

Graphene Has No Birth Certificate

What Executive Order 14415 and China's November Deadlines Mean for Anyone Who Buys, Makes, or Specifies Graphene or Carbon Nanotubes

Abstract

Four dates fall between November 10, 2026 and January 16, 2027. Two are set in Beijing and two in Washington. The Beijing pair are temporary suspensions of export controls on graphite-related materials, and both lapse unless extended. The Washington pair come from Executive Order 14415: a waiver cutoff on January 1, and a due date on January 16 for guidance that will require contractors at every tier within designated critical supply chains to trace those supply chains back to the origin of raw materials.

Only the second Washington date reaches graphite. Graphite is not among the materials the statute names today, so the waiver cutoff does not touch it directly. The tracing duty is broader, and the order leaves "raw materials" undefined.

Graphene and carbon nanotubes sit exactly where that gap matters. The word "graphene" does not carry its feedstock history with it: commercial descriptions can say graphene or graphene nanoplatelets without revealing whether the carbon came from mined graphite, hydrocarbon gas, or waste, and nothing on a purchase order says which. Carbon nanotubes have the same gap, with a catalyst metal added. The newest production routes widen it, because they move the provenance and supply-chain-risk question beyond the mine to inputs such as gas feedstocks, catalysts, substrates, waste streams, and, in some cases, essential energy suppliers. The finding is that the exposure is a documentation gap before it is a supply gap. Four added fields in a purchase specification close the material-specific part of that gap, and a buyer who adds them before November 10 will have written answers before the guidance arrives.

Graphite is not currently a §4872 covered material. The graphene issue arises instead because EO 14415 separately orders raw-material tracing for supply chains the Secretary designates as critical, while Chinese export controls create independent sourcing risk.

1. Four Dates

Date	Set in	What happens
November 10, 2026	Beijing	Suspension of export controls on lithium-ion batteries, artificial graphite anode materials, and related equipment lapses unless extended
November 27, 2026	Beijing	Suspension of the U.S.-specific provisions covering gallium, germanium, antimony, and graphite end-user checks lapses unless extended
January 1, 2027	Washington	Routine waivers under 10 U.S.C. 4872 end for the materials the statute names
January 16, 2027	Washington	Department of War guidance on tracing critical supply chains to raw-material origin is due

Beijing's pair is a pause, not a repeal. Washington's pair is a calendar with statutory force behind it. The buyer sits between them.



Figure 1. Two clocks, set by two governments, running on the same material.

2. What Washington Changed

Executive Order 14415, "Securing America's Defense Supply Chains and Ensuring Domestic Acquisition of Critical Materials," was signed July 20, 2026. It does two separate things, and they reach graphene differently.

The waiver cutoff. Beginning January 1, 2027, the Department stops issuing routine waivers under 10 U.S.C. 4872 for covered materials. Narrower national-security waivers survive only where the prime contractor has an accepted and monitored plan to remove the noncompliant material. As of October 2026 the statute covers samarium-cobalt magnets, neodymium-iron-boron magnets, tungsten metal powder, tungsten heavy alloy and components containing it, tantalum metals and alloys, and molybdenum, with gallium and germanium scheduled to be added on December 18, 2027. Graphite is not on the list. The Defense Federal Acquisition Regulation Supplement definition lags the statute and does not yet list molybdenum. The statute itself shifts on the same date, from material "melted or produced" in a covered country (China, North Korea, Russia, Iran) to material "mined, refined, separated, melted or produced" there. The direction of travel is upstream, toward the mine.

The tracing duty. Section 3 gives the Secretary 180 days, to January 16, 2027, to issue guidance requiring primes and subcontractors at any tier to map their critical supply chains. Contractors must submit a complete indentured bill of materials that traces components, parts, equipment, software, and materials back to the origin of raw materials. If the guidance lands on the deadline, regulations follow by April 16, 2027. This provision is not limited to the statutory list. Law-firm analysis notes that the order defines none of "critical minerals," "critical materials," or "raw materials." The duty attaches to supply chains the Secretary designates as critical, so which acquisitions are designated is the first open question.

Within a supply chain the guidance covers, the order states no mass threshold. A kitchen required to name the farm behind every ingredient does not care that the pepper weighs a gram.

3. What Beijing Is Holding

China announced licensing for certain graphite items in October 2023, effective December 1 of that year: natural flake graphite and its products, including spheroidized and expanded graphite, and high-purity, high-strength, high-density synthetic graphite. In November 2025, after leaders' talks, Beijing suspended a further package. Decision No. 58, covering lithium-ion batteries, artificial graphite anode materials, and related equipment and technology, is paused through November 10, 2026. A separate suspension of the U.S.-specific provisions of the December 2024 announcement runs to November 27, 2026. The military end-use prohibition in that announcement is reported to remain in force.

The concentration numbers explain why the pauses matter. USGS estimated that China produced about 65% of world graphite in 2022, while North America produced 1.2%, all of it in Canada and Mexico. Trade press reports that China refines more than 90% of the graphite that becomes battery anode material.

