BUOYANT FLAKES OCEAN FERTILISATION PROPOSAL:

Draft Scope, Design and Governance Considerations

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# Introduction

The Indian Ministry of Earth Sciences (MES) has requested a formal proposal from those proffering the Buoyant Flakes Ocean Fertilisation concept that suggests how the Ministry might proceed.

It is thought that a brief document that outlines the proposed scope, design and governance considerations will provide a useful start. Under guidance from government agencies, scientists and industry, lead by India the proposal could evolve into a full-fledged global programme designed to address climate change, ocean acidification, and industrial sustainability.

It should be noted that the Indian Government has already performed scientific research and ocean trials with ocean fertilisation under the joint leadership of Dr. Wajih Naqvi, Director of the National Institute of Oceanography, and Professor Victor Smetacek. This research produced many worthwhile results. However, as it was focussed upon the wild and distant Southern Ocean, as it utilised standard, non-buoyant, fast-release, high-loss, iron-cation-only fertiliser, and as it was curtailed by cost, time and design from detecting the full beneficial effects of its intervention, further trials were not contemplated – until now.

# Scope

Whilst research on buoyant flakes might be considered by some as just another scientific research project to be funded and organised similarly to other such projects, that would be a mistake. This is so for these reasons, amongst others:

* Few, if any, other R&D projects provide the prospect of averting or substantially mitigating a range of developing climate catastrophes, profitably and in time to avoid exceeding environmental tipping points;
* No others offer carbon offsets substantial enough to permit India to become carbon negative; and
* When combined with complementary innovated technologies in the proposed programme, no other known technologies have the capability to become the bases for so many new, sustainable, and job-creating industries.

Nonetheless, such prospects should not prevent the project evolution from proceeding in carefully gated stages.

# Staging

Whilst some stages will overlap and, in order to develop process optimisation rapidly and with assurance, alternative method development should proceed in parallel and possibly in competition, this might represent the broad staging:

1. Proposal refinement, approval, and early-stage, gated funding
2. Theoretical vetting and defence of the buoyant flake science and engineering, including Earth Systems modelling of the likely outcomes
3. Laboratory experimentation and optimisation
4. Industry involvement and business case development, including risk management
5. Governance determination, approvals, and Minicoy piloting
6. Approvals negotiated for, and rights to, biomass harvested from fertilised ocean plumes & their additional carbon sequestration; together with the progressive deployment of buoyant flake technology to: the Arabian Sea, Indian Ocean, Southern Ocean and other nutrient-deficient ocean regions
7. Investigation, development and deployment of complementary technologies, improvements, and uses, such as those for methane-suppressing flakes, flake compositions for other nutrient-deficient ocean waters, optimisation of global logistics, manufacturing & resources, marine cloud brightening (MCB), ice shields, and integrated biorefinery development. These conceptual technologies are likely to be useful in: improving the effectiveness of buoyant flake deployment; in cost reduction; and to ensure that regional cooling occurs in the right order and magnitude to avoid less desirable regional consequences.

# Design

Design and application may well broadly follow that which has been outlined in the presentation https://vimeo.com/128378154 in the documents at <http://envisionation.co.uk/index.php/sev-clarke> together with additional material and updates that can be made available. Buoyant flake and ice shield technologies are available for free, under Creative Commons International Attribution 4.0 licensing.

# Governance Considerations

Whilst nations are principally responsible for climate intervention (CI) activities within their own territorial waters, it will generally be advisable to follow the Oxford Principles as described at <http://www.geoengineering.ox.ac.uk/oxford-principles/principles/> and in more detail at http://www.geoengineering-governance-research.org/perch/resources/workingpaper1rayneretaltheoxfordprinciples.pdf . It is submitted that these principles apply more to pilot deployments than to modelling or laboratory R&D that can have no adverse climatic effect.

Approval for ocean trials whose location or effects may occur significantly outside national boundaries is presently governed by the international London Convention & London Protocol (LC/LP), though moves are contemplated to make the UNFCCC the agency with overall governance authority for activities relating to climate change, such as those listed above. In a recent conference on Marine Geoengineering to the International Maritime Organisation (IMO), the Chair of LC/LP listed both buoyant flakes and ice shields as CI technologies worthy of consideration.