogenated) or piperazine ring in the structure, (other than malonylurea and its derivatives, loprazolam, mecloqualone, methaqualone, zipeprol, and salts thereof) n.e.c. in 2933.5	498
293379	Heterocyclic compounds; lactams; other than 6-hexanelactam (epsilon caprolactam) and clobazam (INN) and methyprylon (INN)	32,059.08
293399	Heterocyclic compounds; n.e.c. in headings no. 2933	4,268.261

Source: UN Comtrade Database.

None of these items are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[81]

Project Anthracite also identified four individual shipments of organic chemicals from India into North Korea that allow for more detailed analysis.

Table 12: Specific Chapter 29 Shipments from India to North Korea (2015–24)

HS6 Code	Shipment Description in Trade Data	Shipments
293399	Entecavir	2
293499	Orlistat	2

Source: Trade data provided by a third-party commercial supplier.

According to the UK National Health Service, Entecavir is used to treat Hepatitis B, and Orlistat is used for weight loss.[82]

All four shipments listed Pyongyang as their port of unloading and were sent by the Indian company SRI Distributors. The company profile for SRI Distributors on the online marketplace IndiaMart identifies it as a 'famous manufacturer, exporter,

81. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
82. Cambridge University Hospitals, 'Entecavir', <https://www.cuh.nhs.uk/patient-information/entecavir/>, accessed 30 June 2025; NHS, 'Treatment: Obesity', <https://www.nhs.uk/conditions/obesity/treatment/>, accessed 30 June 2025.

supplier, and trader of [a] wide range of Medicines'.[83]

While the Orlistat shipments went to an 'unknown' consignee, the Entecavir shipments were sent to the North Korean company Ryomyong Ecotech.[84] Project Anthracite found no information about the company in open source information searches.

Neither of these medications are on the UNSCR 1718 (2006) sanctions list or the CWC Annex on Chemicals.[85] While the AG Common Control List[86] does include certain heterocyclic compounds with nitrogen heteroatoms as potential precursors for the chemical incapacitant BZ, Entecavir is a more complicated and structurally different molecule to these precursors and lacks key characteristics for straightforward CWA synthesis.[87]

Imports from Malaysia

UN Comtrade reports that from 2015 to 2016 Malaysia exported at least 178 tonnes of organic chemicals into North Korea under two HS codes.

Table 13: North Korea's Chapter 29 Imports of Interest from Malaysia (2015–2016)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
290517	Alcohols; saturated monohydric, dodecan-1-ol (lauryl alcohol), hexadecan-1-ol (cetyl alcohol) and octadecan-1-ol (stearyl alcohol)	18,000
290545	Alcohols; polyhydric, glycerol	160,150

Source: UN Comtrade Database.

Malaysia's External Trade Development Corporation only offers annual export data for 2018 to 2021 and stops at the HS2 level, making it difficult to discern any discrepancies between national statistical reporting and the UN Comtrade data.[88]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[89]

Imports from Russia

Although UN Comtrade does not report any exports of chapter 29 items from Russia into North Korea between 2015 and 2024, shipment-level trade data provided by a third-party commercial supplier identifies six North Korean imports from Russia under the HS code 291521, which covers 'acetic acid', in 2023.[90] In total, the shipments amount to 135.8 tonnes of acetic acid, which is not prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[91]

All of these shipments list Pyongyang as their consignee's address.[92]

83. *IndiaMart*, 'SRI Distributors', archived via the Wayback Machine 11 February 2025, <https://web.archive.org/web/20250211165545/https://www.indiamart.com/sridistributors/profile.html>, accessed 11 February 2025.
84. Trade data provided by a third-party commercial supplier.
85. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'.
86. AG, 'Australia Group Common Control List Handbook: Volume 1'.
87. National Center for Biotechnology Information, PubChem, 'Compound Summary Entecavir', <https://pubchem.ncbi.nlm.nih.gov/compound/Entecavir>, accessed 19 February 2025.
88. Malaysia External Trade Development Corporation, <https://archive.data.gov.my/data/en_US/organization/malaysia-external-trade-development-corporation-matrade?q=Export&sort=title_string+asc&page=1>, accessed 20 July 2025.
89. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
90. *Ibid*.
91. *Ibid*.
92. Trade data provided by a third-party commercial supplier.

Shipment-level trade data also includes information about shipment consignees and consignors. An analysis of the companies exporting and importing the above shipments from Russia is included below.

Consignees

Five consignees appear for the remaining shipments:[93]

1. Mangyongbong International Trade and Economic Development Company.
2. Myohyang Trading Company.
3. Puhung Trading Company.
4. Rakyon Trading Company.
5. Rungra Trading Company.

There is little open source information about these companies, although each company name follows a format typical for state-owned North Korean entities. Project Anthracite found no information about Rakyon Trading Company in open source searches. However, because the reference to Rakyon Trading Company was likely translated from Cyrillic in Russian trade reporting into English within the dataset, it is possible that this may be the same entity as the Rakwon Trading Corporation that facilitates pharmaceutical imports for North Korean elites.[94]

Mangyongbong International Trade and Economic Development Company allegedly aided in sending North Korean workers into China in 2020.[95]

Myohyang Trading Company was named in a 2005 unclassified US Army report as one of North Korea's primary trading companies, owned by the Worker's Party and primarily responsible for importing 'construction materials and general merchandise'.[96] The company is also allegedly involved in manufacturing food flavouring.[97]