China accounts for roughly 65% of global graphite mine production and more than 90% of processing for battery-anode graphite. Those figures describe different stages and different populations, so they cannot be combined into a single probability for any given unit of material.

They do show that a non-Chinese mine origin does not establish a non-Chinese processing origin.

Two cautions apply. The shares are global production shares, not any one buyer's sourcing, and a buyer can choose differently. And graphite is a proxy for graphene feedstock, which is a smaller and different market. The refining figure comes from trade press rather than a primary statistical series.



Figure 2. Four specimens, one chain. Each hand-off is a place where origin can be lost.

4. Graphene Is Not One Supply Chain

The label covers at least three production routes with different exposure, and Section 5 adds the newer ones.

Top-down exfoliation starts from graphite and inherits the full concentration above. Producers themselves say the vast majority of graphene made today is derived from graphite.

Chemical vapor deposition builds graphene from a carbon-bearing gas on a metal substrate. It avoids mined graphite and introduces a catalyst substrate and a gas supply. Depending on how the implementing guidance defines in-scope materials, suppliers, and essential services, those inputs may become relevant to the mapped critical supply chain.

Hydrocarbon-gas detonation converts gas directly into graphene without a graphite step. HydroGraph, a Texas producer, describes its process this way and says its first commercial phase is scaling toward 360 tons per year. The company has also asked the federal government to designate graphene a critical material under the Defense Production Act. Those are company statements, and the capacity figure is a plan, not output.

Domestic production carries its own gate. Graphene Manufacturing Group, an Australian

producer, has submitted an amendment application to the EPA seeking approval to manufacture graphene and its coating, lubricant, and coolant-additive products in the United States, replacing a notice filed in June 2026 on EPA's guidance, and says it expects approval by the end of September 2027. Its existing approval covers export, distribution, sale, and use of coatings, not domestic manufacture.

Same label, different kitchens. A buyer who writes "graphene" on a purchase order has said nothing about which kitchen the material came from, and the tracing duty asks exactly that.



Figure 3. Two origins, two graphene materials whose feedstock history is not visible on inspection.

5. Carbon Nanotubes and the New Routes

The same provenance problem extends beyond graphene. Carbon nanotubes (CNTs) carry it too. A widely used nanotube route is catalytic chemical vapor deposition: a carbon-bearing gas meets a metal catalyst, typically iron, cobalt, or nickel, and tubes grow. The carbon source, the catalyst, and the energy supply are three separate inputs, and none appears in the label "CNT." Nanotubes are already sold into batteries. OCSiAl, a single-wall nanotube producer, announced new dispersions for silicon-rich anodes, high-energy cathodes, and solid-state cells in April 2026 and says it plans to quadruple nanotube capacity, with a Luxembourg project supporting up to 1,000 tonnes. Those are company statements and plans.

The newer production routes matter here for one reason: they change what the origin question is.

Route	Carbon source	Other inputs that may matter	Evidence
Exfoliation of graphite	Mined or synthetic graphite	Mine, processor, chemicals	Industry norm
Detonation of hydrocarbon gas	Acetylene	Gas supplier, reactor site	Company claims; 360 tons/year targeted
Methane decomposition (graphene)	Natural gas	Gas supplier, hydrogen co-product	Company claims
Flash Joule heating	Coke, biomass, rubber, food waste	Waste stream, grid power	Company claims
Floating-catalyst CVD (methane to hydrogen and CNTs)	Methane	Catalyst, gas recycling, hydrogen offtake	Peer-reviewed, reactor scale
Molten-carbonate CO ₂ electrolysis	Captured CO ₂	Electricity, nickel and steel electrodes	Peer-reviewed, laboratory scale

Three developments deserve a sentence each. HydroGraph's Texas plant at Bellville has a 10-year acetylene supply contract with Western International Gas & Cylinders, targets up to 360 tons per year initially and more than 750 later, and expects the facility to open in the first half of 2027, according to company-sourced trade coverage. A named gas supplier under a long contract is what a feedstock record looks like. Cambridge researchers reported in *Nature Energy* in January 2026 a multi-pass floating-catalyst reactor that converts methane to hydrogen and nanotubes with gas recycling; they argue that selling the carbon can offset the cost of low-carbon hydrogen. Universal Matter says its flash Joule heating process, which heats feedstock to over 3,000 degrees Celsius with a burst of electricity, accepts petroleum coke, biomass, recycled rubber, carbon black, and food waste, and that its graphene is more than 99% carbon. And the molten-carbonate route, developed by Stuart Licht at George Washington University, turns carbon dioxide into nanotubes using nickel and steel electrodes; the account verified for this article is a 2017 laboratory-stage report, and no commercial output was verified.

New use cases follow the same pattern. Peking University reported in July 2024 a tensor processing unit built from 3,000 carbon-nanotube transistors; institutional coverage quotes the team as claiming advantages over commercial silicon transistors in speed and power. Georgia Tech reported in January 2024 the first functional graphene semiconductor, grown epitaxially on silicon carbide wafers, with ten times the electron mobility of silicon. Graphene Manufacturing Group says its G-Fluid additive raises heat transfer about 20% in company testing when dosed

at 1% into demineralized water, a data-center cooling application. HydroGraph lists aerospace lightweighting, electromagnetic shielding, thermal management, and infrastructure. Every one of these is a laboratory result or a company claim, and every one lands the material in a high-value assembly: a chip, a battery, a cooling loop, an airframe. Those are the assemblies where a bill of materials gets read.

