IN THE MATTER OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THE PARIS AGREEMENT

Re: Inclusion of non-CO_2 aviation emissions in Nationally Determined Contributions

---

LEGAL ADVICE

INTRODUCTION

1. We are instructed by Transport & Environment and Opportunity Green, both leading non-governmental organisations advocating for the decarbonisation of domestic and international transport and a reduction in the climate impacts of the aviation sector. We are asked to advise on whether any legal obligation exists requiring Parties to the Paris Agreement to include non-CO_2 emissions from domestic and international aviation in their Nationally Determined Contributions ("**NDCs**").

2. This Advice will briefly address the broader position regarding the inclusion of international aviation emissions as a whole within NDCs, before turning to the more specific question of non-CO_2 aviation effects: comprising emissions of nitrous oxides (NOx), water vapour (H2O), sulphur dioxide (SO2) and soot particles, and the atmospheric processes to which these emissions give rise, such as the formation of ozone (O3) and increased cirrus cloudiness from persistent condensation trails ("**contrails**").

3. For the reasons set out in detail below:
   (a) As previously advised in 2021, the United Nations Framework Convention on Climate Change ("**UNFCCC**") and the Paris Agreement impose legal obligations on Parties to take steps to pursue economy-wide emissions

reduction measures.[1] Notwithstanding the text of paragraph 53 of the "Paris Rulebook" in Decision 18/CMA.1, which fails correctly to reflect the legal obligations imposed by the Agreement itself, or the stated position in the 2006 *Guidelines for National Greenhouse Gas Inventories* published by the International Panel on Climate Change ("**IPCC**"),[2] it follows as a matter of law and logic that Parties to the Paris Agreement must include international aviation emissions in their NDCs, though the European Union ("**EU**") and its Member States are currently the only Parties to do so.

(b) We consider that the obligation on Parties under Article 3 of the Paris Agreement to "undertake and communicate" NDCs and on developed country Parties under Article 4(4) to undertake "economy-wide absolute emission reduction targets" in pursuit of the long-term temperature goal under Article 2 create a legal obligation on (especially developed country) Parties to include non-CO_2 aviation effects in their NDCs. This is because:

i. The first long-term goal under Article 2(1) of the Paris Agreement is expressed in terms of temperature rather than a reduction in emissions of specific greenhouse gases ("**GHGs**"), in contrast with the approach previously taken under the Kyoto Protocol. Non-CO_2 effects have a warming impact and are plainly relevant to the achievement of the long-term temperature goal.

ii. The language of the Agreement indicates that emissions reductions should be economy-wide, with no carve out for specific sectors or categories of emissions.

iii. Article 3(3) of the UNFCCC and established caselaw require a precautionary approach to environmental protection to be taken where scientific uncertainty exists. The Paris Agreement requires measures to be based on the best available science and does not require scientific certainty before action is taken.

---

1 Legal analysis by Estelle Dehon KC for Transport & Environment on the inclusion of international aviation and shipping emissions in Nationally Determined Contributions (3 May 2021), https://www.transportenvironment.org/uploads/files/Re-Aviation-Shipping-NDC-UPDATED-Legal-Advice-Final-3-5-21-corr-1.pdf

2 IPCC, *Guidelines for National Greenhouse Gas Inventories*, Vol. 1, pp. 1.5, 8.4; Vol. 2, pp. 3.55, 3.65, https://www.ipcc-nggip.iges.or.jp/public/2006gl/.

(c) Our conclusions on the proper interpretation of Parties' obligations under the Paris Agreement are bolstered by:

i. the 2024 Advisory Opinion by the International Tribunal on the Law of the Sea ("**ITLOS**") concerning states' obligations to take measures to address pollution of the marine environment through GHG emissions, which clarified that traditional principles of customary international law regarding transboundary harm could be applied to GHG pollution and that participation in joint measures might not be enough to discharge states' individual responsibilities to prevent or reduce this harm; and

ii. the 2025 Advisory Opinion by the Inter-American Court of Human Rights ("**IACHR**") on the climate emergency and human rights, which specifically clarified that, to comply with their international human rights obligations, State Parties to the American Convention on Human Rights must put in place urgent mitigation measures to reduce emissions of long- and short-lived climate pollutants, with specific reference made to non-CO2 aviation effects and to extra-territorial emissions.

iii. the 2025 Advisory Opinion by the International Court of Justice ("**ICJ**") on the obligations of states in respect of climate change, which confirmed the legally binding nature of the Paris Agreement obligations. It also indicated that the failure of a State to take appropriate climate action may constitute an internationally wrongful act, which is attributable to that State, and that this includes an obligation to regulate the emitting activities of private actors as a matter of due diligence.

REASONS

FACTUAL BACKGROUND

Scientific understanding of non-CO_2 aviation effects

4. Emerging scientific understanding of non-CO_2 aviation effects was first brought to the attention of policymakers and the public in a 1999 special report, published by the Intergovernmental Panel on Climate Change ("**IPCC**"), on 'Aviation and the Global Atmosphere'. This report addressed the role of NOx emissions in the

formation of persistent contrails and extensive cirrus clouds, finding a positive correlation between the two in what were (at the time) a limited number of studies.[3] It also identified the role of NOx emissions in changing atmospheric ozone and methane concentrations as key uncertainties for future research to address.