The unclassified US Army report also lists a 'Rungra 888 Trading Corporation' as a main North Korean trading company for 'clothing material, light industry, agricultural and marine products';[98] this could potentially be the same entity as Rungra Trading Company. Rungra Trading Company, more commonly referred to as Room 39 or Office 39,[99] is an arm of the North Korean government tasked with generating wealth for the Kim regime – often through covert and illegal overseas activities.[100]

On 31 January 2025, Japan's Ministry of Economy, Trade and Industry added Puhung Trading Company to its Foreign User List of entities with potential proliferation risks, citing suspicions of connections to raw materials, biological, chemical and nuclear

93. *Ibid*.
94. Pyongyang Papers, 'Korea Rakwon Trading Corporation', <https://pyongyangpapers.com/entity/korea-rakwon-trading-corporation/>, accessed 18 July 2025.
95. OpenSanctions, 'Mangyongbong International Trade and Economic Development Company', accessed 25 May 2025, <https://www.opensanctions.org/entities/kprusi-fcd480289fc35f3d0d994827a7ce9d2b75568cae/>, accessed 22 August 2025.
96. Cindy Hurst, 'North Korea: A Government-Sponsored Drug Trafficking Network', Defense Technical Information Center, 2006, <https://apps.dtic.mil/sti/citations/ADA443303>, accessed 10 September 2025.
97. *KBS World*, 'North Korea Reflected in Daily Necessities Packaging', 27 April 2022, <https://world.kbs.co.kr/service/contents_view.htm?lang=e&menu_cate=northkorea&id=&board_seq=421882>, accessed 20 May 2025.
98. *Ibid*.
99. Shirley A Kan, 'China and Proliferation of Weapons of Mass Destruction and Missiles: Policy Issues', Congressional Research Service Report Number RL31555, 5 January 2015, <https://sgp.fas.org/crs/nuke/RL31555.pdf>, accessed 1 February 2025.
100. CRDF Global, 'Office 39: North Korean Shadow Operations for Sanctions Evasion', <https://www.crdfglobal.org/insights/event-recap-office-39-north-korean-shadow-operations-sanctions-evasion/>, accessed 12 January 2025.

warfare, and missile production.[101] A 2021 UNSCR 1718 Panel of Experts report found that Puhung Trading Company wired payments to a Vietnamese bank account for an operative of North Korea's Munitions Industry Department in 2017 and 2018 and opened accounts in Vietnamese dong and US dollars in April 2017. These accounts were closed in July 2020.[102]

Consignors

The Russian entity Company Trophy LLC made these shipments, with two being on behalf of another Russian company called Siberian Vinegar LLC.[103]

Company Trophy LLC is based in Novosibirsk,[104] and its website describes the company as covering 'several areas of activity – packaging and sealing, entrance and interior doors, locks, hardware, door and window fittings, mixers, aluminium radiators, and other types of goods'.[105] The company's website does not list chemicals in its list of goods and services.[106] Siberian Vinegar LLC describes itself as the 'largest enterprise in Russia' and a 'manufacturer of food acetic acid and a wide range of table and natural vinegars'.[107]

Imports from Germany

UN Comtrade reports that from 2015 to 2019 Germany exported at least 116 tonnes of organic chemicals into North Korea under eight HS codes. However, Eurostat reports that, in the same period and under the same HS codes, Germany exported 46 tonnes of organic chemicals into North Korea.

Table 14: North Korea's Chapter 29 Imports of Interest from Germany (2015–19)

Hs6 Code	Shipment Description, UN Comtrade	Total Quantity, UN Comtrade (kg)	Total Quantity, Eurostat (kg)
290511	Alcohols; saturated monohydric, methanol (methyl alcohol)	260	260
290532	Alcohols; acyclic, diols; propylene glycol (propane-1, 2-diol)	138	138
290545	Alcohols; polyhydric, glycerol	115,950.659	45,741
292090	Esters; other than thiophosphoric esters (phosphorothioates) and their salts, their halogenated, sulfonated, nitrated or nitrosated derivatives	125	125
292249	Amino-acids, other than those containing more than one kind of oxygen function, their esters; salts thereof, excluding lysine, glutamic acid, anthranalic acid and tilidine, their esters and salts thereof	1	1

101. Japanese Ministry of Economy, Trade and Industry, '外国ユーザーリストの改正について' ['Revision of the Foreign User List'], 31 January 2025, <https://www.meti.go.jp/policy/anpo/20250131_5.pdf>, accessed 20 May 2025.
102. UNSC, 'S/2021/211', <https://www.un.org/securitycouncil/sanctions/1718>, accessed 15 January 2025.
103. Trade data provided by a third-party commercial supplier.
104. Sayari.
105. Trophy, archived via the Wayback Machine 13 December 2024, <https://web.archive.org/web/20241213065457/http://trofi.ru/>, accessed 6 February 2025.
106. *Ibid*.
107. Siberian Vinegar LLC, archived via the Wayback Machine 13 December 2024, <https://web.archive.org/web/20241213182840/http://sibyksys.ru/index.php/en/company/o-company>, accessed 8 February 2025.

Hs6 Code	Shipment Description, UN Comtrade	Total Quantity, UN Comtrade (kg)	Total Quantity, Eurostat (kg)
292250	Amino-alcohol-phenols, amino-acid-phenols and other amino-compounds with oxygen function	1	1
293311	Heterocyclic compounds; with nitrogen hetero-atom(s) only, containing an unfused pyrazole ring (whether or not hydrogenated) in the structure, phenazone (antipyrin) and its derivatives	6	16
293399	Heterocyclic compounds; n.e.c. in headings no. 2933	3	3

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[108]

Imports from Thailand

UN Comtrade and Thailand's Ministry of Commerce report that in 2015 Thailand exported at least 20,630 kg of organic chemicals into North Korea under HS6 code 290539, which covers 'Alcohols; acyclic, diols, other than ethylene glycol (ethandiol) or propylene glycol (propane-1,2-diol)'.[109]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[110]

Imports from Singapore

UN Comtrade reports that from 2015 to 2016 Singapore exported at least 9 tonnes of organic chemicals into North Korea under two HS codes.

