

MARKET INTELLIGENCE 03

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VITALSPEC MARKET INTELLIGENCE · PRECURSORS

The commodity chain

From ammonia and cotton to finished rounds: the precursor supply chains that decide whether Europe's ammunition plants can actually run.

CORE JUDGEMENT

Every new European energetics plant announced since 2022 assumes its feedstocks will be there when it opens. Many will not be — or will be there on terms set in Beijing. The ammunition rebuild's least-examined risk is upstream of the factory gate: nitrocellulose feedstock is majority-sourced from China, nitroguanidine has a single significant Western producer, hexamine and DNAN chains are thin, and Europe's nitric-acid backbone rides on a fertiliser industry shedding capacity for a decade. We assess it **likely** that at least one precursor becomes a binding constraint on European energetics output before 2029 — and that precursor positions, small in capex terms, will earn strategic premiums out of proportion to their cost.

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SCOPE NOTE

This paper maps the commodity and precursor chains behind a complete 155 mm round: what each element is made from, where those inputs come from, and where the chain concentrates into single points of failure. It complements the VitalSpec Defence Industrial Outlook 2026 (which models plant-level capacity) and MI-02 (bodies and freight) by answering the question both leave open: when the plants are built, can they be fed? Public sources only; estimative language per the Outlook conventions; planning assessments are labelled and confidence-rated.

KJ Key judgements

1 The chain, not the plant, is the system boundary

HIGH CONFIDENCE

EU programme design already concedes the point: ASAP allocated roughly three-quarters of its budget to powder and explosives precisely because chemical inputs, not buildings, pace ammunition output^{7 73}. Analysis that stops at plant announcements systematically overstates future output.

2 Nitrocellulose feedstock is the acute dependency, and the mitigation race has begun in earnest

HIGH CONFIDENCE

Europe relies on China for more than 70% of the cotton linters behind military nitrocellulose (Rheinmetall CEO estimate); Beijing restricted nitrocellulose exports from 2024^{41 42}. Military NC demand of ~20,000 t/yr faces a shortfall estimated at up to 10,000 t⁴¹. The mitigation is now specific: Rheinmetall acquired Hagedorn-NC in April 2025 to convert industrial NC toward military grade⁷⁷, and Eurenco has restarted NC at Bergerac under France's €540m propellant programme^{31 29}. But these attack the NC stage, not the cotton-linters stage — the bottleneck is moving upstream, not disappearing, and none closes the gap before ~2030.

3 Nitroguanidine is a one-company Western market — now doubling down rather than standing still

MODERATE CONFIDENCE

Alzchem of Germany is the West's only significant NQ producer, working from its calcium-carbide chain; capacity doubling commissions from H2 2026, and the US DoD has committed \$150m toward a US Alzchem plant by end-2029^{68 69}. The single point of failure persists through at least 2029 — it is becoming a single company with two sites, not two companies. NQ sits in both triple-base propellant and IM fills (IMX-101 class), so the IM transition increases, not reduces, this exposure^{53 54}.

4 The acid backbone is a quiet strategic asset MODERATE CONFIDENCE

Every nitration step — TNT, RDX, NC, NG — consumes nitric and sulphuric acid at scale, and Europe's nitric acid capacity is a by-product of a fertiliser industry squeezed by energy costs, with precursor sourcing drifting to China⁶⁷. Co-located acid production and recovery is the cheapest insurance in the entire energetics complex, and almost nobody is building it as a merchant business.

5 Precursor and energetics positions are small-capex, high-leverage — and no longer purely defence bets

MODERATE CONFIDENCE

Against \$150–350m for an RDX plant, precursor investments — NQ synthesis, energetic-cellulose processing, hexamine supply agreements, acid recovery — sit in the tens of millions, yet each can gate hundreds of thousands of rounds per year. And the output is dual-use: RDX, HMX, HNS and PETN carry a standing civilian demand base in oil & gas well perforating (a ~US\$2–3bn charge market), commercial explosives and aerospace pyrotechnics^{94 95}. Dual demand de-risks exactly the plants Europe and the UK now want built — the UK MOD's energetics notice explicitly requires export-plus-civilian demand as the majority of the business case⁷⁸.

6 Buyers are now specifying the chain, not just the plant HIGH CONFIDENCE

The UK MOD's SDR-Energetics notice (November 2025, closed December 2025) seeks onshore UK synthesis of RDX (Bachmann/Woolwich), HMX, TNT, NC, NG, NQ, HNS, ammonium perchlorate and BKNO₃, with a funded pipeline (feasibility → FEED → MOD investment contract, construction from 2026), £45m/50% capital grants across three windows, and UKEF export finance behind it^{78 87 88 97}. This is the first Western procurement to treat the molecule list — this report's bill of materials — as the unit of investment.

