ARTICLE 6.4 MECHANISM

A6.4-SB006-AA-A09

Information note

Compilation of the public inputs on removal activities under the Article 6.4 mechanism

Version 01.0

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Supervisory Body, at its fifth meeting, requested the secretariat to prepare a compilation of all public inputs received so far on activities involving removals, as well as to produce an information note on the elements in A6.4-SB005-A02 - Information note: Guidance and questions for further work on removals (v.02.0) according to the mode of work specified in the introduction to that annex.

2. Purpose

2. The purpose of this document is to provide a compilation of submissions on activities involving removals received prior to the sixth meeting of the Supervisory Body.

3. Current work

3. This document compiles inputs received on activities involving removals, as below:

(a) CMA 4 invited Parties and admitted observer organizations to submit their views on activities involving removals, including appropriate monitoring, reporting, accounting for removals and crediting periods, addressing reversals, avoidance of leakage, and avoidance of other negative environmental and social impacts, in addition to the activities referred to in chapter V of the rules, modalities and procedure by 15 March 2023[1]. Table 1 below lists the Parties and Table 02 below includes the admitted observer organizations who responded to this call.

(b) Table 2 also includes the inputs received:

(i) In response to a specific call by the Supervisory Body that was open between 27 Sep to 11 Oct 2022 on “Activities involving removals under the Article 6.4 Mechanism of the Paris Agreement”[2];

(ii) In response to calls for inputs on issues included in the annotated agenda and related annexes of the meetings of the Article 6.4 Supervisory Body[3];

[1] Details of the call for public input and the full submissions are available at: https://unfccc.int/submissions-guidance-on-the-mechanism-established-by-article-6-paragraph-4-of-the-paris-agreement#Submissions-on-views-on-on-activities-involving-removals-including-appropriate-monitoring-reporting-accounting-for-removals-and-crediting-periods-addressing-reversals-avoidance-of-leakage-and-avoidance-of-other-negative-environmental-and-social-impa

[2] Details of the call for public input and the full submissions are available at: https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism/calls-for-input/sb002-removals-activities

[3] Details of the call for public input and the full submissions are available at: https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism/calls-for-input#__22

(iii) In response to call for inputs in the structured consultation launched by the SB at SB005 which was open from 6 to 19 June 2023[4]. Late submissions received before 30 June 2023 are also included.

(c) Further, the call for inputs from stakeholders on methodology requirements was open from 16 March to 11 April 2023.[5] Relevant inputs received in relation to leakage and permanence are also included in this document under table 02.

4. Part I of this document contains a compilation of inputs received in response to the calls opened prior to SB 005, and Part II (page 88 onwards) contains a compilation of inputs received in response to the call for inputs in the structured consultation launched by the SB 005.

5. Secretariat synthesised, paraphrased and grouped the information in the submissions for easy readability and flow of information. In that process, despite the best efforts, some relevant information may have been unintentionally omitted or not correctly represented. Also, it was difficult to fit some information under the prevailing elements and categories. Moreover, due to some submissions being received late and paucity of time, some inputs may not have been considered. Future iterations of this document will take into account these additional inputs. Readers are encouraged to consult the full submissions available at the "Calls for input" web page of the Supervisory Body's public web site to fully understand the background and context in which proposals are made in the submissions. These are also listed in table 1 and 2 of Part II of this document.

6. In-text citations in this document through an acronym and a reference number (e.g., ROK,57; HLB,1) are included to enable easy access to original submission. Reference section of this document also includes hyperlinks to the submissions.

Table 1. List of Parties who responded to the call for public input

Submission date	Party	Acronym	Reference number
22/05/2023	Russian Federation	RU	53
09/05/2023	United Kingdom	UK	54
02/05/2023	Papua New Guinea on behalf of Coalition for Rainforest Nations	PN	55
17/04/2023	Norway	NW	56
07/04/2023	Republic of Korea	ROK	57
23/03/2023	Colombia on behalf of Chile, Colombia, Guatemala, Panama, Paraguay, and Peru	CO	58
15/03/2023	European Union on behalf of European Union	EU	59

[4] Readers are encouraged to consult the full submissions available at the "calls for input 2023" web page of the Supervisory Body's public web site to fully understand the background and context in which proposals are made in the submissions at: https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism/calls-for-input/sb005-removals-activities

[5] Details of the call for public input and the full submissions are available at: https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism/calls-for-input/sb004-requirements-methodologies.

Table 2. List of stakeholders who responded to the calls for public input

Submission date	Stakeholder	Acronym	Reference number
04/10/22	Hayes Limnology Lab: Ocean alkalinity enhancement using electrolysis	HLB	1
06/10/22	Planetary Technologies: Ocean alkalinity methods	PT	2
10/10/22	GCC: Inputs on Annex 5 to the SB002 annotated agenda	GCC	4
11/10/22	Winrock: ACR & ART input-6.4 removals public comment	ACR	8
11/10/22	Wetlands International: Inputs on removal activities	WI	9
11/10/22	Verdane: Response to UNFCCC Article 6.4 call	VA	10
11/10/22	TREEO: Review Article 6.4 mechanism	TREEO	11
11/10/22	TNC: Removals and REDD-plus	TNC	12
11/10/22	Timber Finance Initiative: Engineered timber as carbon storage	TFI	13
11/10/22	The HBAR Foundation: Response of THF to UNFCC Calls for Input on A6.4M	HBAR	14
11/10/22	Stockholm-Exergi: Contribution by Stockholm Exergi in response to UNFCCC's Call for input 2022	SE	15
11/10/22	Running Tide: Article 6.4 input for ocean-based carbon removal	RT	17
11/10/22	Perspectives: Input on removal activities under A6.4 Mechanisms	PCR	18
11/10/22	Orsted: Peatlands and BECCS	OD	19
11/10/22	Instituto Acao Verde: Deforestation Double Counting	IAV	22
11/10/22	ICLRC: Response to call for input 2022-Activities involving removals	ICLRC	24
11/10/22	GCCSI: Submission to the A6.4 Supervisory Body Call for Inputs 2022 - SB002-A05	GCCSI	25
11/10/22	Evident C-capsule: Inputs on removal activities	ECP	27
11/10/22	Drax: Response to the A6 consultation	DG	29
11/10/22	DAC Coalition: Recommendations from Direct Air Capture Coalition	DC	30
11/10/22	Climeworks: Response to the documents regarding removals under Article 6.4	CW	31
11/10/22	Clean Air Task Force: CATF Article 6.4 Comments	CAT	32
11/10/22	Cercarbono: Additionality and double counting	CCO	33
11/10/22	Center for Clean Air Policy: CCAP Submision Annex 5 to the SB002	CCAP	34

Submission date	Stakeholder	Acronym	Reference number
11/10/22	Carbon Recycling: Contributions to the Information Note document	CR	36
11/10/22	Carbon Finance Labs: UNFCCC Article 6.4 Contribution	CFL	38
11/10/22	Carbon Engineering: Role of DACCS removal activities	CE	39
11/10/22	Carbon Business Council: Inputs on removal activities	CBC	40
11/10/22	CARBFIX: Subsurface mineralization of CO2	CF	41
11/10/22	BeZeroCarbon: Consultation response	BZC	43
11/10/22	Bellona: Response to CDR call for input	BF	46
11/10/22	Arcusa S: Call for input 2022 - activities involving removals under the Article 6.4 Mechanism	SA	47
11/10/22	ALLCOT: Inputs on Land-Based Removals	ALLCOT	48
13/10/22	Center for International Environmental Law: CIEL Submission on Article 6.4 Removals (late submission)	CIEL	50
14/10/22	IETA: Removals input for 6.4SB (late submission)	IETA	51
27/10/22	MDB Working Group comments on the annotated agenda of the third meeting of the Supervisory Body	MDB WG	53
15/03/23	Office of the United Nations High Commissioner for Human Rights (OHCHR) on behalf of The Office of the UN High Commissioner for Human Rights	OHCHR	60
10/04/23	Action Group on Erosion Technology and Concentration (ETC group) on behalf of Action Group on Erosion Technology and Concentration (ETC Group)	ETC	61
21/03/23	Oeko-Institut e.V. Institute for Applied Ecology on behalf of Stockholm Environment Institute, University of Edinburgh and Oeko-Institut	OI	62
17/03/23	Bellona Foundation (BF) on behalf of Bellona Foundation	BF	63
16/03/23	Center for International Environmental Law (CIEL)	CIEL	64
16/03/23	Heinrich Böll Foundation (HBF)	HBL	65
15/03/23	Global Carbon Capture and Storage Institute on behalf of The Global CCS Institute	GCCSI	66
15/03/23	LIFE Education Sustainability Equality (LESE) on behalf of Women and Gender	LESE	67
15/03/23	Carbon Capture and Storage Association (CCSA)	CCSA	68
15/03/23	ActionAid International on behalf of CLARA submission, submitted by ActionAid International	CLARA	69