5. Crucially, however, even accounting for uncertainty and excluding changes in cirrus clouds, the report found that the impact of aviation on radiative forcing ("**RF**") (i.e. the net change in the energy balance of the planetary system due to a natural or manmade perturbation) over the period 1992 to 2050 would likely be two to four times greater when non-CO_2 effects were accounted for than if aircraft carbon-dioxide were considered alone.[4]

6. In the United Kingdom, a 2009 report by the Climate Change Committee ("**CCC**"), 'Meeting the UK aviation target – options for reducing emissions to 2050', noted that there was already "high scientific confidence that the total climate warming effect of aviation is more than that from CO_2 emissions alone".[5] In particular, impacts from induced cirrus cloudiness, while subject to a wide confidence interval, were identified as potentially causing far greater radiative forcing than CO_2 impacts alone.[6] The report also anticipated that these effects were likely to be included "in any international framework to address global emissions" as scientific understanding developed further.[7]

7. In 2017, as part of the revision of the EU Emissions Trading System ("**ETS**") regarding aviation, the European Commission requested an updated analysis of the current state of scientific knowledge and remaining uncertainties around non-CO_2 aviation effects from the European Union Aviation Safety Agency ("**EASA**").

---

3 IPCC, Special Report: Aviation and the Global Atmosphere (1999), p. 8, section 4.6.
4 *Ibid*, pp. 8-9, section 4.8.
5 CCC Report, Meeting the UK aviation target – options for reducing emissions to 2050 (2009), p.120, https://www.theccc.org.uk/publication/meeting-the-uk-aviation-target-options-for-reducing-emissions-to-2050/
6 *Ibid,* Box 6.1, reproduced from Lee et al. (2009) 'Aviation and global climate in the 21st century'. *Atmospheric Environment*.
7 *Ibid*, p. 120.

8. The EASA analysis, published in 2020, used the effective radiative forcing ("**ERF**") metric to measure the warming impact of non-CO_2 aviation effects on the climate, instead of the older RF metric.[8] Among the key conclusions of the analysis were that:
   (a) "The largest aviation non-CO_2 impacts that can be calculated with 'best estimates' are those from 'net-NOx' and contrail cirrus, both of which have significant uncertainties in their magnitude, particularly contrail cirrus"; and
   (b) "The Effective Radiative Forcing (ERF) from the sum of non-CO_2 impacts yields a net positive (warming) that accounts for more than half (66%) of the aviation net forcing in 2018."[9]

9. In its 2018 Special Report on Global Warming of 1.5°C, the IPCC evidenced robust differences in the extent and seriousness of harmful impacts between a temperature rise of 1.5°C and 2°C. This was emphasised by the ICJ in its Advisory Opinion, which cited the "high confidence" conclusion in the 2018 Special Report that warming of 1.5°C is not considered "safe" for most nations, communities and ecosystems and poses significant risks to natural and human systems (§83).

10. Throughout the 2018 Special Report, the IPCC addressed both CO_2 emissions and "non-CO_2 forcers", which included all anthropogenic emissions other than CO_2 that result in radiative forcing, including that caused by aviation.[10] A key conclusion reached by the IPCC was that "[l]imiting warming to 1.5°C implies reaching net zero CO_2 emissions globally around 2050 and concurrent deep reductions of non-CO_2 forcers, particularly methane (*high confidence*)".[11] This is because, without

---

8 Unlike RF, ERF includes tropospheric and land surface adjustments as well as adjustments due to stratospheric temperature change. The report noted at p.8 that the size of various non-CO_2 impacts might be affected by the choice of metric but that "Irrespective of which metric is used, ERF or RF, the largest aviation non-CO_2 impacts remain 'net-NOx' and contrail clouds."

9 EASA, 'Updated analysis of the non-CO_2 climate impacts of aviation and potential policy measures pursuant to EU Emissions Trading System Directive Article 30(4)' (2020), p.7, https://www.easa.europa.eu/en/document-library/research-reports/report-commission-european-parliament-and-council.

10 IPCC, 2018: Global Warming of 1.5°C.An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (SR1.5), see eg Summary for Policymakers (SPM) fn 12. https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf .

11 *Ibid* Technical Summary pg 33; Main Report pg 95.

addressing the non-CO_2 "forcers", the achievement of a temperature goal for limiting warming is not feasible.

11. The IPCC is due to publish a 'Methodology Report on Inventories for Short-lived Climate Forcers' in 2027 to assist in calculating relative contributions to global and regional emissions from various short-lived climate forcers including "NOX, CO, NMVOCs, SO2, NH3, BC and OC, as well as emissions of primary particulate matter relevant for radiative forcing, as appropriate".[12]

12. However, the science is already clear that non-CO_2 aviation emissions have a net warming effect on the climate. It is also established with a high degree of confidence that this effect is larger than that of CO_2 aviation emissions.

Regulatory and policy response

13. Despite the growing scientific consensus that the total climate impact from non-CO_2 aviation effects is equal to or greater than the impact caused by the sector's CO_2 emissions, there has been no substantive regulatory response from the International Civil Aviation Organisation ("**ICAO**"). The ICAO Symposium in 2024 focused on non-CO_2 aviation effects and concluded that they make an important contribution to radiative forcing. However, it proposed nothing to address them, simply stating that "ICAO is closely taking stock of the scientific knowledge on non-CO_2 effects through the new Tracker of Aviation Non-CO_2 emissions initiatives, which is following up the developments on research and initiatives that are addressing these emissions and related effects".[13] ICAO's Carbon Offsetting and Reduction Scheme for International Aviation ("**CORSIA**") applies only to CO_2 emissions.[14]

---

[12] Decision IPCC-LXI-7. Seventh assessment report (AR7) products – Outline of the 2027 IPCC Methodology Report on Inventories for Short-Lived Climate Forcers, https://www.ipcc.ch/report/methodology-report-on-short-lived-climate-forcers/.

[13] ICAO Environment: Non-CO_2 Aviation Emissions, https://www.icao.int/environmental-protection/non-co2-aviation-emissions.

