environmental defender's office new south wales

Submission to the Royal Society – 'Geoengineering climate'

The EDO Mission Statement

To empower the community to protect the environment through law, recognising:

- *the importance of public participation in environmental decision making in achieving environmental protection*
- *the importance of fostering close links with the community*
- *that the EDO has an obligation to provide representation in important matters in response to community needs as well as areas the EDO considers to be important for law reform.*

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SUMMARY

This report is submitted by the *NSW Environmental Defenders Office* and *Professor Rosemary Rayfuse of the University of New South Wales* in response to the Royal Society's call for submissions to inform its study on geoengineering the Earth's climate. It addresses terms of reference (3) and (4) which are:

3) To identify further research requirements, and any specific legal and policy implications, and
4) To provide guidance to policymakers by which options can be evaluated.

We have identified international environmental law that imposes limitations on the potential for geoengineering projects and set a framework for the way in which they must be conducted. These general limitations are:

- The duty not to cause transboundary harm,
- The precautionary principle,
- The principle of intergenerational equity,
- The duty to cooperate, and
- The procedural duties to undertake environmental impact assessments, to provide prior and timely notification, to undertake good faith consultation and to obtain prior informed consent.

We have also identified relevant treaties. These are:

- UN Framework Convention on Climate Change 1992,
- Convention on Long Range Transboundary Air Pollution 1979,
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Convention) and Protocol 1996,
- UN Convention on the Law of the Sea 1982, and
- UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques 1976.

To provide guidance for policymakers, we have considered how the law would be relevant in two case studies. These are:

- Sulfur-based aerosols, and
- Ocean iron fertilization.

Overarching recommendation

The EDO recommends that an international body, such as a subsidiary body of the UNFCCC, be established to:

- Coordinate research and exchange of information on geoengineering,
- Ensure that risks are properly identified and assessed, and
- Ensure that obligations under international law are complied with.

A new protocol should be drafted to consolidate all relevant law and establish appropriate procedures and commitments to ensure compliance.

Term of Reference 3: Legal implications of geoengineering – International law applicable to geo-engineering projects

Duty not to cause transboundary harm

A fundamental element of international environmental law is the general obligation of States not to use or allow others to use their territory in a way that can harm the interests of another State. It is established in numerous international treaties and declarations including the UN Convention on the Law of the Sea (UNCLOS), the Rio Declaration and the UNEP Environmental Guidelines,[1] and it has been affirmed several times by the International Court of Justice.[2] Parties to the UN Framework Convention on Climate Change (UNFCCC) are specifically committed to minimising the adverse effects of projects undertaken to mitigate climate change.[3] As geoengineering is intended to have global impacts, this duty suggests that any geoengineering projects which could have adverse effects should not be undertaken.

Precautionary principle

The precautionary principle applies where science is uncertain, placing the burden of proof on those advocating an action that might cause severe or irreversible harm to human health, the economy or the environment. It is established in international instruments such as the Convention on Biological Diversity (CBD), the UNFCCC, the Protocol to the London Convention on the Prevention of Marine Pollution and the Stockholm Convention on Persistent Organic Pollutants.[4] Given the significant scientific concern about geoengineering proposals, the precautionary principle requires that geoengineering projects be delayed until research demonstrates that such concerns are not serious.

Intergenerational equity

This principle highlights the need to consider, and minimize, the impact of activities on future generations. It is established in several environmental instruments including the UNFCCC and the Millennium Declaration,[5] and has been applied in the Philippines Supreme Court and noted in a Canadian court. This principle requires that geoengineering projects likely to have long-term or irreversible effects be avoided.

Duty to Cooperate

The duty to cooperate is a key element of international law, highlighted in Article 1 of the UN Charter.[6] States have the duty to co-operate with one another in order to maintain international peace and security and to promote international economic stability and progress and the general welfare of nations.[7] Given the global effects of geoengineering projects, the duty to cooperate requires States contemplating such activities not to act unilaterally.

Procedural duties

Environmental impact assessments (EIAs) are required under numerous international instruments[8] and in the domestic legislation of over 150 states.[9] The UNFCCC specifically suggests that parties undertake EIAs to minimise the effects of climate change mitigation activities.