7 The fast money is upstream MODERATE CONFIDENCE

A firm second-sourcing a raw material such as RDX can be accepted by primes in months; qualifying a new munition runs two-to-four years under STANAG 4170/AOP-7. Combined with civilian perforating demand, an energetics entrant can be revenue-positive years before its first MOD contract — inverting the usual defence-startup cash-flow problem.

01 What a round is made of

A complete 155 mm round is roughly 46 kg of forged steel, 10 kg of high-explosive fill, 8.5–10.5 kg of propellant, a copper-alloy driving band, a fuze and initiation train, and the packaging and charge consumables that move it. Every kilogram has a supply chain, and the chains do not resemble each other: steel is a global commodity with defence-grade certification layers; the energetic materials descend from a handful of chemical trunk routes with single-digit numbers of qualified Western nodes.

FIGURE 2 Indicative bill of materials for a complete round

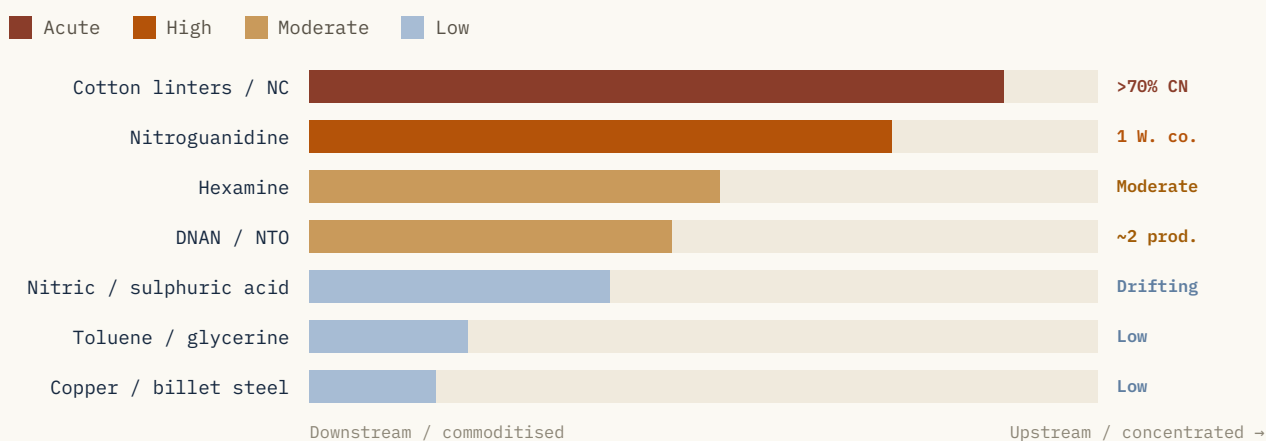
ROUND ELEMENT	IMMEDIATE INPUTS	TRUNK PRECURSORS
Steel body	Forging-grade billet (AISI 1045-class), heat treatment consumables	Iron ore/scrap, alloying elements; defence-certified mills
HE fill (conventional)	TNT + RDX (60/40 planning case)	Toluene + nitric/sulphuric acid; hexamine (from methanol + ammonia) + nitric acid
HE fill (IM)	DNAN + NTO + NQ (IMX-101 class)	Anisole/chlorobenzene chain; triazole chain; calcium carbide/cyanamide chain
Propellant	Nitrocellulose + nitroglycerine (+ NQ for triple-base), stabilisers	Cotton linters or wood cellulose + mixed acid; glycerine; DPA/centralite stabilisers
Driving band	Gilding metal (copper-zinc)	Copper cathode; strip mills
Initiation	Primary explosives, PETN boosters	Specialist chains (out of scope; see Outlook adjacent constraints)

Upstream of each element sit the precursors mapped in Section 3. The energetic rows (amber) descend from single-digit numbers of qualified Western nodes.

02 Where the chain leaves Europe

The exposure pattern has a shape: the further upstream, the more Chinese the chain. Finished energetics are Western-made in Western plants; their feedstocks — linters, NQ precursors, increasing shares of merchant nitric acid and speciality intermediates — concentrate in China, which is simultaneously the world's largest producer, a strategic partner of Russia, and a demonstrated user of export controls as policy^{41 42 67}. The 2024 nitrocellulose restrictions were a warning shot at exactly this seam.

FIGURE 1 Precursor exposure — China concentration and single-source risk across the chain



Bar length indicates relative exposure (China concentration blended with single-source risk); ordered from the chain's most dangerous seam downward. The finished energetics are Western; the feedstocks are not.