[14] ICAO Resolution A41-22: Consolidated statement of continuing ICAO policies and practices related to environmental protection — Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (2022), https://www.icao.int/environmental-protection/CORSIA/Documents/Resolution_A41-22_CORSIA.pdf

14. The EU ETS requires monitoring, reporting and verification ("**MRV**") of non-CO_2 effects for intra-European flights and flights to the United Kingdom ("**UK**") and Switzerland from 1 January 2025 and will require MRV for long-haul flights to other destinations from 1 January 2027, but there is currently no certainty regarding if or when non-CO_2 effects will be subject to any requirement to surrender allowances under the EU ETS.[15]

15. In respect of NDCs, no Parties to the Paris Agreement currently include non-CO_2 aviation effects within their submitted NDCs and only the EU and its Member States include any international aviation emissions, though some other countries such as the UK include CO_2 emissions from international aviation in their domestic carbon budgets.

16. In terms of existing policy initiatives to promote the reduction of non-CO_2 aviation emissions, funding is available in the UK through the Non-CO_2 Programme, coordinated by the Department for Business and Trade, Innovate UK, and the Aerospace Technology Institute ("**ATI**") to fund research and development in relation to technologies included in the ATI's Non-CO_2 Technologies Roadmap.[16] Funding is also available through UNIC European University's 'Accelerating climate neutral aviation, minimizing non-CO_2 emissions' programme, which is a collaboration between ten European universities.

17. Overall, however, the regulatory and policy response to the known climate risks of non-CO_2 aviation effects has been slow, piecemeal, and lacking in ambition.

LEGAL FRAMEWORK

18. At an international level, the system of legal obligations around climate change has evolved such that parties to the relevant agreements commit themselves to

[15] Commission Implementing Regulation (EU) 2024/2493 of 23 September 2024 amending Implementing Regulation (EU) 2018/2066; see also 'Non-CO_2 Aviation Effects Explainer' from the Dutch Emissions Authority, https://www.emissionsauthority.nl/topics/non-co2-aviation-effects#:~:text=It%20is%20important%20to%20note,situation%20by%20the%20European%20Commission..

[16] Aerospace Technology Institute, Non-CO_2 Technologies Roadmap, March 2024 https://www.ati.org.uk/wp-content/uploads/2024/03/ATI-Non-CO2-Technologies-Roadmap-Report-FINAL-March-2024.pdf.

displaying the highest ambition in the context of the best available science. Where the science is still uncertain, the legal framework of international climate obligations requires the adoption of a precautionary approach.

United Nations Framework Convention on Climate Change and the Kyoto Protocol

19. The overarching international treaty addressing climate change is the UNFCCC. Article 2 states that:

> "The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." (emphasis added).

20. Article 1 includes an expansive definition of GHGs as "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation" and a definition of 'emissions' which recognises that they can include GHG themselves "and/or their precursors".[17]

21. In achieving this objective, Article 3(1) of the UNFCCC obliges developed countries to "take the lead" in combating climate change and its adverse effects, and enshrines the principle of Parties acting "in accordance with their common but differentiated responsibilities and respective capabilities."

22. Article 3(3) requires the Parties to act in accordance with the precautionary principle and takes a broad view of the activities and emissions to be encompassed by the provisions of the Convention, providing that (emphasis added):

> "The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such

[17] A glossary provided by the UNFCCC Secretariat includes a definition of GHG as " Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)." https://unfccc.int/resource/cd_roms/na1/ghg_inventories/english/8_glossary/Glossary.htm.

measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors."

23. The UNFCCC was adopted on 9 May 1992 and entered into force on 21 March 1994. It was ratified by 197 countries and included the European Economic Community ("**EEC**") as a 'developed country party'.

24. The Kyoto Protocol to the UNFCCC, adopted on 11 December 1997 and which entered into force on 16 February 2005 (FCCC/CP/1997/7/Add.1), has 192 Parties. It "operationalises" the UNFCCC by committing 37 industrialised countries and economies in transition, and the EEC (i.e. Parties included in Annex I to the UNFCCC), to limit and reduce GHG emissions in accordance with agreed targets.

25. Unlike the expansive definition in Article 1 of the UNFCCC itself, Annex A to the Protocol includes a closed list of GHGs to which it applies: namely Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6).

26. Article 2(2) of the Kyoto Protocol addresses emissions from aviation and shipping explicitly and provides that:

> "The Parties included in Annex I [to the UNFCCC] shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol [on substances that deplete the ozone layer] from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively."

The Paris Agreement

27. The Paris Agreement was adopted on 12 December 2015 and entered into force on 4 November 2016 and aimed to enhance the implementation of the UNFCCC and

strengthen the global response to climate change, which was acknowledged to be "a common concern of humankind".

28. Article 2(1) commits the Parties (including the European Union) to three core goals, the first of which is the "long-term temperature goal" under Article 2(1)(a): to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change".

29. Applying the Vienna Convention on the Law of Treaties, which provides that states must have recourse to relevant decisions of governing bodies of treaties, which may create legally binding obligations for the parties, the ICJ in its Advisory Opinion concluded that decisions taken by the Conference of the Parties mean that the 1.5°C threshold is "the parties' agreed primary temperature goal for liming the global average temperature increase under the Paris Agreement." (§224).

30. In order to achieve the long-term temperature goal, Article 4(1) requires Parties to "aim to reach global peaking of greenhouse gas emissions as soon as possible" and to "undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century". In other words, the Paris Agreement is not only concerned with a long-term emissions reduction target for 2050 and beyond ("second half of this century"), but requires a significant focus on emissions reductions in the years up to that point.

31. Article 3 concerns nationally determined contributions ("**NDCs**") and provides:

> "As nationally determined contributions to the global response to climate change, all Parties are to undertake and communicate ambitious efforts as defined in Articles 4, 7, 9, 10, 11 and 13 with the view to achieving the purpose of this Agreement as set out in Article 2. The efforts of all Parties will represent a progression over time, while recognizing the need to support developing country Parties for the effective implementation of this Agreement." (emphasis added).