Submission date	**Stakeholder**	**Acronym**	**Reference number**
15/03/23	International Emissions Trading Association (IETA)	IETA	70
15/03/23	WWF	WWF	71
15/03/23	Institute for Agriculture and Trade Policy (IATP)	IAP	72
15/03/23	Friends of the Earth International on behalf of Friends of the Earth International	FoE Int	73
15/03/23	Institute for Governance and Sustainable Development (IGSD)	IGSD	74
15/03/23	The University of Texas at Austin	UT	77
14/03/23	Indigenous Education Network of Turtle Island (IENTI/IEN) on behalf of Indigenous Environmental Network (IEN)	CMW	78
14/03/23	Carbon Market Watch (CMW) on behalf of Carbon Market Watch (CMW)	CMW	78
14/03/23	Plymouth Marine Laboratory (PML)	PML	79
14/03/23	Environmental Defense Fund (EDF) on behalf of Environmental Defense Fund, Conservation International, The Nature Conservancy, Wetlands International, Rare, Ocean Conservancy, Ocean & Climate Platform, National Wildlife Federation	EDF	80
20/04/23	Stockholm Exergi	SE	81
31/03/23	Drax Group	DG	82
27/03/23	Friends of the Earth Germany/ BUND	FoE/BUND	83
22/03/23	Friends of the Earth England, Wales and Northern Ireland	FoE UK	84
17/03/23	Carbon Finance Lab	CFL	85
17/03/23	AirCapture and Denominator	AD	86
17/03/23	IEAGHG	IEAGHG	88
22/05/23	Jack Roberts	JR	89
22/05/23	Jason Demeny	JD	90
22/05/23	Thoralf Gutierrez (Sirona Tech)	TG	91
22/05/23	Richard Edwards (Clo Carbon Cymru)	Clo	92
22/05/23	Paul Halloran (University of Exeter)	UoEx	93
22/05/23	CarbonRun	CR	94
22/05/23	Inplanet GmbH	IP	95
17/03/23	Inplanet GmbH	IP	95
22/05/23	Prof. Ning Zeng (University of Maryland)	UMD	96
22/05/23	Tim Isaksson	TI	97
22/05/23	Planetary Technologies	PT	98

Submission date	Stakeholder	Acronym	Reference number
22/05/23	Paolo Piffaretti (Carbonx)	CX	99
22/05/23	David Andersson (ECOERA AB)	ECOERA	100
22/05/23	Adam (Zopeful Climate)	ZC	101
23/05/23	Hanna Ojanen (Carbonculture)	CC	102
22/05/23	Tony S. Hamer (GHG PATS)	PATS	103
23/05/23	Carbon-Based Consulting LLC	CB	104
23/05/23	Carbon Removal India Alliance (CRIA)	CRIA	105
23/5/2023	BlueSkies Minerals Inc.	BS	106
24/05/23	Carbon Business Council	CBC	107
24/05/23	Kaja Voss (Inherit Carbon Solutions AS)	ICS	108
24/05/23	Lead authors of the State of Carbon Dioxide Removal Report	SCDRR	109
24/05/23	Cella	CLLA	110
24/05/23	Stockholm Exergi	SE	111
24/05/23	Plymouth Marine Laboratory	PML	112
24/05/23	Injy Johnstone	IJ	113
24/05/23	OpenAir	OA	114
24/05/23	OXO Earth	OXO	115
26/05/23	Keep Our Sea Chemical Free	KOSCF	116
27/05/23	Marginal Carbon AB	MC	117
24/05/23	Charm Industrial	CI	118
24/05/23	Carbon Finance Labs	CFL	119
24/05/23	Dr. Robert Chris	RC	120
25/05/23	Stockholm Environment Institute; University of Edinburgh; Oeko-Institut	SEI+	121
27/05/23	Linden Trust for Conservation	LTC	122
29/05/23	1PointFive	1.5	123
24/05/23	Seafields	SF	124
24/05/23	Microsoft Inc.	MS	125
24/05/23	Climeworks AG	CW	126
27/05/23	Equatic	EQ	127
28/05/23	IEAGHG	IEAGHG2	128
29/05/23	Business Council for Sustainable Energy	BCSE	129
30/05/23	Business Council for Sustainable Energy	BCSE	129
31/05/23	Running Tide	RT	130

Submission date	Stakeholder	Acronym	Reference number
25/05/23	Negative Emissions Platform and other co-signatories	NEP	131
10/06/23	Phil Kithil	PK	132
11/06/23	CCU Alliance	CCU	133
12/06/23	Timber Finance	Tfi	134
25/05/23	Air Capture	AC	135
25/05/23	Mati Carbon Removals	MCR	136
25/05/23	Center for Negative Carbon Emissions	CNCE	137
25/05/23	CarbonPlan	CP	138
25/05/23	Captura	CC	139
25/05/23	UNDO	UNDO	140
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25/05/23	44.01	44.01	142
25/05/23	IETA	IETA	143
25/05/23	Carbon Direct.Inc	CD	144
25/05/23	The Doers Club	CRDC	145
25/05/23	Drax Group	DG	146
25/05/23	Carbfix	CX	147
25/05/23	Puro.earth	PE	148
25/05/23	CO2RE Hub	CO2RE	149
25/05/23	Swiss Lenten Fund	SLF	150
25/05/23	Coalition for Negative Emissions	CNE	151
25/05/23	Climate Analytics GmbH	CA	152
25/05/23	Climate Action Platform Africa	CAPA	153
25/05/23	The Bioenergy Association of Finland	BEAF	154
25/05/23	Zero Emissions Platform	ZEP	155
25/05/23	Leefmilieu	LU	156
25/05/23	Carbon Gap	CG	157
25/05/23	Orsted	ORST	158
25/05/23	The Bellona Foundation	BF	159
25/05/23	Fern	FERN	160
25/05/23	Carbon Capture and Storage Association	CCSA	161
25/05/23	Dogwood Alliance	DA	162
25/05/23	CCS+ Initiative	CCSI	163
25/05/23	Stripe Climate & Shopify	SCS	164

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25/05/23	Carboniferous	CF	165
25/05/23	National Wildlife Federation	NWF	166
24/05/23	KLIMPO	KLIMPO	167
25/05/23	Direct Air Capture Coalition	DACC	168
25/05/23	Octavia Carbon	OC	169
25/05/23	Aspiration	AN	170
25/05/23	Global CCS Institute	GCCSI	171
24/05/23	Carbon Capture Inc.	CCI	172
25/05/23	Biofuelwatch	BW	173
25/05/23	Carbon Capture Coalition	CCC	174
25/05/23	Environmental Defense Fund	EDF	175
24/05/23	Paebbl	PBL	176
25/05/23	EFI Foundation	EFIF	177
25/05/23	Recarb	RB	178
25/05/23	World Resources Institute	WRI	179
25/05/23	Clean Air Task Force (CATF)	CATF	180
24/05/23	Edison Electric Institute (EEI)	EEI	181
25/05/23	Ocean Visions	OV	182
25/05/23	John M. Fitzgerald	JF	183
26/05/23	Prof. William R Moomaw (Tufts University)	WRM	184
26/05/23	PD Forum	PD-F	185
25/05/23	CIBOLA Partners	CP	186
25/05/23	Heirloom	HM	187
25/05/23	Perspectives Climate Research GmbH	PERSP	188
25/05/23	Carbon Engineering	CE	189
26/05/23	Boston Consulting Group	BCG	190
25/05/23	Mary S. Boot, Partnership for Policy Integrity and Chad Hansen, John Muir Project	PPI	191
25/05/23	Nasdaq Stockholm	NSQ	192
09/06/23	Michael Hayes	MHS	200
12/06/23	Blueskiesminerals.inc	BSM	201
14/06/23	Seal Research Trust	SRT	202
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15/06/23	Roberto Rochadelli (fupef)	RBI	204

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15/06/23	Sky Harvest Carbon (Will Clayton)	SHC	205
15/06/23	NovoCarbo	NC	206
15/06/23	Capture6	CAP	207
16/06/23	Finnwatch	FNW	208
16/06/23	ECOERA	ECOERA	209
16/06/23	OpenAir	OAIR	210
16/06/23	Carbon Business Council	CBC	211
16/06/23	Rick Berg (Nori.inc)	NORI	212
16/06/23	Thomas Hoffmann (Decarbo Engineering GmbH)	THN	213
16/06/23	Timber Finance	TFI	214
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19/06/23	Seaweed Generation	SWG	226
19/06/23	Max Planck Institute for Biogeochemistry	MPI	227
19/06/23	Carbon Mineralization Flagship Center	CNF	228
19/06/23	Green East Master Ltd	GEM	229
19/06/23	The Charles Darwin Rescue Plan	CDR	230
19/06/23	International Biochar Initiative	IBI	231
19/06/23	CarbonHemp Blo.Inc	CHB	232
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19/06/23	University of Hamburg	UoH	236
19/06/23	German Biochar Association	GBA	237
19/06/23	Omega Terraform	OT	238