Table 15: North Korea's Chapter 29 Imports of Interest from Singapore (2015–16)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
290532	Alcohols; acyclic, diols; propylene glycol (propane-1, 2-diol)	5,805
290545	Alcohols; polyhydric, glycerol	3,240

Source: UN Comtrade Database.

Singapore's Department of Statistics does not appear to report exports to North Korea,[111] making it difficult to discern any discrepancies between national statistical reporting and the UN Comtrade data.

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[112]

108. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
109. UN Comtrade Database; Thailand's Ministry of Commerce, Thailand's Trade Statistic, <https://tradereport.moc.go.th/en/stat/reporthscodeexport04>, accessed 22 August 2025.
110. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
111. Singapore Department of Statistics, 'Domestic Exports of Chemicals and Chemical Products by Market', <https://tablebuilder.singstat.gov.sg/table/TS/M45026>, accessed 20 June 2025.
112. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.

Imports from Brazil

UN Comtrade reports that in 2020 Brazil exported at least 990 kg of organic chemicals into North Korea under two HS codes. Brazil's national statistical reporting system, Comex Stat, confirms these shipments and provides more detail in the shipment descriptions.[113]

Table 16: North Korea's Chapter 29 Imports of Interest from Brazil (2020)

Brazilian HS8 Code	Shipment Description in Trade Data	Total Quantity (kg)
29313999	Other organophosphorus derivatives	876
29335915	Enrofloxacin, piperazine salts	114

Sources: UN Comtrade Database; Ministry of Development, Industry, Trade and Services, Government of Brazil, 'Comex Stat', <https://comexstat.mdic.gov.br/en/home>, accessed 14 July 2025.

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[114]

Of these shipments, no chemicals are relevant enough to CWA development to warrant mention. However, HS4 code 2931 could potentially include CWA-relevant chemicals, but the trade data descriptions for the corresponding HS8 codes do not name specific chemicals, inhibiting further analysis into whether any of these North Korean imports could be relevant to CW production.[115]

Imports from the UK

UN Comtrade and Eurostat report that in 2015 the UK exported at least 388 kg of organic chemicals under HS6 code 293353, which covers 'Allobarbital (INN), amobarbital (INN), barbital (INN), butalbital (INN), butobarbital, cyclobarbital (INN), methylphenobarbital (INN), pentobarbital (INN), phenobarbital (INN), secbutabarbital (INN), secobarbital (INN) and vinylbital (INN); salts thereof'.[116]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[117]

Imports from Austria

UN Comtrade reports that from 2016 to 2018 Austria exported at least 172 kg of organic chemicals into North Korea under three HS codes. However, Eurostat reports that, in the same period and under the same HS codes, Austria exported only 9 kg of organic chemicals into North Korea.

Table 17: North Korea's Chapter 29 Imports of Interest from Austria (2016–18)

HS6 Code	Shipment Description, UN Comtrade	Total Quantity, UN Comtrade (kg)	Total Quantity, Eurostat (kg)
292090	Esters; other than thiophosphoric esters (phosphorothioates) and their salts, their halogenated, sulfonated, nitrated or nitrosated derivatives	56.768	5

113. Ministry of Development, Industry, Trade and Services, Government of Brazil, 'Comex Stat', <https://comexstat.mdic.gov.br/en/home>, accessed 14 July 2025.
114. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
115. General Administration of Customs of the People's Republic of China, 'Customs Statistics'.
116. UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.
117. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.

HS6 Code	Shipment Description, UN Comtrade	Total Quantity, UN Comtrade (kg)	Total Quantity, Eurostat (kg)
292159	Amine-function compounds; aromatic polyamines and their derivatives, other than item no. 2921.51	105.39	4
293090	Organo-sulfur compounds; n.e.c. in heading no. 2930	10.526	0

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[118]

Imports from the Netherlands

UN Comtrade and Eurostat report that in 2016 the Netherlands exported at least 46 kg of organic chemicals under the HS6 code 292250, which covers 'Amino-alcohol-phenols, amino-acid-phenols and other amino-compounds with oxygen function'.[119]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[120]

Imports from Turkey

UN Comtrade reports that in 2020 Turkey exported at least 5 kg of organic chemicals under the HS6 code 292244, which covers 'Amino-acids, other than those containing more than one kind of oxygen function, and their esters; tilidine (INN) and its esters; salts thereof'.[121]

None of these goods are prohibited for export to North Korea by UNSCR 1718 (2006) or the AG Common Control List.[122]

HS4 Code 8419: Machinery, Plant or Laboratory Equipment

According to UN Comtrade, from January 2015 to December 2024 North Korea imported at least 2,124 tonnes of equipment and related parts that are of particular relevance for potential CWA production. Table 18 breaks down this total at the HS6 level.