32. The obligations concerning NDCs are further elaborated in Article 4, meaning that the NDC requirements are situated very firmly in the context of both achieving the global temperature goal and of the urgent need to reach global peaking of GHG. Article 4(2) requires each Party to "prepare, communicate and maintain successive nationally determined contributions that it intends to achieve". The verbs used are important – Article 4(2) places a legal obligation on Parties to prepare, communicate and maintain successive NDCs. Parties are also then required to "pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions."

33. Article 4(3) creates further obligation: each Party's successive NDC must represent a progression and "reflect its highest possible ambition, reflecting its common but differentiated responsibilities and respective capacities, in light of different national circumstances." These terms are not defined, giving some flexibility to Parties in applying them to their NDCs, while still imposing the overarching legal obligation of achieving progression.

34. However, the ICJ considered the question of whether, as has sometimes been suggested, the content of NDCs is discretionary, and rejected this argument. It held at §240 that the use of the term "will" in Article 4, paragraph 3 of the Paris Agreement should be understood as being prescriptive, reflecting an obligation for NDCs to reflect the "highest possible ambition", and at §249 that "NDCs must satisfy certain standards under the Paris Agreement. All NDCs prepared, communicated and maintained by parties under the Paris Agreement must, when taken together, be capable of realizing the objectives of the Agreement which are set out in Article 2".

35. In its consideration of measures required to meet commitments made under NDCs, at §252 the Court held that:

> "since the domestic mitigation obligations under Article 4, paragraph 2 [of the Paris Agreement] establish an obligation of conduct, parties are required to act with due diligence in taking necessary measures to achieve the objectives set out in their successive NDCs. Thus, a party's compliance with its obligations to pursue domestic mitigation measures under Article 4, paragraph 2, is to be assessed on the basis of whether the party exercised

due diligence in its efforts and in deploying appropriate means to take domestic mitigation measures, including in relation to activities carried out by private actors. Indeed, as ITLOS observed, the "obligation of due diligence is particularly relevant in a situation in which the activities in question are mostly carried out by private persons or entities" (Climate Change, Advisory Opinion, ITLOS Reports 2024, p. 90, para. 236)."

36. Article 4(4) focuses on developed country Parties, which "should continue taking the lead by undertaking economy-wide absolute emission reduction targets." (emphasis added). "Economy-wide" is not defined, and is not intended to be a term of art, so bears its normal meaning. Article 4(4) reflects the principle of common but differentiated responsibility, which is one of the few elements of persistent consensus since the entry into force of the UNFCCC, through the Kyoto Protocol and into the Paris Agreement. Accordingly, the normative expectation placed on Parties by Article 4(4) is strong.

37. In communicating their NDCs, all Parties are required to provide "the information necessary for clarity, transparency and understanding" in accordance with the decision adopting the Paris Agreement and "any relevant decisions" of the Conference of the Parties ("**COP**").

38. This is reflected in Article 4(13), which provides important further detail in relation to NDCs:

> "Parties shall account for their nationally determined contributions. In accounting for anthropogenic emissions and removals corresponding to their nationally determined contributions, Parties shall promote environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting, in accordance with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement." (emphasis added).

39. Article 4(1) (the global peaking objective), Article 7(5) (enhancing adaptive capacity), and Article 14(1) (the 'global stocktake' provision) all recognise that

Parties' efforts to support climate mitigation and adaptation should be guided by "the best available science". The ICJ endorsed the agreement of the parties before it that the IPCC's reports constitute the best available science (§74).

40. It is significant that the first long-term goal of the Paris Agreement is framed in terms of a temperature target rather than a specific percentage of emissions reductions. Moreover, unlike the Kyoto Protocol, the Paris Agreement does not define relevant GHGs by reference to a closed list. Nor does it enshrine a role for ICAO in pursuing a reduction in emissions from aviation fuels.[18]

41. These changes indicate that the Paris Agreement requires Parties to make ambitious efforts to address emissions of GHGs and/or their precursors, as defined in Article 1 to the UNFCCC from all sources, so as to "prevent dangerous anthropogenic interference with the climate system" (Article 2, UNFCCC), in pursuit of a long-term temperature goal. There is no carve out provided for international aviation emissions to be dealt with outside of Parties' economy-wide NDCs.

The Precautionary Principle

42. As set out above, the UNFCC indicates that Parties should take a precautionary approach to mitigating the adverse effects of climate change, while the Paris Agreement commits Parties to pursuing mitigation and adaptation efforts on the basis of the best available science. The international legal framework recognises that climate science is evolving and that lack of full scientific certainty is not a reason for delaying action. The ICJ concluded that the precautionary approach or principle, as a settled principle of customary international law, applies as a guiding principle for the interpretation and application of the most directly relevant legal rules, including the climate change treaties (§161).[19]

---

[18] That is reflected in the ICJ Advisory Opinion, which addresses ICAO only in relation to obligations arising from "other environmental treaties" (ie not the climate change treaties). The Court emphasised that States parties to instruments and mechanisms established under ICAO "must have due regard to these obligations when taking measures to ensure the protection of the climate system and other parts of the environment." (§317). This sits alongside their obligations under the Paris Agreement.

[19] The Court also concluded at §161 that other settled principles of customary international law also apply: the principles of sustainable development, common but differentiated responsibilities and respective capabilities, equity and intergenerational equity. These principles also support the analysis given below.

43. Historically, a precautionary approach was also endorsed in other international agreements concerning the mitigation of environmental risks, such at the 1985 Vienna Convention on the Protection of the Ozone Layer and the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. The recitals to the Montreal Protocol described Parties as:

> "*Determined* to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge[...]"

44. The ICJ concluded that the Ozone Layer Convention and the Montreal Protocol have a close connection with the issue of climate change and form part of the most directly relevant applicable law in determining states' obligations regarding climate change (§§129 and 324).