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19/06/23	Carbon Lockdown Project	CLP	239
19/06/23	Carbofex Oy	CFO	240
19/06/23	Everest Carbon Inc	ECI	241
19/06/23	Dead Battery Depot.ltd	DBD	242
19/06/23	CROPS Carbon International LTD	CROPS	243
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19/06/23	Cella Mineral Storage, Inc	CLLA	259
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19/06/23	John M. Fitzgerald	JMF	270
19/06/23	Drax Group Plc	DG	271
19/06/23	ARCTECH USA	AU	272

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19/06/23	Mati Carbon Removals	MCR	273
19/06/23	Direct Air Capture Coalition	DACC	274
19/06/23	Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science	GRI/LSE	275
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19/06/23	Terrra	TERRA	279
19/06/23	The European Biochar Industry Consortium	EBIC	280
19/06/23	Inventive Resources, Inc	IRI	281
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20/06/23	HBAR Foundation	HBAR	283
20/06/23	Inversion Point Technologies Ltd	IPT	284
20/06/23	Oeko-Institut, Greenhouse Gas Management Institute, Stockholm Environment Institute, University of Edinburgh Business School, Infras, Carbon Limits, and Calyx Global	OI	285
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20/06/23	JPMorgan Chase & Co	JPM	301
20/06/23	Climeworks	CWORKS	302
20/06/23	International Coordinating Council of Aerospace Industries Associations	ICCAIA	303

Submission date	Stakeholder	Acronym	Reference number
21/06/23	Ted Christie-Miller (BeZERO)	BEZERO	304
21/06/23	Sylvera	SYRA	305
22/06/23	Pachama	PACHA	306
22/06/23	Conservation International	CI	307
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24/06/23	Austrian Biomass Corbonisation Society	ABCS	309
25/06/23	PYREG GmbH	PYREG	310
26/06/23	IETA	IETA	311
23/06/23	Climate Analytics	CA	312
27/06/23	South pole	SP	313
29/06/23	Global CCS Institute	GCCSI	314
19/06/23	Carbon Capture Machine	CCM	315

4. Subsequent work and timelines

7. Further work will be carried out based on the guidance to be provided by the Supervisory Body.

5. Recommendations to the Supervisory Body

8. The Supervisory Body may wish to consider this document and provide guidance for any further work.

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1. Procedural background

1. The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA), by its decision 3/CMA.3 “Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement”, requested the Supervisory Body of the mechanism established by Article 6, paragraph 4, of the Paris Agreement (the Supervisory Body) to elaborate and further develop, on the basis of the rules, modalities and procedures of the mechanism (RMPs, contained in the annex to the decision) recommendations on activities involving removals, including appropriate monitoring, reporting, accounting for removals and crediting periods, addressing reversals, avoidance of leakage, and avoidance of other negative environmental and social impacts, in addition to the activities referred to in chapter V of the RMPs (Article 6, paragraph 4, activity cycle).

2. The CMA, by decision 7/CMA.4, paragraph 22, requested the Supervisory Body to consider broader inputs from stakeholders provided in a structured public consultation process while developing the recommendations referred to in the paragraph above.

3. A6.4-SB005-A02 Information note: Guidance and questions for further work on removals (hereafter SB005 Information note) provided instruction and direction to the secretariat for compiling the stakeholder inputs on the elements and format, which was foreseen to reflect the outline and substantive scope of the draft recommendations on activities involving removals.

4. The secretariat, under the guidance of the relevant small group, was mandated to produce an information note that elaborates approaches to address the rules, modalities, and procedures (RMP) elements identified in A6.4-SB005-A02 and to do so on the basis of SB005 discussions, prior recommendations and outlines[1] produced by the SB, and taking into account public input in all submissions provided through SB005 (to the extent possible, through SB006) that are responsive to these elements. The information note outline and contents have been prepared to provide clear, objective, and balanced background information.

5. The following sub-sections present an overview of the feedback received. The submitting organizations are identified by their acronyms and reference number as shown under the cover note. A complete list of references is included under the Reference section of this document.

[1] Activities involving removals under the Article 6.4 mechanism (A6.4-SB003-A03; November 2022), Guidance and questions for further work on removals (A6.4-SB004-A02; March 2023)

2. Cross-cutting issues

6. The SB 005 Information Note calls for a discussion of Cross-cutting questions as follows:

   (a) Discuss the role of activities involving removals and this guidance in supporting the aim of balancing emissions with removals through mid-century.

   (b) What are the roles and functions of the following entities in implementing the operations referred to in this guidance: Activity proponent(s), Article 6.4 mechanism Supervisory Body (6.4SB), 6.4 mechanism registry administrator, Host Party, stakeholders?

   (c) How are these elements understood, in particular, any interrelationships in their functions, timeframes, and implementation?

      (i) Monitoring period

      (ii) Crediting period

      (iii) Timeframe for addressing reversals

2.1. Overarching role of removals

7. Below is a summary of public inputs received.

8. All types of removals are needed to reduce net emission levels, balance residual emissions toward net-zero emissions, and achieve and sustain net negative emissions. Article 6.4 is perceived as a global standard for methodologies for carbon removal activities. [JD, 90]

9. According to the IPCC, all emissions pathways that limit planetary warming to 1.5°C by the end of the century without overshoot, and 87% of pathways that limit warming to 2°C, rely on large-scale atmospheric CDR. [EDF, 175]

10. According to the IPCC AR6 Synthesis report, CDR will be needed at gigatonne scale by mid-century to meet the goal of the Paris Agreement. [OA, 114]

11. Carbon removal technologies play an important role in bridging the gap between current emission reduction efforts and reaching net zero. [IP 95]

12. The State of CDR report highlights the importance of “engineered-based” CDR in the mitigation scenarios as assessed by the Intergovernmental Panel on Climate Change and the limited potential of “land-based” CDR methods to provide the required quantities of removals on their own, therefore, the need to complement these with engineered based CDR to keep the Paris climate goals within reach. [SCDRR, 109]

13. The most valuable role Article 6.4 can provide is finance and infrastructure for scaling up technological removal, which the current plan does not sufficiently provide. [IJ, 113]

14. While direct emissions reductions are critical to meeting the goals of the Paris Agreement and Article 6.4, the use of CDR is “unavoidable”, according to the IPCC to limit global warming to 1.5°C would require CDR on the order of 100–1000 GtCO2 during the 21st century. And to reach the upper range of this, engineering-based removal activities will be needed. [LTC, 122]

15. Considering the complementary role of CDR “to deep, rapid, and sustained emission reductions” as IPCC establishes, a mechanism is needed to avoid a conflating between mitigation from emission reductions and CDR so as to allow for more clarity on the role, foreseen share and timing of CDR. [CW, 126]

16. Article 6.4 mechanism should take a technology neutral approach that is aligned with scientific assessments of keeping the 1.5°C target. As the bulk of CDR needed for that would need to come from engineered CDR methods, it should support both land-based and engineering-based removal activities. In addition, there is a need to clearly differentiate between emissions reduction and removal so as to safeguard against CDR hampering far-reaching emission reductions. [NEP, 131]

17. Rather than categorizing solutions, Captura supports a method-neutral approach to methodology, with solutions assessed based on a universal set of criteria, such as those outlined by the Oxford Offsetting Principles, to allow the mechanism to support the most feasible solutions available on the market, including those that are currently in earlier stages of development. [CC, 139]

18. In particular, the Global South's abundance of untapped renewable energy potential is key: removal solutions with a high need for renewable energy, can provide anchor industrial demand that will enable investment in renewable energy, thus improving energy access. This abundance, paired with low existing emissions, means limited moral hazard for the deployment of new renewable energy capacity, as there is little high emission industrial infrastructure to displace. We urge the Supervisory Body to take the time to directly engage with any of the dozens of CDR practitioners and companies currently actively planning or considering projects or activities in the Global South. The Doers Club would be pleased to help facilitate that engagement. Regarding the process, SB would benefit from a broader and more inclusive consultation process. [CRDC, 145]

19. Request for the inclusion of all durable carbon removals but those to be included should be able to demonstrate environmental and social safeguards, and do no significant harm, and are required to meet the long-term goals of the Paris Agreement. [PE, 148]

20. Implementation of CDR technology at scale has the potential to help address energy poverty CDR can be a catalyst for green industrial development and economic growth in Africa. [CAPA, 153]