03 Material-by-material assessment

3.1 Cellulose and nitrocellulose — the gunpowder bottleneck

Military NC demand runs ~20,000 t/yr against a shortfall estimated as high as 10,000 t; >70% of cotton linters come from China; only a few companies are qualified to handle NC production at military grade^{41 42}. Responses to watch: Rheinmetall's Hagedorn-NC acquisition converting industrial NC capacity to military grade⁷⁷; Eurenco's Bergerac NC restart³¹; wood-cellulose qualification programmes; and — the technology wildcard — BAE's NC/NG-free continuous-flow propellant route, which would bypass the chain entirely if proven at scale^{39 40}.

3.2 Nitroguanidine — one Western producer

Alzchem's Trostberg chain (calcium carbide → cyanamide → NQ) is the West's only significant capacity; doubling is underway with commissioning from H2 2026, and the \$150m US DoD commitment to a US plant by 2029 prices the dependency in public money^{68 69}. Chinese producers dominate the rest of the market. Demand rises on two fronts simultaneously: true triple-base propellant for high-zone charges, and NTO/DNAN/NQ IM fills as European qualification follows US practice^{53 54}.

3.3 The acid backbone — nitric, sulphuric, oleum

Nitration chemistry consumes acid in multiples of the product tonnage: each tonne of TNT, RDX or NC draws several tonnes of mixed acid and generates spent acid requiring recovery. Europe's nitric acid base is largely captive to fertiliser production — an industry that has closed capacity under energy-price pressure, with precursor sourcing drifting offshore⁶⁷. No energetics campus should be financed without co-located acid supply and recovery; conversely, merchant acid-recovery capacity adjacent to the new plant clusters (Poland, Sweden, France, UK sites) is an investable gap almost nobody is addressing.

3.4 TNT and RDX feedstocks — toluene and hexamine

Toluene is a petrochemical commodity with broad supply; its defence risk is price and priority, not availability. Hexamine (formaldehyde + ammonia) is thinner: production has consolidated toward Asia, and RDX campaigns compete with industrial resin demand — but its China concentration is economic, not technical, because both inputs are globally commoditised, so onsite or near-site hexamine is a genuine re-shoring wedge rather than a hard-technology barrier. On RDX capacity itself the picture is moving: Rheinmetall's 3,000 t/yr RDX from 2026, the Nitro-Chem-PROZAP (Poland) November 2025 design agreement for a new RDX — and potentially HMX — facility, and Chemring Nobel's more-than-doubling of advanced-explosives output with ~£32m of EU/Norwegian

co-funding plus a new-facility feasibility study with the Norwegian government^{22 34 26}. A chemistry note for investors: HMX arises as a co-product of the Bachmann RDX line (dedicated HMX needs modified conditions), so RDX capacity carries latent HMX optionality. New TNT plants (SWEBAL, Nitro-Chem's second line) and every RDX project should evidence feedstock contracts, not just construction schedules^{19 15} — indicator 4 in Section 7 tracks exactly this.

3.5 IM chain — DNAN and NTO

DNAN derives from the anisole/chlorobenzene chain and is melt-pour processable on TNT-like infrastructure; NTO's visible European base is effectively Chemring Nobel plus one other producer^{26 27}. As argued in the Outlook's future-proofing assessment, dual-capable fill lines plus an NTO position convert the IM transition from a threat into a second demand wave — but only if the DNAN/NTO chains are secured in parallel.

3.6 Steel and copper — certified, not scarce

Forging-grade billet and gilding metal are globally available commodities; the defence constraint is certification, traceability and mill qualification rather than tonnage — MI-02's foundry map treats this in depth⁷⁶. The exception is barrel-grade steel, which concentrates in very few mills (the UK's programme draws on a single forgemaster⁵²) and belongs to the barrel adjacency rather than this chain.

04 Dual demand: the same molecules drill wells

The explosives at the heart of this report are not defence-only chemicals. RDX, HMX, HNS and PETN are the working charges of oil & gas well perforating, selected by downhole temperature: PETN at the low end, RDX to ~330°F, HMX to ~400°F, HNS to ~520°F^{94 96} — a perforating gun and charge market worth roughly US\$2–3bn, with named buyers including Hunting PLC (UK-listed), Halliburton (Jet Research Center), SLB, Baker Hughes and DMC Global/DynaEnergetics, plus commercial-explosives houses (Dyno Nobel, Orica, MAXAM, Austin, Explosia) and aerospace pyrotechnics for HNS^{93 95}. This standing civilian demand changes the investment case for every energetics plant this report tracks: it provides baseload revenue independent of defence procurement cycles, and it is reachable fast — raw-material second-sourcing can be accepted in months versus the two-to-four years a new munition takes under STANAG 4170/AOP-7. Policy has caught up with the logic: the UK MOD's energetics notice requires export-plus-civilian demand to be the majority of proposals, and the US Congress is pushing to reshore TNT, RDX, HMX, HNS and PETN^{78 94}. The unfashionable precursor thesis of KJ5 now has a fashionable customer list.

