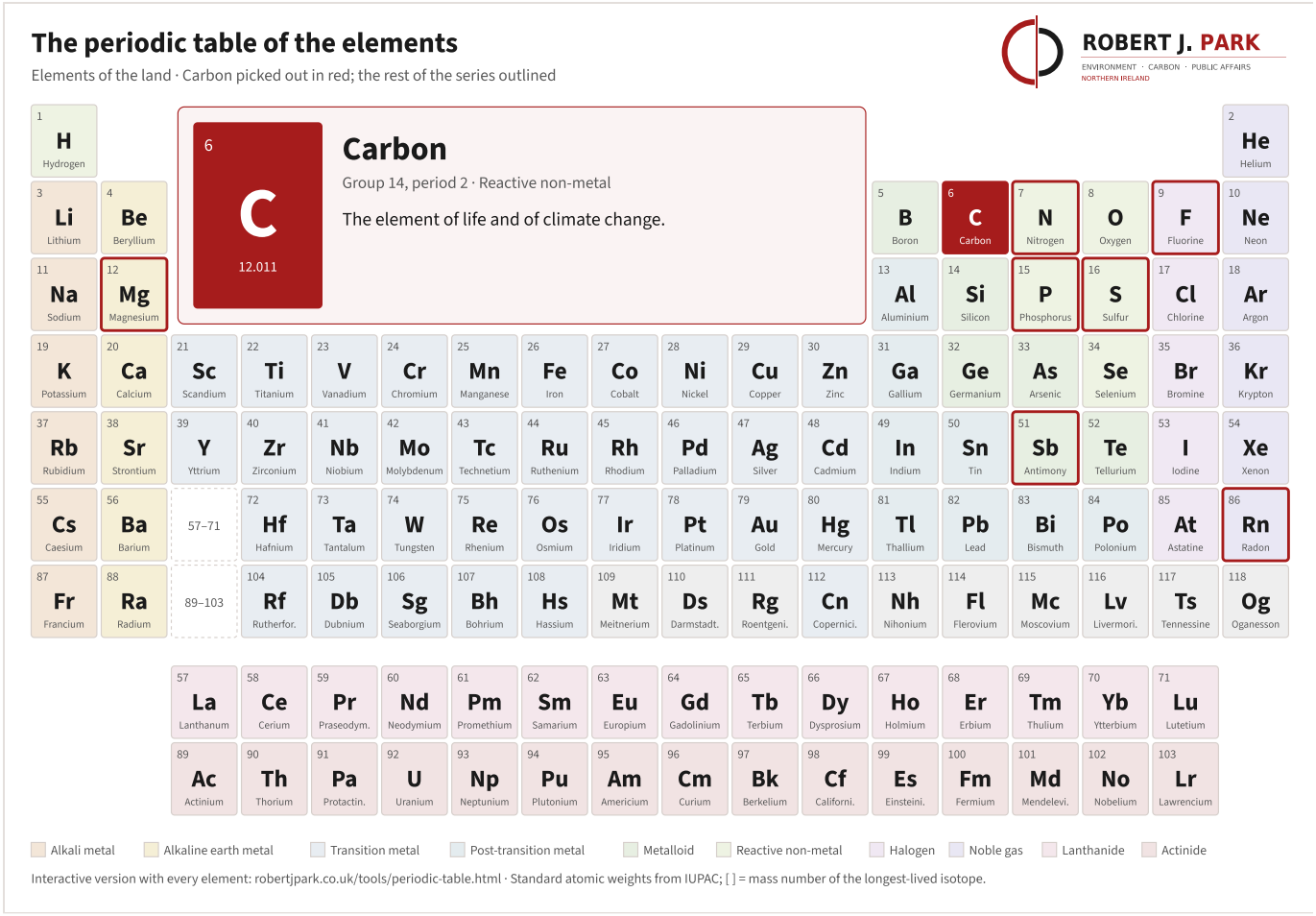
LEARNING BRIEFING · CLIMATE · SOIL · LAND · AGRI-FOOD · ATMOSPHERE

Carbon: the element we count

Element 6 is in every living thing, every fuel and every limestone hill. Climate policy is mostly the business of counting where it goes.



Carbon in the full periodic table. Interactive version with every element: robertjpark.co.uk/tools/periodic-table.html

Carbon is the element of life. It forms long chains and rings with itself and four bonds with almost anything, which is why there are millions of carbon compounds. It is also the element of climate change, because burning carbon fuels and disturbing carbon stores puts carbon dioxide into the air faster than nature can take it back.

The element in one minute

- **Number 6**, group 14, period 2. A non-metal.
- **Many forms:** graphite, diamond, graphene, soot and charcoal are all carbon.
- **Carbon-14**, a radioactive isotope, dates anything that was once alive, back about 50,000 years.

Climate

- **Carbon dioxide (CO_2)** is the main cause of warming and lasts centuries to millennia once released.
- **Methane (CH_4)** is far stronger but shorter-lived: about 28 times CO_2 over 100 years (the AR5 value the UK inventory uses), lasting around 12 years.

- **In Northern Ireland**, CO_2 was 61.5% of greenhouse gas emissions in 2023 and methane 30.2% (NISRA, June 2025). Net emissions were 18.4 million tonnes CO_2e in 2024 (DAERA, 9 June 2026).

Soil and land

Soils hold more carbon than the atmosphere and all plants combined. Most of Northern Ireland's land carbon is in peat: blanket bog on the uplands and raised bog in the lowlands. Healthy, wet peat locks carbon away; drained, cut or burnt peat gives it off as CO_2 for decades.

Mineral soils under grass also store carbon, and gain or lose it slowly. Changes are hard to measure and easy to reverse, which is why claims about soil carbon need care.