21. Establishing a global standard for methodologies for carbon removal activities, including novel removal activities, requires buy-in from market participants and other stakeholders. Carbon market rule-setters across the world are eagerly awaiting the guidance and methodologies to be developed under Article 6.4. [CCSI, 163]

22. There are also already notable cases of public and private efforts to advance removal technologies in developing countries. For example, Ocean Visions, in partnership with the UN Decade of Ocean Science for Sustainable Development, is working with key stakeholders in developing countries to support capacity building and knowledge transfer to accelerate Ocean CDR research and development that could potentially lead to implementation at scale. Engineered removals serve the objectives of the Article 6.4 mechanism as they promote mitigation of greenhouse gas emissions via enhancement of “sinks” while also promoting sustainable development; It is therefore an imperative to collaboratively advance all potential climate solutions including Ocean CDR and then deploy at scale the most promising ones, based on the best available scientific knowledge, comparative risk assessment, and socioeconomic benefits. [OV, 182]

23. As stated by the IPCC, durable carbon removals are required to meet the long-term goals of the Paris Agreement. As shown in the IPCC AR6 WG3 report (Chapter 12, section 3 of the Information Note on removal activities under Article 6.4), the volumes of future global carbon dioxide removal (CDR) deployment assumed in IAM (Integrated Assessment Models)-based mitigation scenarios are large compared to current volumes of deployment, which means that rapid and sustained up-scaling is required if we are to meet the Paris target. [NSQ, 192]

24. Biofuelwatch is deeply concerned about the inclusion of carbon dioxide removals into carbon market mechanisms in general. We believe that this would further delay vital efforts to reduce greenhouse gas emissions at source. Companies are announcing becoming “carbon negative” against a backdrop of a high emission pathway, especially from supply chains; supposedly offset by “negative emission” including BECCS and Direct Air Capture. And oil companies such as Eni are using investments in afforestation and reforestation, i.e., industrial tree plantations, to claim that they are offsetting their actual carbon emissions from fossil oil and gas, moreover often with no mention of the communities living on or using that land for their livelihoods. [BW, 173]

2.2. Removals for NDC achievement

25. Below is a summary of inputs received on the role of activities involving removals for NDC achievement:

26. As engineered removals forms an integral part of some countries’ strategy, they should be part of the Article 6.4 mechanism scope to facilitate the achievement of the NDCs. [JD, 90]

27. Article 6 has immense potential to assist nations to achieve their NDCs more efficiently and to increase ambition. More specifically, Article 6.4 can assist countries that lack the capacity to implement domestic trading schemes. In addition to steep emission reductions, removals are necessary to achieve and sustain net negative emissions for which all types of removals (land-based and engineered) will be needed, and many novel removal methods are ready to be used by countries in their climate targets. The European Union’ framework for removals through the Carbon Removal Certification Framework (CRCF) is under development and its methodologies would follow to correspond with the expected publication of Article 6.4 mechanism. In addition, separate frameworks and

methodologies must be developed for emission reduction and carbon dioxide removal as Verra is planning to launch updates to their programme to differentiate reduction credits from removal [Clo, 92]

28. The market shows growing demand for durable and quantifiable carbon removal solutions offered by engineered solution and willingness to accept higher costs in comparison to shorter-term and hard-to-measure purely land-based solution and scepticism about the quantitative role the latter can play. Ideally, the Article 6.4 framework should enable development of mega- and gigatonne engineered CDR. Many of engineered removals pathways promote sustainable development and as they scale up, they have the potential to contribute to NDCs alongside decarbonisation and other forms of mitigation activity. [ZC, 101]

29. As countries rely on engineered removals to achieve their climate targets; achieving NDCs without engineered approach would be difficult. Article 6.4 is viewed as a global standard setter for methodologies for carbon removal activities, thus leaving engineered removals out of article 6.4 would imply missed opportunity to establish robust methodologies on a global level. [CC, 102]

30. Countries rely on engineered removals to achieve their climate targets and removals will become increasingly important. Article 6.4 is viewed as global standards for methodologies in carbon removal activities, thus excluding “engineered” removals from the scope would imply missed opportunity to develop robust methodologies on a global level. [MC, 117]

31. The role of engineered removals in meeting Nationally Determined Contributions Article 6.4 should provide countries with a supportive mechanism to help them reach their NDCs. Increasingly, countries are incorporating the use of engineered carbon removals into their NDCs to help them abate hard-to-decarbonize sectors, for example the United Kingdom’s Net-Zero Strategy 25 sets out specific targets for engineered removals in the interim to 2050. Belgium’s National LTS focuses on DACCS and BECCS, Given the diminished importance placed on permanent and durable storage in the information note, the proposed framework will make it harder for these countries to achieve their NDCs. [DACC, 168]

2.3. Outlook for specific removal technologies

32. In the Indian context, CDR activities and credits serve as a means for financial redistribution to some of the world’s poorest. The additional benefit of Biochar carbon removal improves the livelihood of the poorest by improving soil quality and raises yields. [CRIA, 105]

3. Inputs on specific elements

3.1. Definitions:

33. The SB 005 Information Note calls for a discussion on the role and potential elements of definitions for the guidance, including “Removals”

34. Below is a summary of public inputs received on these issues.

3.1.1. General approach to definition

35. The Supervisory body may wish to define different types of removal activities. A high-level categorization could include the following two broad categories:

    (a) Increasing the natural uptake of carbon in biogenic reservoirs: This may include living biomass, dead organic matter), soil organic carbon and harvested wood products (IPCC pools). It may involve different types of activities, such as afforestation/reforestation or restoration of degraded ecosystems. The extent to which carbon pools may qualify to generate credits under Article 6.4 needs to be carefully assessed.

    (b) Long-term storage of carbon in geological or other non-biogenic reservoirs: This may include, inter alia, direct air capture and storage (DACCS), bioenergy carbon capture and storage (BECCS), storage of carbon in products or enhanced weathering. [EU, 59]

36. These two broad categories could be further subdivided by types of mitigation activities. [EU, 59]

37. The ROK supports the current comprehensive definition of removal which provides a room for direct air carbon capture and storage (DACCS) and direct air capture and carbon utilization (DACCU) technologies to be included as eligible removal activities. [ROK, 57]

38. The Supervisory Body should use a criteria-based approach to define CDR. CDR encompasses a wide range of approaches, some of which may not yet exist, and many of which transcend historical (and arbitrary) binaries, such as “land-based” versus “engineered.” Encouraging this diversity is critical not only because of the nascent state of the field, but because of potential constraints on any single approach’s ability to scale [SCS, 164]

39. A stakeholder workshop in the near future to address open issues and unclear definitions is proposed. With considerable small additional efforts, it will be possible to get good removal standards/methodologies. For such kind of workshop, we can develop more detailed and elaborated input than we can do now shortly before your meeting. [PD, 185]

40. A narrow definition of CDR hinders the industry’s ability to find suitable solutions to climate crisis. The definition of acceptable methods for CDR should be broadened by adopting the definition presented by the Carbon Business Council. (See [CBC, 107]) [BS, 106]

41. Table 1.1 in the State of CDR report[2] provides an expert assessment of technology readiness level (TRL), and known risks as well as co-benefits, based on the literature and does not imply that engineering-based activities are technologically unproven and have unknown risks. [SCDR, 109]

42. Technology Readiness Levels (TRL) should be considered rather than excluding those that are not yet proven. As a given technology’s TRL advances, it should become available under Article 6.4. Limiting inclusion of emerging technologies

[2] https://www.stateofcdr.org/resources (page 23 of the downloadable pdf report)

would hinder the development and commercialization of such technologies. Any activities that measurably and demonstrably reduces atmospheric carbon dioxide concentration while avoiding social and economic harm should be eligible as excluding any technology that is not already at scale from A6.4 contradicts the fact that all approach needed to meet the goals of the Paris Agreement. [AC, 135]

3.1.2. Using IPCC definitions vs going beyond IPCC definitions

43. Is important to consider the potential value of removal methods that also focus on the capture and permanent storage of other greenhouse gases. Stringent methane emissions reductions are directly linked to deep reductions of CO2 needed by 2030 in 1.5°C compatible pathways. Therefore, UK domestic policy focuses on 'Greenhouse Gas Removals' (GGRs) where others may be more familiar with terms such as carbon dioxide removal, or CDR. The UK therefore favours pursuing the IPCC definition of carbon dioxide removals but expanded to include all greenhouse gases (GHGs). The UK does not see the rationale for limiting the type of GHG in the definition at this stage and believes it may risk prematurely disincentivising the development of future GHG removal technologies. As for activity categories, the UK recognizes a range of approaches as removals, which fall very broadly into two categories. This does not represent an exhaustive list of potential Article 6.4 removal activities, nor an indication of their eligibility. The broad two categories are:

(a) Nature-based methods such as afforestation and forestry management, other forms of habitat restoration (including blue carbon) and soil carbon sequestration can remove and store carbon dioxide at scale while delivering a range of additional environmental benefits such as biodiversity gain, air quality, and soil health. Nature-based removals are already a mature approach for capturing and storing carbon and, especially in the case of tree-planting, codes already exist to allow trading on the voluntary carbon market. While nature-based removals are already available at scale, their contribution can be limited by factors such as land availability and timescales for sequestration.