45. The precautionary principle is also enshrined in EU law in Article 191(2) of the Treaty on the Functioning of the European Union ("**TFEU**"), which provides that:

> "Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. <u>It shall be based on the precautionary principle</u> and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay." (emphasis added).

46. It has been relied upon as an interpretative aid in a wide range of cases in the European Court of Justice. In the *ARCO Chemie Nederland and Others* cases of 15 June 2000 (Joined Cases C-418/97 and C-419/97) the Fifth Chamber of the General Court of the EU held at §§39–40 that the concept of 'waste' could not be interpreted restrictively in Directive 75/442/EEC (as amended by Directive 91/156/EEC) because Article 174(2) of the Treaty establishing the European Community (the predecessor of Article 191(2) TFEU) required "Community policy on the environment […] to be based, in particular, on the precautionary principle".

47. In *Pfizer Animal Health* (Case T-13/99) on 11 September 2002, the General Court acknowledged that the precautionary principle also applied to legislative instruments concerned with the protection of human health and held that it "must be integrated into the definition and implementation of other Community policies" (§114). It further held that it was not necessary for European Community institutions to wait until a risk had materialised before taking preventive action (§141). Rather a preventative measure may be taken "if the risk, although the reality and extent thereof have not been 'fully' demonstrated by conclusive scientific evidence, appears nevertheless to be adequately backed up by the scientific data available at the time when the measure was taken" [§143].

48. On 6 May 2021, the Court of Justice of the European Union ("**CJEU**") confirmed in *Bayer CropScience AG and Others v European Commission* (Case C-499/18) that the principle provides continued justification for the adoption of restrictive measures even where "it proves to be impossible to determine with certainty the existence or extent of the alleged risk, because the results of studies conducted are inconclusive, but the likelihood of real harm to the environment persists should the risk materialise" (§80).

49. There have even been some circumstances where the courts have applied the precautionary principle more stringently to require that competent authorities be satisfied beyond reasonable doubt that a negative environmental impact will not occur before consent is granted to bring a product to market or proceed with a plan or project, rather than the principle simply providing justification for the imposition of restrictive measures.

50. First, in *Sweden v Commission* (Case T-229/04) on 11 July 2007, the General Court annulled the Commission's decision to approve herbicide paraquat for continued use. Under Article 5(1) of the now repealed Directive 91/414, concerning the placing of plant protection products on the market, substances were able to be included in a list of approved substances in Annex I where "In the light of current scientific and technical knowledge" their residues would not have any unacceptable effects on the environment, human or animal health. Article 5(4) provided for

restrictions to be placed on problematic uses of substances, such that a substance which would otherwise have unacceptable effects could nevertheless be approved under Article 5(1) on a restricted basis. In Case T-229/04, the Court held at §170 that:

> "Since [Article 5(4)] is to be regarded as a limitation on Article 5(1) of Directive 91/414, it must be interpreted in the light of the precautionary principle. Consequently, before including a substance in Annex I to that directive, it must be established beyond a reasonable doubt that the restrictions on the use of the substance involved make it possible to ensure that use of that substance will be in accordance with the requirements laid down in Article 5(1) of Directive 91/414." (emphasis added).

51. Second, and more significant, in being a judgment of the CJEU rather than the General Court, is the judgment in *Waddenzee* (Case C-127/02) on 7 September 2004. This concerned the interpretation of Article 6(3) of the Habitats Directive and its requirement for competent authorities to carry out an appropriate assessment of any plan or project likely to have a significant effect on a protected site.[20] At §44, the CJEU held that:

> "In the light, in particular, of the precautionary principle, which is one of the foundations of the high level of protection pursued by Community policy on the environment, in accordance with the first subparagraph of Article 174(2) EC, and by reference to which the Habitats Directive must be interpreted, such a risk exists if it cannot be excluded on the basis of objective information that the plan or project will have significant effects on the site concerned […]. Such an interpretation of the condition to which the assessment of the implications of a plan or project for a specific site is subject, which implies that in case of doubt as to the absence of significant effects such an assessment must be carried out, makes it possible to ensure effectively that plans or projects which adversely affect the integrity of the site concerned are not authorised[.]" (emphasis added).

[20] Directive 92/43 on the conservation of natural habitats and wild fauna and flora.

52. Thus, in an EU Law context the precautionary principle may be engaged as an interpretive aid to EU legislative instruments and a justification for preventative or precautionary measures to be taken in circumstances where there is credible scientific data indicating a possible environmental risk, even where the full magnitude or likelihood of that risk materialising is not yet understood or may never be fully understood.

53. Elsewhere, the Supreme Court of India held in *Vellore Citizens Welfare Forum v Union Of India* 1996 (5) SCC 647 that the precautionary principle was a principle of domestic as well as customary international law which had "been recognized as part of the law of the land, drawing strength from Article 21 of the Constitution, which guarantees the right to life and personal liberty" (§71). This was reiterated by the Supreme Court in India in *AP Pollution Control Board v Prof M V Nayudu* (1999) 2 SCC 718, which held the precautionary principle is part of customary international law (§27).

54. The Supreme Court of Pakistan held in *Shehla Zia v WAPDA*, PLD 1994 SC 693 referred to the Rio Declaration and adopted the precautionary principle, finding that there will be instances where, rather than maintain the status quo, it is reasonable to take preventative and precautionary measures straight away where there are threats of serious damage, and such measures "should not be postponed merely on the grounds that scientific research and studies are uncertain and not conclusive." (§9).

55. The Supreme Court of Canada held in *Canada Ltée (Spraytech) v Hudson (Town)* [2001] 2 SCR 241 at §31 linked the precautionary principle with the concept of sustainable development and concluded that there was sufficient international state practice for the precautionary principle to be a principle of customary international law.