WHY DUAL DEMAND MATTERS TO THE CHAIN

A precursor or energetics plant that can sell into oil & gas and commercial explosives between defence orders is a fundamentally more financeable asset than one dependent on procurement cycles — which is precisely why the UK MOD will not be the majority funder and requires an export/civilian majority. For an investor reading the dependency matrix, dual demand converts a strategic-necessity argument into a commercial one.

05 The UK writes the shopping list

The UK has, in effect, procured against this report's bill of materials. The MOD's SDR-Energetics Information Notice (published November 2025, closed December 2025) seeks onshore UK synthesis of RDX via Bachmann/Woolwich, HMX, TNT, NC, NG, NQ, HNS, ammonium perchlorate and BKNO₃ — with proposals required to stand on majority export-plus-civilian demand, a staged funding path (January 2026 pitches → funded feasibility → FEED → MOD investment contract), construction from 2026, DE&S management and SME eligibility⁷⁸. Behind it sit the Defence Investment Plan's £11bn munitions line and six-plus new energetics factories by 2030, £45m/50% capital grants in three windows (Q3 2026, Q2 2027, Q4 2027), and UKEF's £50bn Defence Export Fund^{64 87 88 97}. For readers of the dependency matrix, the arbitrage is direct: the molecules the UK will part-fund are the molecules this report scores as import-dependent.

06 The dependency matrix

PRECURSOR	WESTERN SUPPLY	CHINA EXPOSURE	FIX COST / TIME	ASSESSMENT
Cotton linters / energetic cellulose	Fragmentary; NC-stage mitigation started (Hagedorn-NC, Bergerac), linters-stage none	Acute (>70%)	\$10s of m; 2-4 yrs	Single most dangerous seam; bottleneck moving upstream
Nitroguanidine	One producer (Alzchem); doubling in progress, single-company	High	\$100-150m; 3-4 yrs	Publicly priced by US DoD \$150m commitment
Hexamine	Thin, consolidating; re-shoring wedge (economic not technical concentration)	Moderate	Supply agmts now; plant later	Contract cover before RDX plants commission
Nitric / sulphuric acid	Domestic but fertiliser-captive, energy-exposed	Low-mod (drift)	\$20-60m; 2-3 yrs	Cheapest insurance in the complex
DNAN / NTO	Very narrow (NTO ~2 producers)	Low-moderate	\$30-80m; 3-4 yrs	Premium wedge of the IM transition
Toluene, glycerine, copper, billet steel	Broad commodity supply	Low	Certification, not construction	Manage via contracts and certification

THE INVESTABLE PATTERN

Every acute cell in this matrix shares three properties: capex an order of magnitude below the plants it feeds, qualification timelines that reward whoever starts first, and a customer base — every energetics producer at once — that no single plant investment can match. Precursors are the energetics complex's infrastructure layer. Governments have begun pricing this (ASAP's powder-and-explosives weighting, the DoD's Alzchem commitment); private capital largely has not.

07 Indicators and warning

#	INDICATOR	VALIDATES / DEGRADES
1	Chinese export-control actions on linters, NC, NQ or intermediates ^{41 42}	KJ2/KJ3 — dependency crystallising
2	Alzchem NQ doubling: commissioning from H2 2026; US plant progress toward 2029 ^{68 69}	KJ3 — single-source relief timing
3	Wood-cellulose or alternative-feedstock NC qualification announcements ⁴²	KJ2 — mitigation pace
4	Feedstock supply contracts disclosed alongside new TNT/RDX plant milestones	KJ1/S3.4 — plants fed vs plants built
5	European fertiliser/nitric-acid capacity closures or restarts ⁶⁷	KJ4 — acid backbone direction
6	Scale demonstration of NC/NG-free continuous-flow propellant ^{39 40}	KJ2 — technology bypass
7	New NTO/DNAN capacity announcements ²⁶	S3.5 — IM chain depth
8	Precursor price movements diverging from underlying commodity indices	KJ5 — strategic premium emerging
9	Alzchem H2 2026 commissioning: on-time doubling vs slippage ⁶⁸	KJ3 — single-source relief
10	UK MOD energetics pipeline award decisions and grant-window uptake (Q3 2026, Q2 2027, Q4 2027) ^{78 87}	KJ6 — buyer-led onshoring
11	First military-grade NC output from Hagedorn-NC and Bergerac; any move on non-Chinese cotton-linters supply ^{77 31}	KJ2 — mitigation reaching the linters stage

FINAL THESIS

Europe is financing the visible layer of its ammunition rebuild and importing the invisible one. The plants being built from Nora to Kraśnik will only run at the rate their thinnest feedstock allows — and several of those feedstocks currently answer to Beijing's export-control policy. Securing the commodity chain is cheaper, faster and less glamorous than building plants. It is also the difference between capacity on paper and rounds in magazines.

Source register

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