Table 18: North Korea's Total HS4 Code 8419 Imports (2015–24)

HS6 Code	WCO HS6 Code Description	Total Quantity Imported (kg)
841911	Instantaneous gas water heaters	68,420
841912	Solar water heaters	15,000
841919	Other instantaneous or storage water heaters, non-electric	122,183
841920	Medical, surgical or laboratory sterilisers	70,680
841931	Dryers for agricultural products	55,830
841932	Dryers for wood, paper pulp, paper or paperboard	42,950
841939	Other dryers	278,438

118. *Ibid*.
119. UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.
120. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.
121. UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.
122. UNSC, 'Lists of Items Prohibited for Export to and Import from the Democratic People's Republic of Korea'; AG, 'Australia Group Common Control List Handbook: Volume 1'.

HS6 Code	WCO HS6 Code Description	Total Quantity Imported (kg)
841940	Distilling or rectifying plant	46,468
841950	Heat exchange units	261,312
841960	Machinery for liquefying air or other gases	718,130
841981	For making hot drinks or for cooking or heating food	67,430
841989	Other machinery, plant and equipment	218,974
841990	Parts	164,276

Sources: WCO, 'HS Nomenclature 2022 Edition'; UN Comtrade Database.

By aggregating UN Comtrade data with nationally-reported trade data, this report identifies 10 countries as exporting this equipment into North Korea across different periods of 2015–24: China, India, Germany, Switzerland, Sweden, Papua New Guinea, Russia, the Philippines, Finland and the Netherlands. The following subsections further examine the relevant exports of each country by order of export quantities. When available in the trade data, some subsections also include the reported number of individual pieces of equipment in addition to their aggregate weight.

Unless otherwise specified, the project team was unable to identify from the available trade data whether specific shipments below violate trade controls, because the HS categories do not include information about capacity or material construction.

Imports from China

UN Comtrade reports that from 2015 to 2024 China exported at least 2,001 tonnes of items of machinery, plant or laboratory equipment and related parts of particular relevance for CWA production into North Korea.[123] The General Administration of Customs of the People's Republic of China reports exporting at least 4,762 individual units of goods into North Korea within that same timeframe across eight HS codes:[124]

Table 19: North Korea's HS4 8419 Imports of Interest from China (2015–24)

Chinese HS8 Code	Chinese HS8 Code Description	Total Quantity (Units)
84192000	Medical, surgical, laboratory sterilisers	2,684
84193990	Other dryers, nes	291
84194020	Rectifying towers	2
84194090	Other distilling, rectifying plant	86
84195000	Heat exchange units, non-domestic, non-electric	276
84196019	Oxygen producers of volume 15000m3/h	276
84198910	Hydroformer vessels	1
84198990	Other machinery, plant & equip for treat of mat. by a chg of temp, nes	1,146

Source: General Administration of Customs of the People's Republic of China, 'Customs Statistics'.

123. UN Comtrade Database.
124. Chinese customs data does not provide the net weight for these shipments, nor does UN Comtrade list the number of individual units for different HS6 categories of goods, making comparisons between the two datasets difficult. See General Administration of Customs of the People's Republic of China, 'Customs Statistics'.

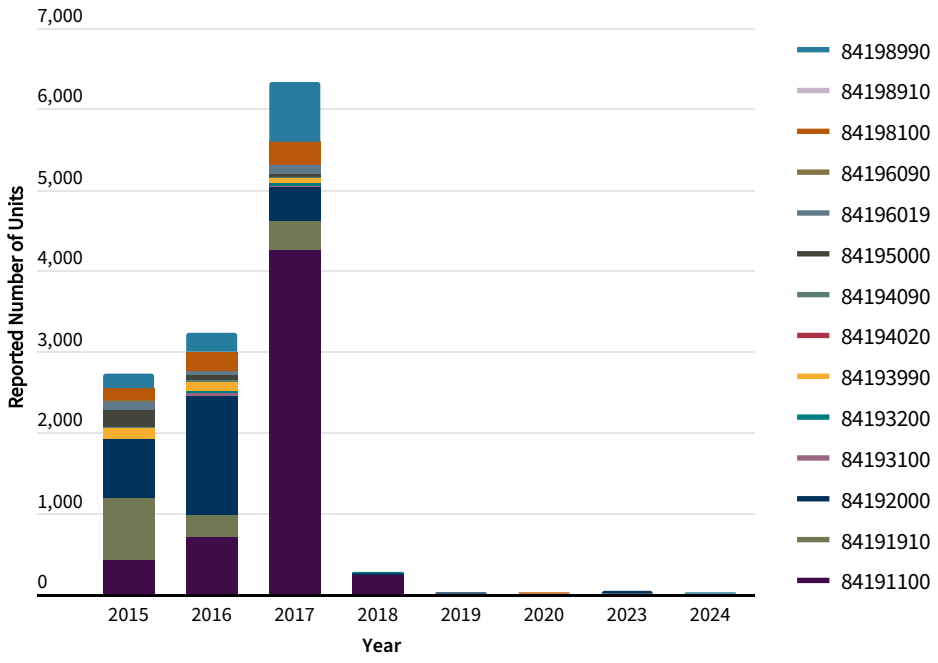
Without descriptions of material construction or differentiation of materials under the HS codes, it is not possible to assess the materials of construction of most of this equipment.

There was an import to North Korea of one hydroformer vessel in 2016, which is likely to have been prioritised for shipbuilding and submarine construction, given that it appears North Korea has been able to import machinery, plant and laboratory equipment.[125] Theoretically, however, a hydroformer could be used to shape stainless steel into reaction vessels and storage tanks.

Of course, there is a possibility that North Korea may not use corrosion-resistant materials such as stainless steel if it has too much difficulty attaining them. Although low alloy steel would corrode much more easily and need to be periodically replaced, it could in theory still be used for CWA production, although it would present significantly more risk of environmental contamination.