56. Finally, the Constitutional Court of South Africa applied the precautionary principle in *Fuel Retailers Association of SA v Director-General Environmental Management*, Mpumalanga 2007 (6) SA 4 (CC) at §98, specifically commenting adversely where

the government department and environmental authorities has failed to take seriously the threat of groundwater contamination: "The precautionary principle required these authorities to insist on adequate precautionary measures to safeguard against the contamination of underground water. This principle is applicable where, due to unavailable scientific knowledge, there is uncertainty as to the future impact of the proposed development."

The ITLOS Advisory Opinion

57. In addition to states' obligations under international agreements specifically designed to address the threat of climate change, there are relevant obligations under the United Nations Convention on the Law of the Sea ("**UNCLOS**"). Adopted in 1982 and entering into force in 1994, this Convention lays down a comprehensive regime of rules governing the uses of oceans and their resources.

58. Article 1(1)(4) defines "pollution of the marine environment" as "the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities".

59. Article 194 provides, as relevant:

> "Measures to prevent, reduce and control pollution of the marine environment
>
> 1. States shall take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection.
> 2. States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment[…]

3. The measures taken pursuant to this Part shall deal with all sources of pollution of the marine environment. These measures shall include, inter alia, those designed to minimize to the fullest possible extent:
   (a) the release of toxic, harmful or noxious substances, especially those which are persistent, from land-based sources, from or through the atmosphere or by dumping; […]" (emphasis added)

60. Article 212 provides:

"Pollution from or through the atmosphere

1. States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to the air space under their sovereignty and to vessels flying their flag or vessels or aircraft of their registry, taking into account internationally agreed rules, standards and recommended practices and procedures and the safety of air navigation.
2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.
3. States, acting especially through competent international organizations or diplomatic conference, shall endeavour to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control such pollution" (emphasis added).

61. On 21 May 2024, ITLOS issued an advisory opinion in Case No 31 clarifying States' obligations under UNCLOS to tackle the climate crisis and protect the marine environment from climate harm caused by GHG emissions.[21] ITLOS concluded at §179 that "anthropogenic GHG emissions into the atmosphere constitute pollution of the marine environment within the meaning of article 1, paragraph 1, subparagraph 4, of the Convention", and the obligations on contracting states under Articles 194 and 212 to take all measures necessary to prevent, reduce and control

[21] Request for an Advisory Opinion Submitted by the Commission of Small Island States on Climate Change and International Law, Case No.31, 21 May 2024, https://www.itlos.org/fileadmin/itlos/documents/cases/31/Advisory_Opinion/C31_Adv_Op_21.05.2024_orig.pdf

such pollution, and to put in place laws and regulations to reduce and control pollution of the marine environment through the atmosphere therefore apply to GHG emissions (including aviation emissions.)

62. ITLOS addressed the factors which States should consider in their objective assessment of necessary measures to prevent, reduce and control marine pollution from anthropogenic GHG emissions, finding that "the science is particularly relevant" and twice endorsing the IPCC's finding in SR1.5 concerning the need for deep reductions in non-CO_2 forcers concurrently with reducing CO_2 emissions to net zero (§63 and §§207-210). In light of this, it is clear that the necessary measures required include addressing non-CO_2 emissions.

63. While Article 212 envisages states working "especially through competent international organizations" to establish regional and global rules, standards and practices, the Advisory Opinion was clear that this does not negate the obligation imposed <u>on states</u> by Article 194, to take all necessary measures to reduce pollution of the marine environment from GHGs. The Tribunal concluded at §202:

> "In relation to marine pollution from anthropogenic GHG emissions, given the global and transboundary nature of such pollution, joint actions should be actively pursued. It was contended in this regard that it is only through joint action that global levels of GHG emissions in the atmosphere and the consequent pollution of the marine environment can be prevented, reduced and controlled. While the importance of joint actions in regulating marine pollution from anthropogenic GHG emissions is undisputed, it does not follow that the obligation under article 194, paragraph 1, of the Convention is discharged exclusively through participation in the global efforts to address the problems of climate change. <u>States are required to take all necessary measures, including individual actions as appropriate</u>." (emphasis added).

64. Indeed, the Tribunal went even further, observing at §236 that the "obligation of due diligence is particularly relevant in a situation in which the activities in question are mostly carried out by private persons or entities."

65. A failure to take all necessary measures to combat climate change would therefore place states in breach of their international law obligations under UNCLOS, though ITLOS were not asked to consider what specific acts or emissions might constitute a breach or give rise to a claim for injunctive or compensatory relief (§145).

The IACHR Advisory Opinion

66. In 2023, Chile and Columbia requested an advisory opinion from the IACHR on the obligations on State Parties to the American Convention on Human Rights ("**the American Convention**") to take steps to mitigate and adapt to climate change. The IACHR Opinion was handed down in July 2025 and addressed a range of substantive and procedural rights under the American Convention and, in some cases, the Protocol of San Salvador.[22] Its conclusions are far reaching and will be strongly persuasive in signatory states to the American Convention and likely persuasive elsewhere.

67. The IACHR Opinion is a wide-ranging document, covering a broad sweep of international legal obligations. At an overarching level, the Court affirmed the human right to a stable climate (§§298–299) and set out a range of obligations on States to prevent and mitigate climate risks. These obligations include, *inter alia*, the setting of progressively more ambitious mitigation targets based upon the best available science and taking into consideration the principles of common but differentiated responsibility and intergenerational equity in accordance with the framework established under the UNFCCC and the Paris Agreement (§§323–332) and the setting of human rights-based mitigation strategies to meet those targets.