(b) Engineered solutions, such as Direct Air Carbon Capture and Storage (DACCS) and Bioenergy with Carbon Capture and Storage (BECCS), are necessary to offset and remove residual greenhouse gas emissions from hard to abate sectors and can offer highly durable removal of greenhouse gases from the atmosphere, potentially for thousands of years. Whilst the Information note: Removal activities under the Article 6.4 mechanism appears to classify BECCS as a land-based biological removal, the UK views BECCS as an engineered removal technology, given the engineering elements of the activity associated with carbon capture and storage. [UK, 54]

44. The UK also recognises that there is a suite of novel seawater-based greenhouse gas removal methods, (e.g., 'Direct Ocean Capture'), that are at an earlier technological stage than DACCS or BECCS methods, that the UK classifies as engineered solutions. The UK believes that after guidance relevant for all Article 6.4 activities (both reductions and removals) is established, distinct guidance should build on this, and be developed for certain types of activities. At a minimum this should include separate guidance on methodologies for nature-based and

engineering-based removals. This is due to the fact the individual monitoring, reporting and verification (MRV) protocols will inherently be activity specific. [UK, 54]

45. CATF recommends using the latest definition of Carbon Dioxide Removal provided by the IPCC Working Group III contribution to the Sixth Assessment Report Technical Summary: “Anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological, geochemical or chemical CO2 sinks, but excludes natural CO2 uptake not directly caused by human activities.” Compared to the definition used in the IPCC Special Report on 1.5 degrees and the IPCC Working Group III Annex 1: Glossary, the definition outlined above has replaced “direct air capture” with a technology-neutral reference to “chemical CO2 sinks”. In line with the IPCC, CATF considers CDR methods based on this definition to include enhancement of terrestrial- and ocean-based sinks through anthropogenic interventions such as forest management, afforestation and reforestation, coastal wetland restoration, and soil-carbon sequestration. [CATF, 32]

46. There is already a widespread confusion of terms, in case the application of Art 6.4 requires a departure from the definition proposed by IPCC AR6-WG-III, the document should clearly describe why that is necessary as well as how the proposed definition would be different. [SE, 15]

47. It would be useful to understand why a departure from the existing definition by the IPCC AR6-WG-III is required and how it would differentiate. If a new definition is required, we believe carbon should be replaced with GHG in consideration of allowing for ongoing innovations associated with other emission removal types (e.g.CH4). These could be normalized to CO2e. [ECP, 27]

48. The definitions in the CDR space are often used inconsistently. Distinguishing between “engineering-based” and “land-based” carbon removal strategies is unclear and unnecessary, as an emerging set of solutions straddle both categories. We recommend the UNFCCC leverage its global leadership to bring greater clarity to this space by adopting a more specific definition of CDR that is consistent with existing norms and true to the fundamental goals of the process (for example, as used in IPCC AR6 WGIII Report Glossary p 1,796. Referred IPCC glossary extract is included below under paragraphs 17 (a) and (b):

    (a) Anthropogenic removals: The withdrawal of greenhouse gases (GHGs) from the atmosphere as a result of deliberate human activities. These include enhancing biological sinks of CO2 and using chemical engineering to achieve long-term removal and storage. Carbon capture and storage (CCS), which alone does not remove CO2 from the atmosphere, can help reduce atmospheric CO2 from industrial and energy-related sources if it is combined with bioenergy production (BECCS), or if CO2 is captured from the air directly and stored (DACCS). [Note: In the 2006 IPCC Guidelines for National GHG Inventories (IPCC 2006), which are used in reporting of emissions to the UNFCCC, ‘anthropogenic’ land related GHG fluxes are defined as all those occurring on ‘managed land’, i.e., “where human interventions and practices have been applied to perform production, ecological or social functions”.

However, some removals (e.g., removals associated with CO2 fertilisation and N deposition) are not considered as ‘anthropogenic’ or are referred to as ‘indirect’ anthropogenic effects, in some of the scientific literature assessed in this report. As a consequence, the land-related net GHG emission estimates from global models included in this report are not necessarily directly comparable with LULUCF estimates in national GHG Inventories.]

(b) Carbon dioxide removal (CDR): Anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical CO2 sinks and direct air carbon dioxide capture and storage (DACCS) but excludes natural CO2 uptake not directly caused by human activities. See also *Anthropogenic removals, Afforestation, Biochar, Bioenergy with carbon dioxide capture and storage (BECCS), Carbon dioxide capture and storage (CCS), Enhanced weathering, Ocean alkalinisation/Ocean alkalinity enhancement, Reforestation, and Soil carbon sequestration (SCS*). [EDF, 175]

49. The IPCC’s definition of CDR as “anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products” (IPCC AR6 WGIII Report p1,796) should be followed. The label of “engineering-based” should be avoided as most CDR approaches are hybrid of nature and engineering. Furthermore, CDR is a new commercial sector and encompasses a range of pathways, from land-based soil and forest carbon sinks, biomass-based carbon removal and storage (BiCRS) to marine carbon dioxide removal (mCDR) to mineralization-based approaches to direct air capture (DAC), as well as emergent and yet-undiscovered methods. The sector is advancing quickly, and there are a number of approaches ready for deployment now, with more expected to reach that stage of maturity in coming years. To account for above, a method-neutral, criteria-based approach should be employed to determine eligibility of individual CDR project’ under the Article 6.4 mechanism. Five key criteria for high-quality CDR are additionality, durability, net-negativity, verification, and equity and community engagement. [CBC, 107]

50. If the implication is that CCS of incinerated biogenic waste is not considered to be a removal, we disagree with this interpretation. Such CCS does face a set of requirements to be considered a removal but cannot a priori be deemed not to be a removal with regard the biogenic portion. [SE, 15]

51. Definitions must be consistent with the most up-to-date Intergovernmental Panel on Climate Change (IPCC) guidelines or decisions adopted by the Convention, the CMP and the CMA. 4. Definitions of parameters, concepts or approaches needed for crediting removals should be adopted after achieving a common understanding of each of them (i.e., time horizon, permanence period, storage period, among others). Categories and subcategories of the removal activities must be clearly defined and must have a delimited scope to facilitate the development of an appropriate methodological approach to quantify and monitor the removals achieved with an activity. [CO, 58]

52. The Information Note on removals presents a suggestion (paras 21-22) that an IPCC definition of removals be expanded beyond removal from the atmosphere, to include removal from the ocean. Article 6.4 rules should not rewrite IPCC definitions that were adopted by consensus, and which address removal from the atmosphere. Moreover, marine or ocean-based geoengineering is not an appropriate topic for consideration under Article 6.4. As other commenters have noted, the Supervisory Body should acknowledge and respect moratoria in place under other treaty processes. [CA, 152]

53. The IPCC's definition of CDR as "anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products" should be adopted. [OA, 114; CBC 107]

3.1.3. Definition of components (e.g., storage)

54. The Supervisory Body should consider the definition of a geological storage to also explicitly include mineralization in addition to "isolation from the atmosphere". The definition of a suitable site should not be limited to porosity and cap rock, but be defined by the objective of said characteristics as stated in (c) (i) "All available evidence, such as data, analysis and history matching, indicates that the injected carbon dioxide will be completely and permanently stored such that, under the proposed or actual conditions of use, no significant risk of seepage or risk to human health or the environment exists;". The requirement of porosity and caprock may be limiting to innovations in geological storage. Furthermore, it should be clarified that various states of carbon oxides (not just dioxides) can safely be injected and stored in geological reservoirs including liquid, in solution, in supercritical. [CW, 31]

55. The term "carbon sequestration" is not defined elsewhere, therefore, we recommend using the term "carbon storage" instead. Please consider our proposal (https://carbon-recycling.eco/) consisting of the same conversion technology (heating in an oxygen-limited environment) but defining a slightly different term of "Biocarbon" (and "Pyrocarbon"). The term biochar is defined by IPCC as a product for disperse soil application (without a monitoring of its permanence in the future), whereas the biocarbon is proposed to be tangibly disposed in a site subject to regular monitoring of the removed and stored biocarbon stocks. [CR, 36]

56. Taxonomy of removal activities. The following are the broad types of removal methods: (a) Biological methods: The separation of CO2 from the atmosphere is achieved through the photosynthesis process. These methods can be further divided into: (i) Land based biological methods consisting of tree planting or regeneration of natural vegetation such as forests. Almost all current removals come from this category; This definition only includes CO2 removal by afforestation and reforestation. In fact, growing forests now remove an amount of nearly 30% of annual emissions. This value can be substantially increased and perhaps doubled by managing more existing forests to achieve their potential for carbon accumulation and biodiversity by avoiding harvest. [WRM, 184]