Among the equipment with the highest average unit price (calculated by the aggregate monthly total value and units) are oxygen generators. There were frequent reported exports of these units to North Korea until 2018, showing a reliance specifically on imported equipment for large-scale oxygen generation from air. This is an important feedstock across chemical industries but is of no particular relevance to a CW programme.

Figure 1: Chinese HS4 8419 Exports to North Korea from China (2015–24)



Source: General Administration of Customs of the People's Republic of China, 'Customs Statistics'.
Note: Goods under HS6 code 841990 (parts of machinery) are not included because they are reported by aggregate weight and not the number of individual units.

125. One analysis has placed the start of North Korea's nuclear submarine programme as early as 2014. Another describes the construction of North Korean naval vessels as lasting over a decade. See Vann H Van Diepen, 'North Korea's Nuclear-Powered Missile Submarine: A Mystery Wrapped Around a Riddle and an Enigma', *38 North*, 21 March 2025, <https://www.38north.org/2025/03/north-koreas-nuclear-powered-missile-submarine-a-mystery-wrapped-around-a-riddle-and-an-enigma/>, accessed 22 August 2025; Colin Zwirko, 'North Korea Launches Largest New Warship, States Aim to Sail Beyond Peninsula', *NK News*, 26 April 2025, <https://www.nknews.org/2025/04/north-korea-launches-largest-new-warship-on-west-coast-state-media/>, accessed 22 August 2025.

There was a drop off in the quantity, average unit price and average unit weight of equipment under HS code 8419 from China to North Korea after 2017 (see Figure 1). This could be for several reasons:

- North Korea was revitalising its chemical industry from 2015 to 2017 and thus imported more equipment during this period. This timeline aligns with Kim Jong-un's May 2016 speech during the Seventh Party Conference when he announced the establishment of the 'C1 chemical industry',[126] which was followed one year later by the commencement of a project in pursuit of this goal at Sunchon Chemical Complex.[127]
- China may have placed restrictions on exporting industrial equipment to North Korea from 2018 onwards, possibly due to the termination of some sort of trade agreement or to constrain North Korean proliferation or exercise coercion in some other way.
- These shipments may have continued but were obfuscated by assignment under other HS codes.

Imports from India

UN Comtrade reports that from 2015 to 2021 India exported at least 602 items of machinery, plant or laboratory equipment and 203 kg of related parts of particular relevance for CWA production into North Korea across four HS6 codes:

Table 20: North Korea's HS4 Code 8419 Imports of Interest from India (2015–24)

HS6 Code	Shipment Description in Trade Data	Total Quantity
841940	Distilling or rectifying plant; not used for domestic purposes	2 units
841950	Heat exchange units; not used for domestic purposes	12 units
841989	Machinery, plant and laboratory equipment; for treating materials by change of temperature, other than for making hot drinks or cooking or heating food	588 units
841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	203 kg

Source: UN Comtrade Database.

Imports from Sweden

UN Comtrade reports that in 2015 Sweden exported at least 3.1 tonnes of machinery, plant or laboratory equipment or related parts of particular relevance for CWA production into North Korea across two HS6 codes. However, Eurostat reports that, in the same period and under the same HS codes, Sweden exported 3.2 tonnes of the same goods into North Korea.

126. Frank Ruediger, 'The 7th Party Congress in North Korea: A Return to a New Normal', *38 North*, 10 May 2016, <https://www.38north.org/2016/05/rfrank052016/>, accessed 22 August 2025.
127. Korea News Service, 'Start of Project for Building C1 Chemical Industry in DPRK', 14 May 2017, <http://kcna.co.jp/item/2017/201705/news14/20170514-10ee.html>, accessed 20 August 2025.

Table 21: North Korea's HS4 Code 8419 Imports of Interest from Sweden (2015)

HS6 Code	Shipment Description in Trade Data	Total Quantity, UN Comtrade (kg)	Total Quantity, Eurostat (kg)
841950	Heat exchange units; not used for domestic purposes	105	89
841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	3,000	3,112

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

Imports from Papua New Guinea

UN Comtrade reports that in 2019 Papua New Guinea exported at least 10,000 items under HS6 code 841989, which covers 'Machinery, plant and laboratory equipment; for treating materials by change of temperature, other than for making hot drinks or cooking or heating food', with an aggregate weight of 2.5 tonnes.

Imports from Russia

UN Comtrade reports that from 2015 to 2019 Russia exported at least 2.2 tonnes of machinery, plant or laboratory equipment or related parts of particular relevance for CWA production into North Korea across six HS6 codes.

Table 22: North Korea's HS4 Code 8419 Imports of Interest from Russia (2015–19)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
841920	Sterilisers; for medical, surgical or laboratory use, not used for domestic purposes	18.3
841931	Dryers; for agricultural products, not used for domestic purposes	190
841939	Dryers; for products n.e.c. in heading no. 8419, not used for domestic purposes	128.5
841940	Distilling or rectifying plant; not used for domestic purposes	7
841950	Heat exchange units; not used for domestic purposes	12.4
841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	1,871

Source: UN Comtrade Database.