Two consequences for the specification. First, a graphene or nanotube made from gas or waste has no mine, so its material-provenance record begins with the carbon feedstock and the conversion site; catalysts, substrates, process gases, and essential energy suppliers may also become relevant to the broader critical-supply-chain map. The semiconductor example adds a silicon carbide wafer, which is itself a material with an upstream. Second, "not from graphite" is not the same as "not exposed." It moves the exposure to whatever replaced the graphite.

6. The Specification Problem

Suppose a 1,000 kg composite structure carries graphene as an additive; the arithmetic for nanotubes is the same. The loadings below are illustrative and are not drawn from any specific product.

Loading (wt%)	Graphene in the part
0.1	1 kg
0.5	5 kg
2.0	20 kg

The masses are small. The order itself states no mass-based exemption for in-scope supply chains, so low loading does not by itself remove the provenance question. Whether the implementing guidance creates de minimis thresholds remains open.

A specification designed for the provenance problem should capture at least four fields.

1. **Production route.** Name the specific process: top-down exfoliation, chemical vapor deposition, hydrocarbon-gas detonation, flash Joule heating, methane decomposition, CO₂ electrolysis, or other. State whether the material is graphene or a nanotube and, for nanotubes, single-wall or multi-wall.
2. **Feedstock identity and origin.** For graphite: mine, country, and grade. For gas: supplier and country. For waste or coke: the stream and its source. Include catalysts and substrates, such as the catalyst metal for nanotubes or the wafer for epitaxial graphene.
3. **Conversion site.** The legal entity and country where the graphene or nanotube material was produced.
4. **Last-processing country,** plus the evidence behind each answer, graded A (independent third-party documentation), B (primary commercial records), C (supplier attestation), or U (unknown or unverified).

"Unknown" is a valid entry. A blank is not. A supplier's statement of origin is self-reported evidence, not independent verification, and the record should show which grade the buyer holds.

7. Markers

These propositions can be scored against public events.

- **M1.** Neither suspension lapses into operative controls before December 1, 2026; each is extended or replaced first. Falsified if either regime becomes operative before that date.
- **M2.** The Department's tracing guidance is published on or before January 16, 2027. Falsified if it is later.
- **M3.** The guidance requires provenance below the immediate material supplier for at least some designated critical supply chains. Falsified if it limits provenance to the immediate supplier. Scored when the guidance is published.
- **M4.** A publicly available defense solicitation or contract clause issued after implementation requires raw-material provenance for a material not independently listed as a §4872 covered material. Scored PASS on the first documented example; scored NO PUBLIC EXAMPLE if none is identified by December 31, 2027.

8. So What

If your product contains graphene or carbon nanotubes and may enter a Department of War supply chain that the Secretary designates critical under EO 14415, add the four fields to your purchase specification now, send them to every supplier before November 10, and hold written answers by January 16, 2027, the day the tracing guidance is due. Collecting them is prudent even before the Department says which supply chains are in scope.

If you supply graphene or nanotubes, the ability to answer those four fields is part of the product. A producer who can document route, feedstock, catalyst, conversion site, and processing origin will be better positioned to qualify for work where traceability becomes a contractual requirement.

If you allocate capital or policy attention, the working thesis is that the near-term scarce asset in provenance-sensitive defense supply chains is documented origin, not tonnage. Economic sovereignty comes down to being able to prove where your inputs came from.

Limits of This Analysis

- The November 10 suspension is taken from the Ministry of Commerce's own Announcement No. 70. The November 27 provisions rest on secondary summaries, and the military end-use point rests on a single secondary summary and carries no weight in the argument.
- The §4872 covered-material list and its effective dates were checked against Cornell Legal Information Institute's reproduction of the current U.S. Code; the official House and GPO sites were not reachable at the time of the check. The DFARS definition lags the statute and does not yet include molybdenum.
- HydroGraph, Graphene Manufacturing Group, Universal Matter, and OCSiAl statements, including capacities and performance figures, are company claims or plans. The Peking University, Georgia Tech, and Cambridge results are laboratory reports and do not establish commercial production.
- The Georgia Tech and Peking University results are from 2024, and no newer replications were reviewed. The Licht account is from 2017, and commercial output was not confirmed.
- The Order requires a bill of materials traced to raw-material origin for designated supply chains. Whether catalysts, substrates, process gases, or energy suppliers fall inside that duty, or only inside broader supplier mapping, depends on guidance not yet issued.
- Concentration figures describe graphite, not graphene feedstock, and the mining and processing shares are not combined.
- Which supply chains fall under Section 3 depends on the Secretary's designation and on guidance not yet issued.
- Nothing here is legal or investment advice.

Disclosure

The author is the founder of a company that develops graphene-enabled materials.

Sources

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