The duties to provide prior and timely notification and to undertake good faith consultation with all potentially affected states are established in numerous international instruments.[10] States are also under an obligation to obtain free, prior informed consent from Indigenous communities for activities affecting them.[11] The UNFCCC specifically requires parties to promote and cooperate in the undertaking of research and exchange of information related to the consequences of climate change response strategies.[12] As the impacts of geoengineering are likely to be long term, wide reaching and unpredictable, these duties require states to ensure that research and broad consultation are undertaken before any geoengineering projects are commenced.

Key treaties

UN Framework Convention on Climate Change 1992 (UNFCCC). Parties are committed to minimising the adverse effects of projects undertaken to mitigate climate change.[13]

UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques 1976 (ENMOD). Parties are prohibited from modifying the environment to cause damage or injury to other states. ENMOD highlights the need for precaution in considering geo-engineering proposals and may prohibit any such project that causes adverse effects.[14]

Term of reference 4: Guidance for policymakers – Application of legal principles to two case studies

Case Study 1: Sulphur based aerosols

Following observations of the cooling effects of major volcanic eruptions,[15] one climate geoengineering proposal that has been discussed is to inject sulphate aerosols into the stratosphere to increase the planetary albedo.[16] This would be done by burning sulphur (S_2) or dihydrogen sulphide (H_2S), or a sulphur containing gas such as carbonyl sulphide (COS), carried into the tropical or arctic stratosphere on balloons and by artillery guns, to produce sulphur dioxide (SO_2). Chemical and micro-physical processes will then convert the SO_2 into sub-micrometer sulphate particle to act as condensation nuclei and increase cloud albedo, thereby backscattering solar radiation into space.[17]

Duty not to cause transboundary harm

The use of sulphur based aerosols to geoengineer the climate has the potential to have impacts on the entire world, therefore the likelihood of causing transboundary harm through experimentation or use of this process must be considered. Potential transboundary harms that may be caused include;

- Unintended modification of the climate system, beyond what is intended by using or experimenting with the technique. There is currently insufficient understanding of how aerosols interact with the climate system,[18] particularly

how aerosols interact with cirrus clouds[19] and radiations through the depth of the atmosphere.[20]

- Adverse human health impacts of sulphate particles may occur in transboundary jurisdictions.[21] It is *hoped,* however not known, that releasing sulphur into the stratosphere, rather than the troposphere, will avoid these risks.[22]
- Ecological damage through increased acid precipitation and deposition may affect pristine areas significantly.[23]
- Alteration of regional hydrologic cycles, with tropical and arctic SO_2 injection potentially disrupting the Asian and African monsoon season, reducing precipitation necessary for food supply.[24]
- Ozone depletion has also been raised as a potential side effect of tropical and arctic SO_2 injection.[25] Ozone depletion has impacts on human health and biodiversity.[26]

Precautionary principle

Given the considerable scientific uncertainty on unintended or unknown consequences of using sulphur based aerosols to geoengineer the climate,[27] and given the disastrous consequences if some of these unintended side effects were to occur, the precautionary principle suggests that with the current level of scientific knowledge, experimentation or use of these techniques should not proceed.

Intergenerational equity

Using sulphur based aerosols to geoengineer the climate is likely to be a relatively short term solution, with sulphur needing to be continuously deployed to modify the climate permanently.[28] As the technique only modifies the earth's temperature and not the atmospheric CO_2 concentration, consequences of increased atmospheric CO_2 such as ocean acidification[29] and changes in ecological systems[30] would still occur and require action by future generations.

Although the consequences of using sulphur based aerosols to geoengineer the climate has relatively short term effect (1-2 years),[31] by taking this approach, the longer term consequences of ocean acidification and altered ecological systems as a result of CO_2 concentration are left unmitigated, maintaining the problem for future generations.

Duty to cooperate

This duty suggests that states should not proceed with using sulphur based aerosols to modify the climate unilaterally, and any decision made to further experiment with the method should be made cooperatively to ensure the use of the technique would be beneficial to nations and international peace and security.

Procedural duties

Due to the broad reaching impacts as well as potential disagreement between states about using sulphur aerosols for climate modification, extensive consultation and environmental impact assessment covering, as a minimum, the potential issues raised in this submission should be undertaken before even experimentation of this technique is undertaken. There is also the potential for disagreement between states

on how extensively to use this technique and others to cool the climate, given the different preferences of counties at different latitudes for temperature ranges,[32] highlighting the need for extensive consultation with parties fully aware of potential consequences.