Project Anthracite also identified 12 individual exports from Russia to North Korea under HS4 code 8419 – matching several of the above codes – that allow for more detailed analysis.[128]

128. Trade data provided by a third-party commercial supplier.

Table 23: North Korea's Shipment-Level HS4 Code 8419 Mirrored Imports from Russia (2015–24)

HS6 Code	HS Code Description	Shipment Description	Shipment(s)	Total Quantity (With Unit Capacity in Brackets)
841920	Medical, surgical or laboratory sterilisers	Air steriliser	2	2 units
841931	Dryers: For agricultural products	Used disassembled dryer for agricultural products	1	1 unit
841939	Dryers: Other	Refrigerated dryer	1	1 unit (1200 L/min)
		Forced convection drying cabinet	1	1 unit (10 trays)
841940	Distilling or rectifying plant	Medical electric aquadistillator	3	3 units (5 L/hr)
841950	Heat exchange units	Brazed heat exchanger	3	3 units (5 m/s, 1" connections)
		Engine oil cooler	1	1 unit

Sources: WCO , 'HS Nomenclature 2022 Edition'; trade data provided by a third-party commercial supplier.

On initial review, this equipment includes various dual-use items that could be of relevance to a CW production ability, including heat exchangers, distillation and rectifying towers, and industrial dryers. All these shipments were sent to addresses in Rason, North Korea.[129]

The 2022 HS nomenclature is the first to include a distinct HS6 code for lyophilisation apparatus, freeze dryers and spray dryers, which are on the AG Common Control List, given their direct applicability to stabilisation of chemical and biological warfare agents in munitions and delivery devices. Until 2022, such dryers would have been lumped into the general HS code 841939, under which there had been at least 293 units shipped to North Korea by 2018.

Some heat exchangers constructed with corrosion-resistant materials are included in the AG Common Control List[130] and are subject to UNSCR 1718 (2006) sanctions.[131] After more detailed analysis, the descriptions of most of these shipments are insufficient for determining whether they are subject to the AG Common Control List or UNSCR sanctions.

Consignees

All shipments were imported by JV RasonConTrans except for one – the used disassembled dryer for agricultural products[132] – which was imported by North Korea tourism company Krahun Company.[133] One potential connection between Krahun Company and a need for agricultural machinery is that the company once facilitated a tree-planting programme on behalf of North Korea's tourism board, inviting ethnic

129. *Ibid*.
130. AG, 'Australia Group Common Control List Handbook: Volume 1'.
131. International Atomic Energy Agency (IAEA), 'Communication Received from the Permanent Mission of the United States of America to the [IAEA] regarding Certain Member States' Guidelines for the Export of Nuclear Material, Equipment and Technology', INFCIRC/254/Rev.11/Part 1, 12 November 2012, Paragraph 5.5.5.
132. Trade data provided by a third-party commercial supplier.
133. Krahun Co, archived via the Wayback Machine 1 December 2023, <https://web.archive.org/web/20231201233124/https://krahun.com/>, accessed 7 January 2025.

Koreans from outside the country to plant trees to join 'efforts to help beautify the land and make a positive contribution for future generations'.[134]

Consignors

Four consignors appear for these shipments:[135]

1. Incolab Services Russia LLC (the forced convection drying cabinet).
2. JV RasonConTrans (all shipments imported by JV RasonConTrans after 2017).
3. Maly Port Logistics LLC (the engine oil cooler on behalf of Radex-Techno LLC).
4. TLC VL Logistic LLC (the used agricultural dryer on behalf of Element Trade LLC).

No information about Maly Port Logistics LLC appears in searches of English- and Russian-language open sources. In the shipment details for the engine oil cooler, the exporter code is the tax identification number for Radex-Techno LLC, a now-liquidated company whose primary business venture was the 'production of other special purpose vehicles'.[136]

According to its website, Incolab Services Russia LLC is an international company that specialises in 'providing its clients with high-tech services in the field of quality control, quantity and certification of solid mineral fuels … biofuels, iron ore and manganese materials, ferroalloys, grains, legumes, oilseeds, as well as their processed products and other bulk cargo'.[137]

While, as previously mentioned, the vagueness of the available data on these shipments prevents any determination of whether the above entities violated sanctions or trade controls with these exports to North Korea, the above information might again show the kinds of routes North Korea uses to import goods and materials into the regime.

Imports from Germany

UN Comtrade and Eurostat report that from 2015 to 2018 Germany exported at least 1.6 tonnes of machinery, plant, laboratory equipment and related parts of particular relevance for CWA production into North Korea across four HS6 codes.

Table 24: North Korea's HS4 Code 8419 Imports of Interest from Germany (2015–18)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
841919	Heaters; instantaneous or storage water heaters, non-electric, other than instantaneous gas water heaters	1,200
841950	Heat exchange units; not used for domestic purposes	128
841989	Machinery, plant and laboratory equipment; for treating materials by change of temperature, other than for making hot drinks or cooking or heating food	129
841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	211

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

134. Dan-Bi Um and Jung-Sup Um, 'Informed Consent Utilizing Satellite Imagery in Forestry Carbon Trading with North Korea', *International Environmental Agreements: Politics, Law and Economics* (Vol. 17, 2017), pp. 531–52.
135. Trade data provided by a third-party commercial supplier.
136. Sayari.
137. Incolab Services Russia, archived via the Wayback Machine 11 February 2025, <http://web.archive.org/web/20250211225929/https://incolab.ru/company/>, accessed 11 February 2025.

Note: UN Comtrade does not report individual units for some of these goods, so the HS6 subtotals are only aggregated by net weight for consistency.

Imports from Switzerland

UN Comtrade and Eurostat report that in 2015 Switzerland exported at least four units of machinery, plant, laboratory equipment (with an aggregate weight of 1.6 tonnes) of particular relevance for CWA production into North Korea across two HS6 codes.