57. This management option has been called "proforestation." In 2022, IPCC AR6 WG2 page 303 stated, "It is also the case that protection of existing natural forest ecosystems is the highest priority for reducing GHG emissions (Moomaw et al.,

2019) and restoration may not always be practical. An actual demonstration that halting harvest (proforestation) results in major increases in carbon dioxide removal and accumulation of carbon in forests has been found in Tasmania when half the forest harvests were abruptly halted, within less than a decade, emissions from LULUCF went from +10 to -12 MMt CO2. [WRM, 184]

58. Table 4 does not include proforestation that produces large trees that store disproportionate amounts of carbon. Lutz et al. (2018) found in a survey of 48 mature and old growth forests globally, the largest 1% of trees stored half the carbon. The four more heavily harvested forests in the United States in the study had just 30% of the carbon in the largest 1% of trees. [WRM, 184]

3.1.4. ‘CO2’ removal vs ‘GHG’ removal

59. IETA believes that the definition of removals should be clear and simple to avoid risks pertaining to environmental integrity. Yet, it should remain open for potential methods for carbon dioxide removals still under development. IETA agrees with the proposed definition from the IPCC that “CDR refers to anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological, geochemical or chemical CO2 sinks, but excludes natural CO2 uptake not directly caused by human activities. Considering the limited experience and assessment of removal activities covering other greenhouse gases (GHGs) apart from CO2, IETA do not see a need to explicitly address those in the definition of removals for the purpose of the Article 6.4 Mechanism, especially where these may risk conflating emission reductions and carbon removals. [IETA, 70]

60. Article 6.4 work on ‘removals’ should be conducted with a clear understanding that the scope is for removals of all greenhouse gases addressed by the UNFCCC. This is so despite a near term practical focus on CO2 as other GHG removal methods may become more relevant over time. [PTV, 18]

61. For the sake of clarity, it is preferable to only focus on the removal of CO2 from the atmosphere, since the removal of other GHGs is not currently anticipated at relevant scales and it is unclear if the removal of other greenhouse gases has a comparable mitigation effect to the removal of CO2. [BF, 46]

62. Using CDR (carbon dioxide removal) instead of GGR (GHG removal) is logical when we are speaking about ecosystem-based removals. However, the removal of methane becomes more and more actual task. [WI, 9]

63. Trying to change the definition of removals, which is nothing more than the capture and storage of CO2 emissions already in the environment, is complicating the discussion, more specifically:

(a) It is not scientifically justifiable to treat temporary greenhouse gases equally to carbon dioxide as the GWP cannot be measured empirically and requires a choice of the time horizon. Carbon removal should be limited to carbon dioxide.

(b) The definition must include all components of the mobile carbon pool (environment), not just the atmosphere. Defining carbon removal activities by where the CO_2 is captured will restrict options.

(c) The definition focuses heavily on where the carbon dioxide is sourced but omits the fact that if a tree has been growing for decades and is cut down for BECCS, this tree is no longer part of the mobile carbon pool. Extending the minimum sequestration duration to 200-300 years would open the door for cutting down old growth.

(d) The discussion of ownership arises because the mechanism focuses on removals. This could be avoided by focusing on storage instead as whether the carbon dioxide is captured from the source or the environment makes no difference. [CNCE,137]

64. Other factors need to be recognised in addition to CO_2 as ecosystems can store organic carbon whilst also contributing to global warming through emissions of non-CO_2 Green House Gases (GHGs). For example, wetlands are a source of methane. This methane can offset the carbon stored in coastal macroalgae habitats. Same applies to the contributions from nitrous oxide that are largely unknown. [PML, 112]

65. According to the Institute for Governance and Sustainable Development (IGSD) methane removal deserves a much greater emphasis than it has yet received in the documents and plans under A6.4. Methane removal is likely to be no less crucial than CO_2 removal, hence the urgency in understanding what options may be available here. And methane removal and CDR play fundamentally different roles in the climate solution ecosystem. Ideally, we should have them both, and they shouldn't be pitted against each other. [JF, 183]

3.1.5. Reductions vs removals

66. The Supervisory Body should establish workable definitions for reductions and removals to be agreed upon in tandem. This is especially considering the flexible nature of CCS, where point-source CCS projects can be considered reductions, while Direct Air Carbon Capture and Storage (DACCS) and Bioenergy Carbon Capture and Storage (BECCS) projects can be considered removals. The flexible nature of CCS is further demonstrated through the use of CCS networks, which can function for both reduction and removal technologies, and that further streamline the necessary cost and resource efficiencies necessary for achieving the goal of the Paris Agreement and unlocking the 'net' in net zero emissions. Such nuances in the various applications of CCS technologies renders the case for the Supervisory Body to further discuss CCS in more detail in upcoming defining sessions involving removals. [GCCSI, 25]

67. Reporting the capture of biogenic carbon as avoidance or reduction would create an inconsistency between the accounting of CO_2 for the purposes of the 6.4 mechanism and those same emissions when accounted for in host country greenhouse gas emission inventories. As such, the importance of appropriate eligibility criteria is essential, to ensure that only biomass that has a neutral or positive carbon impact on the land sector during the project lifetime provides a removal supported by the carbon market. [DG, 146]

68. Mixed Farming and Agroforestry Systems (MiFAS) combines emission reductions and biogenic carbon dioxide removal through optimisation of resources and diversified production (energy, crops, trees, livestock) by different enterprises. It is theoretically transferable across Europe, North America, Canada and some regions of Asia and South America and expected to bring multiple co-benefits including economic and environmental. [Clo, 92]

3.1.6. Benefits of a reliable harmonized definition

69. A reliable and accurate definition of 'removal activities' is crucial to ensure a sound policy framework from the beginning. The principles adopted by the Advisory Council of the European Zero Emission Technology and Innovation Platform, outline the need for removal activities to specify the atmospheric origin and permanent storage of the removed CO2, but also emissions associated with the removal process should be included in the emission balance and that the 'net' balance of a removal process should always be negative (i.e. remove more than is emitted) for it to qualify as a removal. The definition for 'removal activities' should include 'net of all associated emissions', to ensure that any certificate or credit issued on the basis of CDR actually results in a net removal from the atmosphere. [BF, 46]

70. Clearly defined terms will help establish understanding and a common set of principles across markets. These definitions likely need to be developed by a government body or third party and will benefit from broad stakeholder buy-in and community input. An improved definition is particularly needed for additionality, which is interpreted, determined, and weighted differently across players and markets. Encompassing and tech-neutral definitions for compliance and voluntary carbon markets will help to ensure that a wide a range of solutions as possible can be scaled up.[CBC, 40]

71. A clear definition and scope of the type of activity also contributes to reduce the risk of double counting. After classifying activities, it is crucial to ensure that a methodological approach will be developed only for those activities/technologies that are in a stage that could be replicated or deployed at scale to minimize the uncertainty of the impact in terms of CO2 removal capacity. The risks and impacts of an activity must be sufficiently studied so that the implementation of the activity can take place properly ensuring that any negative side effect that may occur are taken into account and mitigated (i.e., ocean fertilization, ocean alkalinization). [CO, 58]

3.1.7. Concerns on Broad definition

72. A definition like the one then recommended by the Supervisory Body would be problematic as it could open the door to all manner of removal activities and putting them all on the same qualifying level, in the first place. In our view this open definition comes with in part serious risks to environmental and human systems and could threaten land and marine ecosystems, human rights and livelihoods. Storage in products should generally not be considered a removal activity under the Article 6.4 mechanism as most products have a short lifespan after which greenhouse gases will be re-released into the atmosphere, which does not comply with the demand for permanence of storage or reducing emissions. [HBL, 65]

73. The current definition on “removals” is excessively broad to the extent that it could include all types of anthropogenic activities/removal activities–including processes and in products–as long as that activity could remove greenhouse gases (GHG) from the atmosphere, even when the removal is temporary. This is a red flag for us and we want to underscore the need for due diligence to ensure environmental integrity and promote positive outcomes in terms of human rights, the right to health, gender equality, and the rights of local communities, Indigenous Peoples and Afro Descendants as well as other rights mentioned in the preambular of the Paris Agreement. [LESE, 68]

74. Products were problematically included in the definition of removals. Products should not be used in any definition of removals as a basis for crediting, due to impermanence risks outlined previously. Under such a definition, all wood products could qualify, yet these will not be able to satisfy permanence on the necessary time scale of at least 2-3 centuries. Similarly, such a definition could also allow crediting for synthetic fuels emanating from CCUS, even though these would be used at some point and hence the emissions would be re-released to the atmosphere (this is also because “durably store” is not specific enough in the definition and is open to interpretation).[CMW, 76]