Key treaties

Convention on Long Range Transboundary Air Pollution 1979. Parties to LRTAP have agreed to limit and, as far as possible, gradually reduce and prevent air pollution. Specific actions have been agreed under protocols to the Convention, including reductions in sulphur emissions.[33] Deliberately injecting sulphur into the atmosphere would directly contravene these protocols.

Case Study 2: Ocean Iron Fertilisation

Ocean iron fertilization (OIF) is one of several ocean methods proposed for mitigating climate change. It involves stimulating phytoplankton growth by releasing dissolved iron in certain parts of the open ocean, which then absorbs carbon dioxide (CO_2) from the atmosphere. For the method to work, the phytoplankton must sink to ocean depths.[34] OIF has been studied since 1993 in 12 small-scale experiments.[35] However, the effectiveness of OIF as a carbon mitigation strategy remains uncertain and there are a number of unresolved questions about its impact on the marine environment.[36]

Duty not to cause transboundary harm

Previous OIF experiments have been conducted over relatively small areas (about 100 km^2). However, large-scale experiments (involving the fertilization of ocean patches of about 40,000 km^2, which will cause algal blooms over much larger areas)[37] are now being pursued. The effects of OIF will be spread over large areas by ocean circulation,[38] making it a transboundary issue. OIF has the potential to cause transboundary harm in a number of ways, including due to: toxological impacts of the addition of iron to the ocean; generation of greenhouse gases (in particular dimethylsulphide, nitrous oxide, and methane); creation of low oxygen zones (or dead zones); creation of harmful (toxic) algal blooms; and changes to marine food chains.[39]

Precautionary principle

There is significant scientific uncertainty in relation to both the effectiveness of OIF as a carbon mitigation strategy and its potential impacts on the marine environment.[40] Some scientists argue that large-scale experiments are required to resolve key questions.[41] However, because the effects of OIF will be spread over large areas, conducting experiments to address key uncertainties will be difficult.[42] The precautionary principle suggests a need to keep the size of experiments to a minimum, to control the number of experiments being conducted (eg. through permits), to ensure detailed assessment of potential impacts and risks (including consideration of the sensitivity of the location of experiments), and to ensure extensive monitoring, reporting, and peer-review to enable better predictions of impacts in the future.

Intergenerational equity

There is significant scientific uncertainty in relation to the effectiveness of OIF as a carbon mitigation strategy and, as a number of complex interacting factors are involved, determining the amount of carbon sequestered through experiments is likely to be difficult to do accurately.[43] In addition, there is uncertainty over how long the carbon will be stored in the oceans, although it will be stored over relatively short periods (eg. a few hundred years) rather than geological time scales.[44] These points raise two issues in terms of intergenerational equity: 1) OIF may only make a partial contribution to reducing atmospheric CO_2 levels, and 2) OIF only provides a temporary offset (ie. further mitigation will be required by future generations).

Duty to cooperate

In relation to OIF, the duty to cooperate requires states not to undertake large scale experiments unilaterally and to cooperate to ensure that any use of OIF would benefit nations rather than be detrimental.

Procedural duties

OIF carries potential risks and benefits and has the potential to cause unforseen impacts. Before OIF is undertaken on a large-scale, its impacts on the marine environment must be determined with a reasonable level of certainty and must be communicated to, and acceptable to, society. Society must also be willing to acknowledge and accept unforseen risks. This requires detailed assessment of potential impacts, monitoring and reporting, and extensive community consultation.

Key treaties

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Convention) and Protocol 1996. OIF would require a permit under the London Convention and Protocol.[45] States determining whether to issue such permits would be required to take a precautionary approach "even when there is no conclusive evidence to prove a causal relation between inputs and their effects," and to follow procedures including consultation with other states.[46] In October 2008, Parties to the London Convention and Protocol resolved that marine fertilization activities other than legitimate scientific research projects should not be allowed.[47]

UN Convention on the Law of the Sea 1982 (UNCLOS). Parties have a general duty to protect and preserve the marine environment.[48] Parties to UNCLOS have a duty to cooperate to eliminate effects of pollution and to prevent or minimize damage and, when taking measures to prevent, reduce and control pollution of the marine environment, to ensure that they do not transfer damage or hazards from one area to another or transform one type of pollution into another.[49] At a minimum, parties to UNCLOS would be required to undertake EIAs for OIF, to monitor activities and to share this information.[50] UNCLOS may preclude OIF altogether, however, as transferring excessive greenhouse gases from the atmosphere to the ocean would arguably constitute the transfer of damage and/or hazards.