Table 25: North Korea's HS4 code 8419 imports of interest from Switzerland (2015)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)	Total Quantity (Units)
841950	Heat exchange units; not used for domestic purposes	1,040	2
841981	Machinery, plant and equipment; for making hot drinks, for cooking or heating food	585	2

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

Imports from the Philippines

UN Comtrade and the Philippines Statistics Authority report that from 2015 to 2016 the Philippines exported at least 314 kg of machinery, plant or laboratory equipment or related parts of particular relevance for CWA production into North Korea across two HS6 codes.

Table 26: North Korea's HS4 code 8419 imports of interest from the Philippines (2015–2016)

Philippines HS10 Code	Shipment Description in Trade Data	Total Quantity (kg)
8419111100	Heaters; instantaneous gas water heaters, for domestic or other purposes; of copper	92
8419901909	Other machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	222

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

Imports from Finland

UN Comtrade and Eurostat report that in 2015 Finland exported at least 209 kg of machinery, plant or laboratory equipment or related parts of particular relevance for CWA production into North Korea across three HS6 codes.

Table 27: North Korea's HS4 Code 8419 Imports of Interest from Finland (2015)

HS6 Code	Shipment Description in Trade Data	Total Quantity (kg)
841920	Sterilisers; for medical, surgical or laboratory use, not used for domestic purposes	190
841940	Distilling or rectifying plant; not used for domestic purposes	4
841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	15

Sources: UN Comtrade Database; Eurostat, 'International Trade of EU and Non-EU Countries Since 2002 by HS2-4-6'.

Imports from the Netherlands

UN Comtrade reports that in 2015 the Netherlands exported at least 32 g of goods under HS6 code 841989, which covers 'Machinery, plant and laboratory equipment; for treating materials by change of temperature, other than for making hot drinks or cooking or

heating food'. However, Eurostat does not report any exports from the Netherlands under HS4 code 8419 during this same period.

Conclusions and Insights

Project Anthracite's analysis of North Korea's imports of at least 667,820 tonnes of chemicals and 2,124 tonnes of relevant equipment from January 2015 to December 2024 that could be used to produce CWAs identified at least three imported chemicals either explicitly scheduled by the CWC and banned by UNSC 1718 (2006) and/or the Australia Group (phosphorus trichloride, sodium fluoride) or one step removed from the production of CWAs (disodium sulfate).

The analysis also revealed limited insights into trading patterns and relationships that are potentially relevant to North Korea's CW capability:

- **A dependency on Chinese imports**. With over 171,170 tonnes of exports across 93 different Chinese HS8 codes, China is the most holistic supplier to North Korea of the chemicals and equipment identified in this report that could be used to produce CWAs. While the different reporting structures of the datasets analysed in this report make it difficult to draw detailed comparative conclusions, the overwhelming availability of data on Chinese imports show a reliance on Chinese chemicals and related equipment. The incomplete nature of the mirrored trade data does not, however, allow a detailed statistical analysis nor assurance that identified discrepancies are indicative of trade patterns and not data reporting.
- **Repetitions in Russia's exports**. There were 28 nearly identical shipments, whose descriptions cite repair operations in the Rason port area, from TLC VL Logistic to JV RasonConTrans on 2 February, 2 March and 2 June 2024.[138] Another set of shipments on 20 February 2024 was nearly identical, missing only one entry (silica gel).[139] Each shipment has a unique declaration number, which precludes the possibility of the earliest set of these shipments on 2 February 2024 being incorrectly reported as occurring again in March and June. The shipment descriptions claim that these exports were for the port's maintenance appear to be supported by indications that coal shipments to the JV RasonConTrans pier at Rason recently resumed.[140] Additionally, some shipment descriptions refer to being used for the maintenance of Mantsinen port cranes; four Mantsinen 120 and two Mantsinen 70 port cranes appear to operate near the rail terminus at Rason's third pier.[141]
- **Minimal crossover between consignor's HS chapters**. In the Russian and Indian shipment-level trade data, few companies appear in the shipments of goods in more than one of the HS chapters and HS4 codes analysed in this report. JV RasonConTrans, JSC Rzdstroy and TLC VL Logistic were the only three consignors that overlapped between chapters, specifically chapter 28 and HS4 code 84.

138. Trade data provided by a third-party commercial supplier.
139. *Ibid*.
140. Zwirko, 'Russian Firm Restarts Coal Project in North Korea After Over 4-Year Suspension'.
141. Google Earth Pro 7.3.6.10201, Rason Port, North Korea (42.223971 N, 130.280686 E), 7 October 2023, 20 June 2022 and 10 May 2018, Eye alt. 363 m. Airbus, Maxar Technologies, <https://earth.google.com/web/>, accessed 12 February 2025.

- Trade to and from these entities could be searched in third-party import data for other countries to catch falsified reports of port of unloading; some import datasets that could be a point of priority for this research include Russia, Taiwan, Singapore and Malaysia, based on patterns observed in North Korea's evasion of oil import limits.[142]