75. Broadening the definition of Removals by including products as possible sinks is problematic, due to the large variability in permanence and the fact that no actors have formal control over the lifespan of products. We therefore suggest that products not be included. [WWF, 71]

76. We agree that the duration of carbon storage in harvested wood products is typically not very long, as acknowledged by IPCC rate constants for loss of carbon from these pools. [PPI, 191]

77. Harvested wood products can be seen as a lateral transfer of forest carbon into another pool – a transfer that is usually extremely leaky, entailing losses of up to 90% of the ecosystem carbon. The trade-off between storing limited carbon in products with a disproportionately large loss of carbon from forests is illustrated by work done by the European Commission’s Joint Research Centre (JRC) finds that wood products do not offer a net benefit by 2050, which is when the Paris Agreement calls for a balance between sources and sinks. [PPI, 191]

78. The SB is urged to eliminate reference to wood products as a viable strategy for removing and storing carbon and instead emphasize the importance of protecting as much forests as possible -- including allowing degraded, managed forests to grow old and intact -- as delivering the biggest carbon removal and storage impact. Beyond carbon storage, restoring ecological integrity lost as a result of logging for wood production is vital to optimizing forests' ability to help protect communities against impending climate shocks including heat waves, floods and droughts. [DA, 162]

79. "Ocean carbon reservoirs involve a specific set of risks, challenges and opportunities:

(a) Poorly understood processes with potential synergistic impacts and long-term effects, such as proposals to increase CO_2 dissolved in ocean water or deposited on the ocean floor, must not be included in the scope of this Guidance.

(b) Significant science and governance gaps to be considered, particularly in international waters; thus a precautionary approach must prevail.

(c) However, some site-specific blue carbon activities in well-studied and the science may be robust enough. Coastal blue carbon ecosystems – such as mangroves, seagrasses and tidal marshes – sequester and store globally significant quantities of carbon in their biomass and underlying soils, which can be released if these ecosystems are disturbed by anthropogenic activities. In addition to climate mitigation benefits, these ecosystems provide a multitude of other services including resilience to climate change impacts." [WWF, 71]

80. Ocean-based carbon dioxide removal (OCDR), whether driven by biological or engineering-based methods, remains largely untested and more research is needed to understand the potential effects, durability, benefits, and risk of these activities. OCDR could have negative impacts on marine wildlife and human communities, especially if deployed without sufficient safeguards. OCDR activities should also require thorough, timely, and transparent communication with communities. In contrast, there are a handful of “low regret” ocean-based carbon removal activities that should also be scaled up, such as restoration of seagrass meadows, mangrove forests, and kelp forests. Such activities are likely to generate co-benefits for people and biodiversity, without presenting the same risks as “concept-stage” OCDR activities. [NWF, 166]

81. The IPCC AR6 Synthesis Report makes clear that avoided conversion is the greatest mitigation opportunity in the land sector (and one of the top opportunities in all sectors) in this decade.[3]However, the Article 6.4 framework completely excludes avoided conversion (or in other words, fails to encourage intentional preservation of carbon-dense ecosystems), the mechanism might therefore accidentally incentivize further conversion and associated emissions. One alternative might be to allow projects focused on avoided conversion to generate only modest credits for avoided emissions, which could reduce motivation to exaggerate the risk of loss, but still allow these projects to claim credit for the incremental carbon sequestration and storage in the ecosystem, ideally over a multi-decadal crediting period. We urge further consultation on this issue, to consider ways to recognize the value of standing forests and other ecosystems. Therefore, as the Supervisory Body considers projects that might be eligible under this mechanism, we wish to express our concerns around the potential for perverse incentives and unintended outcomes if activities that focus on avoided ecosystem conversion are not included. [NWF, 166]

[3] 3 IPCC. (2023). AR6 SYR (Longer Report), https://www.ipcc.ch/report/sixth-assessment-report-cycle/, p. 50 14Brack and King. (2020). Managing Land-based CDR: BECCS, Forests and Carbon Sequestration, Carbon Policy, https://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12827

3.1.8. Proposals to include specific technologies

82. We support DAC, closed-system ocean removal, BECCS, and other permanent approaches as qualifying as a removal. Using BECCS as an example: i) Removal is permanent -- it is relatively straightforward to show permanent removal at end of life in a way that converting the biomass to engineered timber or other products is not; ii) Removal is verifiable -- it is relatively straightforward how to account for the emissions that are removed from the air and permanently sequestered. [BCG, 190]

83. We also agree that it would be helpful to include removal from oceans. The ocean has large mitigation potential, and there are many ocean-based "closed systems" with similar characteristics to engineered removals that pull CO2 directly out of the atmosphere. These closed systems are verifiable in a way that open systems (e.g., ocean mineralization and algae growth in oceans) are not. [BCG, 190]

84. The definition of CDR should include ocean-based pathways as an essential complement to reducing CO2 levels in the atmosphere. Altering the definition of CDR to include capture from both the “atmosphere and oceans,” as proposed in the Information Note, could help clarify the eligibility of various marine CDR pathways. Such pathways can capture and sequester CO2 at gigaton scale, given the oceans' size, carbon sequestration capacity, and lack of land use complications. Both biological and non-biological marine pathways can capture and store CO2 in ways that provide co-benefits, such as reduced anthropogenic ocean acidification, improved fishery yields, and feedstock production for food and durable products. [EFIF, 177]

85. River Alkalinity Enhancement (RAE) should be added. The knowledge base, technological readiness, effectiveness, affordability, scalability, social acceptance, safety, permanence, and verifiability of RAE are described in Sterling et al., 2023 (https://essopenarchive.org/doi/full/10.22541/essoar.168380809.92137625/v1). [CR, 94]

86. BiCRS (Biomass Carbon Removal and Storage) may be added as a category of activity that combines the advantages of natural photosynthesis and human engineering to achieve efficient carbon removal. For example, Wood Harvesting and Storage (WHS) stores sustainably sourced coarse woody biomass in a durable structure called Wood Vault (WV) through which carbon in the form of woody biomass is taken out of the “fast” photosynthesis-decomposition biotic carbon cycle and transferred to a “slow” geological carbon cycle via human engineering. Such method uses existing technologies and is low-cost and highly scalable while ensuring durability. [UMD, 96]

87. Ocean Alkalinity Enhancement method uses low energy and simple systems to achieve removal, and at the same time, brings benefit to the local ecosystem, thus contributing to sustainable development. [PT, 98]

88. Biochar Carbon Removal (BCR) is a mature technology and is ready to be scaled up. While it provides many of the benefits listed for Land-based activities, it is also an engineered approach. [CC, 102]

89. Biochar Carbon Removal is a mature technology and has been commercialized. As it utilizes waste and generates heat energy in the process, it contributes to reducing waste as well as meeting energy demands. The resulting biochar carbon is permanently locked in and its water holding capacity enhances climate-resilient agriculture. It is scalable and has the potential to provide carbon removal in the magnitude of several gigatonnes annually. [ECOERA, 100]

90. Carbon removal from biomethane production that uses proven technology is a viable solution and has the potential to contribute to sustainable development as biomethane production in itself contributes to sustainable development. Also, as Inherit's biomethane production uses waste stream such as sewage and food waste as feedstock, this type of Bioenergy with Carbon Capture and Storage (BECCS) should be categorised as a removal activity. [ICS, 108]

91. Carbon storage in basalt offers secure, long-term CO2 storage. It injects carbon into basaltic formations, where carbon is sequestered in mineral form through geochemical reactions. The engineered mineralization of carbon in basalt has been demonstrated to be a safe and permanent storage option for carbon dioxide. No mobilizations of trace metals, no adverse effects to the biome, and no reduction in injectivity of the reservoir was detected after over 10 years of injections. Deployment of engineering-based carbon removal technologies should be considered where suitable conditions exist in terms of local and national acceptance, means for rigorous and transparent monitoring of impacts, availability of permanent storage options, and plentiful renewable energy potential. Such conditions are not exclusive to developed economies. For example, Kenya hosts basaltic formations, geothermal resources, and interest from the national government to deploy technologies. [CLLA, 110]

92. Bio-oil sequestration deliver carbon removals in a safe, permanent, and scalable manner and is technologically and economically proven. It also brings a number of co-benefits, including economic benefits, wildfire resilience, and improved air quality. [CI, 118]