[1] UNCLOS, Art. 194(2); Rio Declaration 1992, Principle 2; UNEP Principle 3. See also Stockholm Declaration 1972, Art. 21; IUCN Draft International Covenant on Environment and Development 2004, Art. 11.
[2] *Trail Smelter* Arbitration 1941; *Corfu Channel* case (UK v Albania) 1949; *Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons* 1996.
[3] UNFCCC Art. 4(1)(f).
[4] Rio Declaration, Principle 15; World Charter for Nature 1982, Principle 11; CBD, Preamble; UNFCCC, Art 3.3; Stockholm Convention 2001 Arts. 1 and 8; Protocol to the London Convention 1996, Art. 3(1).
[5] UNFCCC, Art 3.1; Millennium Declaration, paragraphs 6, 11 and 21, Stockholm Declaration, Principles 1 and 2; Rio Declaration, Principle 3; UN A/RES/35/8 1980 "Historical Responsibility for States for the Protection of Nature for the Benefit of Present and Future Generations".
[6] See also UN Charter Arts. 55 and 56; Moon Treaty Art. 2; Rio Declaration, Principle 7.
[7] UN Declaration on Principles of International Law Concerning Friendly Relations and Cooperation among States in Accordance with the Charter of the United Nations, 2625 (XXV), 24 October 1970.
[8] EIAs are required in UNCLOS, Art. 204; ILC Draft Article on the Prevention of Transbounary Harm for Hazardous Activities 2001, Art. 7; UNEP Principles on Shared Natural Resources 1978, Principle 4; Espoo Convention on EIA in a Transboundary Context 1991.
[9] Hunter, Salzman and Zaelke (2007) *International Environmental Law and Policy*, p. 533.
[10] Espoo Convention, Arts. 3, 5, 8; ILC Draft Principles on the Prevention of Transboundary Harm from Hazardous Activities 2001; Rio Declaration, Principle 19; OECD Council Recommendation on Principles Concerning Transfrontier Pollution; London Guidelines for the Exchange of Information on Chemicals in International Trade 1989; Montreal Rules of International Law Applicable to Transfrontier Pollution, Art. 8; UNEP Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilisation of Natural Resources Shared by Two or More States 1978, Principles 6 and 7.
[11] UN Declaration on the Rights of Indigenous Peoples; ILO Convention 169 concerning Indigenous and Tribal Peoples in Independent Countries www.ilo.org/ilolex/english/convdisp1.htm.
[12] UNFCCC Art. 4(1)(g) and (h).
[13] UNFCCC Art. 4(1)(f).
[14] See, eg, Alan Robcock "20 Reasons Why Geoengineering May be a Bad Idea" 64(2) Bulletin of the Atomic Scientists 14 (2008), at 17.
[15] Hansen, J., Lacis, A., Ruedy, R. & Sato, M. (1992) 'Potential climate impact of Mount Pinatubo eruption', *Geophysics Research Letter*, 19, 215-218
[16] Most recently by Crutzen, P.J. (2006) 'Albedo enhancement by stratospheric sulfur injections: A contribution to resolve a policy dilemma?' *Climactic Change*, 77, 211-219; Wigley, T. (2006) 'A combined mitigation/geoengineering approach to climate mitigation' *Science*, 314, 452-454.

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[20] Bengtsson, L., Semenov, V. & Johannessen, O.M. (2004) 'The early 20th century warming in the Arctic- a possible mechanism', *Journal of Climate Oct.*, 2004, 4045-4057.
[21] Nel, A. (2005) 'Air pollution-related illness: effects of particles', *Science*, 308, 804.
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[45] Protocol, Art. 2.
[46] Protocol, Art. 3(1).
[47] LC-LP.1(2008), Adopted at the 30th Meeting of Parties to the London Convention and Protocol, October 27-31.
[48] Art. 192.
[49] Art. 199; Art. 195.
[50] Arts. 204-206.