68. Crucially, the IACHR Opinion is explicit that these strategies do not apply only to CO_2 emissions. The scientific background portion of the text recognises at §50 that, in addition to the long-lived GHGs, CO_2 and N_20, there are short-lived climate

[22] Advisory Opinion AO-32/25 of May 29, 2025. Series A No. 32. Note that the official text of the Opinion has only been published in Spanish as of 7 July 2025, but an unofficial English translation has been published by the Sabin Center for Climate Change Law: https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2025/20250703_18528_decision-1.pdf. Our advice is subject to the official translation being published by the IACHR.

pollutants ("**SLCPs**") which are major contributors to global warming, with footnote 59 including specific reference to aviation contrails. Mitigation strategies, as set out at §337, must include measures to reduce/eliminate SLCPs as quickly as possible. The same paragraph also indicates that consideration must be given to the regulation of activities and sectors whose emissions take place outside of a State's territorial scope. Taken together this constitutes explicit recognition that States must address non-CO_2 aviation effects in their climate mitigation strategies and a strong suggestion that this should include regulation of the full range of international aviation emissions.

The ICJ Advisory Opinion

69. The ICJ handed down its Advisory Opinion on the obligations of states in respect of climate change on 23 July 2025. The first question answered by the ICJ focused on identifying the relevant obligations on States under international law. We have already referred to some of the Court's specific conclusions on the interpretation of the climate change treaties (the UNFCCC, the Kyoto Protocol and the Paris Agreement), in particular in relation to the Paris temperature goal and NDCs. The Court's general conclusion is that the climate change treaties establish stringent obligations on states to ensure protection of the climate system and other parts of the environment from anthropogenic GHG emissions.

70. The second question answered by the ICJ concerned the legal consequences of these obligations. The overarching conclusion of the Court was that the failure of a State to take appropriate climate action may constitute an internationally wrongful act attributable to that State (§221). The Court also held that the obligations on States imposed under the international framework of climate treaties include an obligation to regulate the emitting activities of private actors "as a matter of due diligence" (§428). While the Court did not specifically address short-lived climate pollutants in the same way as the IACHR, its conclusions on States' international law responsibilities under the climate change treaties are plainly relevant to the full range of climate forcing agents and activities.

DISCUSSION

71. This Advice does not repeat at length the contents of previous legal analysis for Transport & Environment in 2021, referred to in fn 1 above, which set out the legal basis for concluding that international aviation emissions must be included in Parties NDCs under the Paris Agreement. That Advice concluded that international aviation emissions plainly fell within the scope of the obligations placed on Parties under Articles 2, 3 and 4 of the Agreement, in particular the obligation on developed country Parties in Article 4(4) to undertake economy-wide emissions reduction targets. The text of paragraph 53 of the "Paris Rulebook" in Decision 18/CMA.1, which states that international aviation emissions should not be included in national totals but reported separately if disaggregated data are available, is contrary to the apparatus of the Paris Agreement itself. The 2006 IPCC Guidelines have not been updated on this point since the Paris Agreement was adopted to reflect its new approach. Both the Guidelines and the Rulebook should be amended to clarify the correct position.

72. Since the previous Advice:

(a) In October 2023, the EU and its Member States submitted updated NDCs for 2030, which sets out how the EU ETS will continue to apply carbon pricing for CO_2 emissions from intra-European flights and departing flights to the United Kingdom and to Switzerland and will begin to apply carbon pricing to emissions from flights involving third countries which do not apply CORSIA from the start of 2027.[23] Thus, the NDCs of a number of developed country Parties now include measures to address at least some CO_2 emissions from international aviation.

(b) As set out above, certain other Parties, including the UK, now include international aviation emissions within their domestic carbon reduction targets, even if they are omitted from their NDCs.

[23] The update of the nationally determined contribution of the European Union and its Member States, 16 October 2023, §14 https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf

(c) The Decision setting out the outcome of the global stocktake at COP28 in December 2023 encouraged "Parties to come forward in their next nationally determined contributions with ambitious, economy-wide emission reduction targets covering all greenhouse gases, sectors and categories" (emphasis added).[24]

(d) The ITLOS Advisory Opinion made it clear that, in addition to their specific obligations under the Paris Agreement, states are also bound by an existing system of international law to take necessary measures to reduce anthropogenic GHG emissions and combat climate change, which includes addressing non-CO_2 forcers.

(e) The IACHR Advisory Opinion went further still, clarifying the existence of a human right to a stable climate and the wide-ranging obligations on states to put in place effective mitigation strategies to meet their mitigation targets under the UNFCCC/Paris Agreement framework. As set out above, it also clarified that these strategies should encompass short-lived climate forcing agents, including aviation contrails, and consider extra-territorial emissions.

73. All of these developments further indicate that the climate impact of international aviation is something which can and should be addressed at a national level. There is no carve out under the Paris Agreement to exclude international aviation emissions from Parties' NDCs nor any text indicating that addressing such emissions should fall within the exclusive competence of ICAO. This is especially so given that ICAO lacks enforcement powers and its CORSIA scheme is limited in scope, currently voluntary, based on off-setting of emissions rather than carbon pricing, due to end in 2035, and applies only to CO_2 emissions above 85% of the 2019 baseline. CORSIA is not an effective scheme, and states' international legal obligations require a more comprehensive response to reduce international aviation emissions.

[24] Decision 1/CMA.5, Outcome of the first global stocktake, p.7, §39, https://unfccc.int/event/cma-5#decisions_reports.

74. We also consider that these obligations apply to non-CO_2 aviation affects, for several reasons. All of these proceed on the basis that the scientific evidence is clear that these effects have a climate forcing impact that is equal to or greater than aviation's CO_2 effects, even while further research is needed to understand the precise nature and extent of these effects.

75. **First**, the first goal under Article 2 of the Paris Agreement is a long-term temperature goal. It is not expressed as an emissions reduction target by reference to specific GHGs. NOx emissions and persistent contrails are both known to have a net warming effect and addressing them falls within the obligation under Article 3 for Parties to undertake "ambitious efforts" towards achieving the purpose of "[h]olding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels".