Agri-food

Agriculture was Northern Ireland's largest emitting sector in 2024: about 5.8 of 18.4 million tonnes CO_2e, or around 31% (DAERA 2024 inventory). Most of it is methane from cattle and sheep digesting grass, with nitrous oxide from soils and CO_2 from fuel. The sector's emissions have risen since 1990 while others fell.

Food processing adds energy use, refrigeration and packaging. The same carbon inventory method that a farm uses runs right through the supply chain.

Atmosphere

Carbon dioxide in the air has risen from about 280 parts per million before industry to over 420 today. Methane has more than doubled. Black carbon (soot) from diesel and solid fuels also warms by absorbing sunlight, and harms health.

Why it matters in Northern Ireland

Northern Ireland's emissions fell much less than the rest of the UK's between 1990 and 2023: 31.5% against 52.7% for the UK as a whole (DAERA, June 2025). Its large livestock sector and peatland are the reasons, and the two biggest levers.

For businesses, carbon is now counted at the border too: EU CBAM applies to iron and steel, aluminium, cement, fertilisers, hydrogen and electricity, and UK CBAM begins on 1 January 2027.

The rules (as at 21 November 2026)

- **Climate Change Act (Northern Ireland) 2022:** net zero by 2050.
- **Carbon budgets:** set by the Climate Change (Carbon Budgets 2023–2037) Regulations (Northern Ireland) 2024 at average annual reductions of 33% (2023–27), 48% (2028–32) and 62% (2033–37) against the baseline, with a 77% target for 2040 (DAERA).
- **Climate Action Plan:** the draft plan for 2023–2027 was consulted on from 19 June to 8 October 2025.
- **Workplace:** COSHH applies to carbon monoxide, carbon dioxide and carbon dusts.

Safety and handling

COSHH applies to carbon dusts (carbon black, graphite, coal) and to carbon monoxide and carbon dioxide. Most deaths come from carbon monoxide (combustion in poorly ventilated spaces) and from CO_2 build-up in cellars, silos and slurry stores.

Form	Classification (CLP)
Carbon: graphite, diamond	Not classified.
Carbon black	No harmonised CLP classification; IARC Group 2B. Combustible dust.
Activated carbon and charcoal	May be self-heating (class 4.2 for transport) depending on test results.

Substance	Workplace exposure limit (EH40/2005)
Carbon black	3.5 mg/m³ LTEL; 7 mg/m³ STEL
Carbon dioxide	5,000 ppm LTEL; 15,000 ppm STEL
Carbon monoxide	20 ppm LTEL; 100 ppm STEL
Graphite	10 mg/m³ LTEL inhalable; 4 mg/m³ LTEL respirable

UN number	Proper shipping name	Class
UN1361	Carbon, animal or vegetable origin (e.g. charcoal)	4.2
UN1362	Carbon, activated	4.2
UN1013	Carbon dioxide	2.2
UN2187	Carbon dioxide, refrigerated liquid	2.2
UN1845	Carbon dioxide, solid (dry ice)	9
UN1016	Carbon monoxide, compressed	2.3 (2.1)
UN1971	Methane, compressed (or natural gas)	2.1
UN1972	Methane, refrigerated liquid (LNG)	2.1

Risks of the element itself. Elemental carbon is low in toxicity, but its dusts can explode and charcoal can self-heat in storage. Carbon monoxide gives no warning. Carbon dioxide is heavier than air and collects in pits and slurry tanks; dry ice in a vehicle or cold room can reach dangerous levels.

Classification and limits change. Always work from the supplier's current safety data sheet and your own COSHH assessment.

Compounds you will meet

Where you meet it	Compound	Why it matters
Nature	Carbon dioxide (CO_2)	about 0.04% of air and rising
	Methane (CH_4)	from wetlands, ruminants and landfill
	Calcium carbonate ($CaCO_3$)	limestone, chalk, shells
	Soil organic matter and peat	the land carbon store
Manufacturing	Coke and coal	reducing agent in blast-furnace steel
	Clinker (from limestone)	cement; covered by EU and UK CBAM
	Carbon black	tyres, inks, plastics
	Graphite	battery anodes, electrodes, lubricants
	Plastics and fuels	almost all made from fossil carbon
	Biochar	charcoal made for soils
Climate	Carbon dioxide	GWP 1 by definition; lasts centuries to millennia
	Methane	100-year GWP 28 (AR5, as used in the UK inventory); lasts about 12 years
	Black carbon (soot)	warms by absorbing sunlight and darkening snow
	Carbon monoxide	not a direct greenhouse gas, but extends methane's life

What this means

- **For businesses:** a carbon inventory is the starting point for CBAM, for customers' questions and for cutting fuel bills.

- **For landowners:** wet peat is a carbon store worth protecting; drained peat is a source you are already counted for.
- **For policy:** in Northern Ireland, carbon policy is farm and land policy. The numbers leave no other route to the budgets.

Sources

- NISRA, Northern Ireland greenhouse gas emissions down 7.1% in 2023 (10 June 2025) and DAERA, statistics 1990–2023 released (June 2025).
- DAERA, Northern Ireland greenhouse gas statistics 1990–2024 released (9 June 2026) and statistical bulletin.
- Climate Change Act (Northern Ireland) 2022.
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- HSE, EH40/2005 Workplace exposure limits (4th edition, January 2020).
- UNECE, ADR 2025.

All sources checked 21 November 2026.

Online version: robertjpark.co.uk/blog/2026/11/carbon-the-element-we-count/

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General information as at 21 November 2026, not legal, safety or agronomic advice. Work from current safety data sheets and your own COSHH assessment. Created with assistive technology including AI and re-checked against the official sources listed.