- **Possible indications of a lack of chemical industry ability**. North Korea has imported basic goods such as bicarbonate and acetic acid. When considered alongside a review of North Korea's patents,[143] this might be a sign of significant bottlenecks or lack of ability within its chemical industry. Acetic acid is reported to be a feedstock for Vinalon production, which would imply that North Korea should be able to produce or source significant quantities.[144] Equally, a lack of ability for producing food-grade chemicals might explain these specific imports.
- **Limitations of trade data analysis**. The categorical nature of HS codes limits the degree of analysis needed to distinguish items of concern from nonrestricted items that share HS codes – for example, there is a lack of information in 8419 codes about item materials. Additionally, the incomplete nature of the data analysed in this report also makes it inadvisable to draw conclusions about unreported trade based on reported trade. Many factors might influence what countries choose to report when exporting goods to North Korea, including the perceived ability of external monitors to trace shipments and the end-use nature of dual-use shipments.
    - The gaps in the shipment-level mirrored North Korean import data may limit larger observations or insights into the regime's import patterns and domestic production needs, but those limitations also help identify further open access sources and materials that would also serve to supplement Project Anthracite's site profiles.
    - Ground level imagery of North Korean chemical facilities would allow analysts to find equipment and check whether any of the available trade data shows how identified equipment might have entered the country, or assess the extent to which equipment installed within North Korea is reported. Images from within recently built or refurbished facilities would be most useful, and modern equipment would be easier to name and trace to manufacturers. North Korean state media does advertise industrial advances; if footage of chemical facilities is shared, it will probably be of facilities with a high propaganda value (and thus, the 'shiny and new' areas within).

142. Asan Institute for Policy Studies, 'The Rise of Phantom Traders: Russian Oil Exports to North Korea', July 2018.
143. Research by the Project Anthracite team, report forthcoming.
144. Cheehyung Harrison Kim, 'North Korea's Vinalon City: Industrialism as Socialist Everyday Life', *Positions* (Vol. 22, No. 4, 2014).

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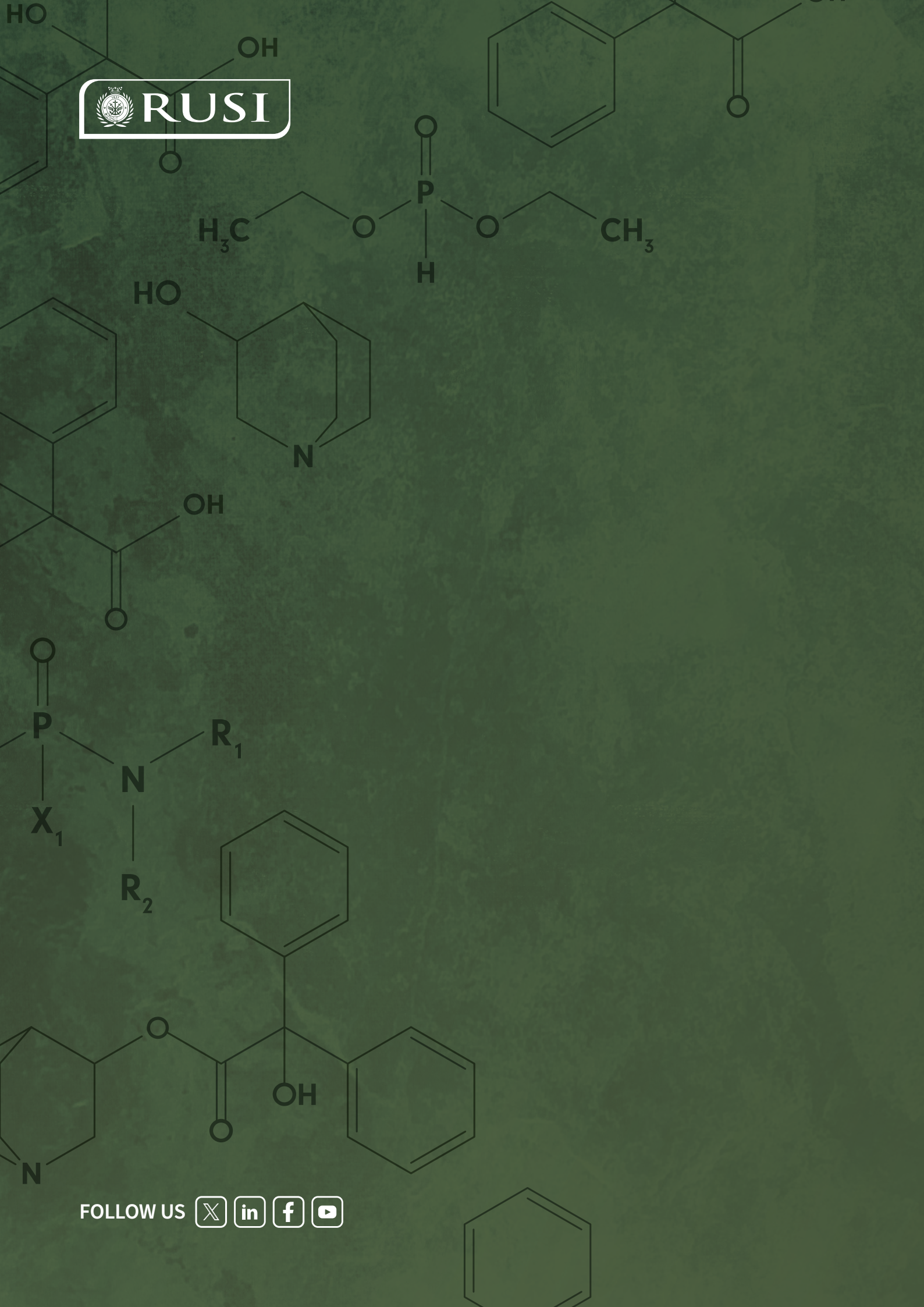
145. RUSI, 'Project Anthracite: Assessing the Chemical Weapons Capability of the DPRK', <https://rusi.org/explore-our-research/projects/project-anthracite-assessing-chemical-weapons-capability-dprk>, accessed 28 October 2024.



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