76. **Second**, the definitions of GHG and emissions in Article 1 of the UNFCCC are wide in scope, encompassing all "gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation". This definition readily encompasses both NOx and water vapour, which is the primary component of persistent contrails. Unlike the Kyoto Protocol, the Paris Agreement contains no list of GHGs to which its provisions apply, and they should therefore be understood as applying to all anthropogenic emissions with a warming effect, including non-CO_2 aviation emissions. Its architecture is sufficiently flexible to allow Parties to address all contributors to global heating in their NDCs.

77. **Third**, the IPCC SR1.5, which provided the global impetus for the Paris Agreement, was very clear. When it addressed the necessary emissions reduction trajectory to limit temperature rise, it stated with high confidence that reductions in CO_2 emissions must happen concurrently with deep reductions of non-CO_2 forcers, including those caused by aviation. The logical imperative behind this is plain and obvious: without addressing the non-$CO2_2$ "forcers", limitation of warming below a target global temperature is not feasible.

78. **Fourth**, Article 3(3) of the UNFCCC and a large body of caselaw (discussed above) indicate that where there is scientific evidence of an environmental risk, even if that risk is of uncertain magnitude, a precautionary approach should be taken. Articles 4, 7 and 14 of the Paris Agreement also refer to the need for Parties to take measures based on the "best available science" (emphasis added). Complete scientific understanding is not a pre-requisite to action under the terms of the Agreement. In this case, we consider that the proper precautionary approach would encompass measures to address non-CO_2 aviation effects, without waiting for further data on their climate impact to become available via the MRV framework under the EU ETS.

79. **Fifth**, continued delay in addressing these effects while the outcome of further research is awaited is even more unacceptable in the context of the global peaking obligation under Article 4(1), which requires Parties to focus sharply on rapid emissions reductions and not only on the 2050 goal or balancing emissions in the second half of the century.

80. **Sixth**, the reasoning and outcomes of the three international advisory opinions relating to climate change which have, thus far, been published. We are aware that these opinions are advisory. There is, however, a wealth of scholarship on why, particularly within the international legal system, the non-binding nature of such advisory opinions may not blunt their persuasive authority.[25] Advisory opinions certainly have normative and rule-shifting capabilities and form part of the development of international law, with the capacity to clear up ambiguity surrounding specific obligations or principles of international law, and to do so 'at large', beyond the context of a specific dispute.[26] In our view, this will be the case in relation to the ITLOS Advisory Opinion (particularly given the cogency of its

[25] See, for example, Leland M Goodrich, 'The Nature of the Advisory Opinions of the Permanent Court of International Justice' (1938) 32 *AJIL* 738 at 758, observing that "the statement that advisory opinions are purely advisory is formalistic, perhaps even naïve"; Anxhela Mile, 'Emerging Legal Doctrines in Climate Change Law—Seeking an Advisory Opinion from the International Court of Justice' (2021) 56 *Texas International Law Journal* 59 at 68; Edvard Hambro, 'The Authority of the Advisory Opinions of the International Court of Justice' (1954) 3 *ICQL* 2; Hugh Thirlway, 'Advisory Opinion', *Max Planck Encyclopedia of Public International Law* (OUP 2006).

[26] See, for example, in *The Role of Advisory Opinions in International Law in the Context of the Climate Crisis* (Maria Antonia Tigre and Armando Rocha, eds) (Brill | Nijhoff, 2025): Dina Lupin and Ruth Nekura "An Advisory Opinion on Human Rights and Climate Change in the African Regional System" at 164; Antoine De Spiegeleir, "Storytelling in the Advisory Proceedings on Climate Change" at 182.

reasoning) and the IACHR and ICJ Advisory Opinions (particularly given the widescale state participation in the process):

(a) The ITLOS Advisory Opinion makes clear that, even beyond the obligations of the Paris Agreement itself, other principles of customary international law require states to take all necessary measures to avoid certain species of transboundary harm. In a context where aviation emissions are growing year-on-year as a percentage of global emissions and where non-CO_2 effects are likely to represent a majority of international aviation's overall climate forcing impact, we take the view that it is plainly necessary for these effects to be addressed within Parties NDCs.

(b) The IACHR Advisory Opinion is the starkest judicial statement to date that States' obligations to set NDCs under the Paris Agreement apply both to short-lived climate forcing agents including aviation contrails and to emissions from activities and sectors occurring outside of countries' territorial scope. It is virtually impossible to read the Opinion as anything but an explicit endorsement of the inclusion of non-CO_2 international aviation effects within the scope of Parties' NDCs. This Opinion is persuasive, even in states which are not signatories to the American Convention.

(c) The ICJ Advisory Opinion clearly sets out that measures included in State Parties' NDCs must be capable of realising the objectives set out at Article 2 of the Paris Agreement, including the long-term temperature objective. Taken together with its comments on the obligations of States to regulate the activities of private actors as a matter of due diligence, the clear conclusion is that NDCs ought as a matter of international law, to include measures designed to regulate the full scope of the aviation sector's climate impact.

CONCLUSION

81. There is no uncertainty that non-CO_2 aviation effects are having a warming effect on the global climate. This effect was identified a quarter of a century ago by the IPCC and has only become clearer in the years since. Currently no regulatory mechanisms are in place to address these effects at an international level or in the NDCs of any Party to the Paris Agreement. This is incompatible with Parties' obligations under the Agreement, as well as other obligations of customary international law. Applying the proper precautionary approach in light of the best available science, non-CO_2 aviation effects must be included in the forthcoming round of NDCs for 2035, and those Parties which have already submitted NDCs should update them to include such effects.

25 July 2025

ESTELLE DEHON KC
DR LOIS LANE

cornerstone barristers

2-3 GRAY'S INN SQUARE
LONDON
WC1R 5JH