93. The technical and commercial readiness of DAC is advanced enough to attract public funding. For sectors such as aviation that are difficult to decarbonize, DAC can contribute to reducing mitigation costs, especially as the cost of DAC technology will decline as the technology scales and improves. Inclusion of DAC under Article 6.4 Mechanism could catalyze the technology deployment. DAC contributes to the objectives of the Article 6.4 mechanism by delivering an overall mitigation in global emissions, thus furthering SDG 13 (Climate Action) and are aligned with SDG 8 (job) and SDG 9 (industry). The IPCC recognizes the role of DAC in that its modelled pathways that limit global warming to 1.5°C includes up to 310 Gt cumulative CDR from DAC with geologic CO2 storage between the years 2020 and 2100. Its ability to provide additional, durable, and verifiable CDR merits DAC's inclusion within the Article 6.4 Mechanism. [1.5,123]

94. The oceans offer a huge opportunity to sequester and safely store carbon dioxide, restore ocean ecosystems and enhance coastal livelihoods in the developing world and because of its size, have the potential to scale. A number of ocean-based CDR approaches are currently being explored, each requiring additional research and testing and need Article 6 to provide a regulatory and governance framework. [SF, 124]

95. Marine carbon dioxide removal (mCDR) via upwelling of nutrient-rich deep ocean, is a marine carbon dioxide removal (CDR) method, which pump deep water to the ocean's surface and stimulate the biological carbon pump (BCP). Theoretically, the process increases the nutrient concentration in the surface layer and decreases surface water temperature. By applying Artificial Upwelling (AU) globally between the years 2020 and 2100 under several different atmospheric CO2 emission scenarios, AU leads to an additional CO2-uptake of as much as 3.70 Pg CO2/year under a high emission scenario. [PK, 132]

96. Timber construction, as a nature-based and technological carbon removal solution, has proven to be feasible and is able to contribute 10% to the climate goals by 2050 if applied properly. As CO2 is stored in the building, it can be measured and monitored. By setting specific criteria it can achieve centuries of CO2. Carbon removal technologies, such as timer construction that are already proven to have a positive effect on climate, the SDGs and are immediately deployable, should be promoted. [TF, 134]

97. Enhanced Rock Weathering (ERW) accelerates the natural silicate weathering process that draws carbon from the atmosphere and sequester carbon in the oceans. It can be deployed at a gigaton scale for carbon dioxide removal while bringing measurable co-benefits such as improved crop productivity, reduced pestilence and soil enhancement. [MCR, 136]

98. Section 7 listing specific engineering-based removal activities but does not include Direct Ocean Capture. Captura’s Direct Ocean Capture technology removes carbon dioxide from the surface layer of the ocean using proprietary electrodialysis technology and commercially available water/gas handling equipment. Using only seawater and renewable energy as inputs, the system removes carbon dioxide from seawater, delivering a stream of captured carbon dioxide gas that can be utilized or safely and securely stored using mature sequestration methods, such as geologic sequestration. The decarbonized seawater is returned to the ocean, enabling the drawdown of an equivalent quantity of carbon dioxide from the atmosphere as part of the natural equilibrium between the shallow ocean and the atmosphere. [CC, 139]

99. Carbfix has successfully applied its technology of geological CO2 storage through subsurface mineralization in rocks, in Iceland for more than ten years, resulting in the safe, cost-effective, and permanent mineralization of over 90 thousand tons of CO2. Over 100 peer-reviewed scientific papers have been published on the method. The natural process of mineralization on which our method relies is an important part of the Earth’s carbon cycle and is responsible for the fact that more than 99% of all carbon on Earth is currently stored in mineral form underground. [CX, 147]

3.1.9. Engineering vs nature based

100. The “Information note: Removal activities under the Article 6.4 mechanism” (A6.4-SB005-AA-A09), despite being in its 4th version, is far from being neutral and still offers analysis and opinion that falls outside of the RMP mandate. The summary of the analysis of technical features of various removal options contained in Table 3 therein aligns with neither the views of leading authorities, such as the IPCC, nor those of Parties and Observer organisations as contained

in their submissions. Importantly, deliberation on the economic viability of certain technologies is neither an aspect called for in the RMP nor a matter that falls within the ambit of the SB. The documents contain slightly different information, presented in different tones and in different formats, presenting an obvious challenge to the effective processing of this material by SB members and other stakeholders. IETA specifically recommends the following:

(a) Improving the process to ensure a balanced synthesis of information provided in submissions to date, reflective of the latest scientific views contained in the IPCC AR6, and the mandate given in the RMP; and ensuring it is presented in a balanced, impartial and accurate manner.

(b) Enhancing capacity. Ensuring that Parties and SB members have a deep understanding of the specific benefits, challenges, choices and trade-offs that are relevant to the methodological options available for integrating carbon removal into a crediting mechanism.

(c) Facilitating engagement. Consider options to enhance engagement to facilitate understanding and clarity in the lead up to, and at, COP28 (e.g., the possibilities to request for a mandate to arrange a workshop and/or other means of information exchanges between experts, market actors, SB members and Parties). The focus must be on ensuring constructive submissions to help bridge existing gaps in understanding and develop appropriate, science-based and broadly supported recommendations on removal activities that are aligned with the mandate set out in the RMP. [IETA, 143]

101. A number of submissions refer to unbalanced representation of the benefits of engineered carbon removals and call for next iteration of the information note to bring about greater balance and technology neutrality by remedying its negative depiction of engineered removals, reflecting the stakeholder submissions in favour of those technologies. [N-AG, 142] [44.01, 142] [CC, 139] [CO2RE, 149] [CNE, 151] [CA, 152] [BEAF, 154] [ZEP, 155] [CG, 157] [BF, 159] [CCSA, 161] [SCS, 164] [CCSI, 163] [CF, 165] [NWF, 166] [DACC, 168] [KLIMPO, 167] [AN, 170] [CCC, 174] [EDF,175] [WRI,179] [PBL, 176] [CATF, 180] [EE, 181] [OV, 182] [HM, 187] [PERSP, 188] [GCCSI, 66][CE, 189] [BCG, 190][4]

102. The mismatch between the current state of scientific knowledge on pros and cons of land-based versus engineered removals was found to be alarming. For broader scientific scrutiny of the various pros and cons ensued by respective carbon dioxide removal pathways, the IPCC AR6 WG3 full report[5] table 12.6 (pp.1275-1276) and the more detailed comparison found in “The State of CDR Report”[6] (pp.18-19) are recommended. [CG, 157]

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[4] This is not an exhaustive listing of all submissions providing this view but represents a sample of submissions

[5] https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Zero%20Emissions%20Platform.pdf

[6] https://www.stateofcdr.org/

103. The CCS+ Initiative disagrees with this narrow scope of the definition used for engineered removals, as well as the characterization of their market readiness, contribution to sustainable development, and suitability for deployment in developing economies. Submissions from leading organizations such as IETA, the Carbon Business Council, Negative Emissions Platform, and DAC Coalition have all expressed concerns about these issues. [CCSI, 163]

104. We commend the Supervisory Body for adopting an inclusive definition of CDR that aligns with the IPCC definition. CATF strongly encourages the Supervisory Body to include all removal activities in Article 6.4 that meet this definition including engineering-based methods such as direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS), as eligible under the objectives of the Article 6.4 mechanism. In the future, carbon removals may be certified by national governments, and they are following the UNFCCC’s work closely. Voluntary carbon markets are already trading engineering-based credits and demonstrating feasibility at a growing scale. [CATF, 180]

105. We do not object to engineering-based removals and suggest keeping all options on the desk. But it should be recognised the nascent phase of these technologies and the questions of how relevant and to which extent carbon offsets may play a role in supporting significantly capital-intensive interventions. This should be kept in mind, and priorities need to be defined. [PD, 185]

106. From our perspective, the initial focus should be on nature-based removal projects as only these project types may have co-benefits for biodiversity and food security. Of course, nature-based removal is complex, but if properly designed, it can contribute over a long time to emission removals. [PD, 185]

107. Different sub sectors of engineering-based carbon removal solutions exist and some of the engineered CDR solutions are technologically proven and results in permanent removal. BECCS, CCUS and utilization (like concrete production) are economically proven and would bring significant climate benefit, yet requires additional policy support, such that could be provided by Article 6.4. They can contribute to sustainable development if developed equitably and could bring opportunities to developing world. [JR, 89]

108. The value of both nature-based and engineering-based removal approaches must be reflected as engineered removals also serve the objectives of the Article 6.4 mechanism as mitigation measures. While some "Engineered" approaches are at earlier stages of their development, they are needed to maximize the global carbon removal capacity over the coming decades. [JD, 90]

109. Nature based solutions are not permanent and are extremely easy to game, and while engineered solution have the potential to be scaled up further than nature-based solutions but requires subsidies to bring the cost down. [TG, 91]

110. We have concerns with Information note on removal activities’ reference to carbon stored in wood products as an effective strategy for natural carbon capture and storage. Logging (aka forest management) for wood products has severely degraded forests around the world, diminishing carbon sinks and the biodiversity that underpins all life-sustaining ecosystem services. Any carbon stored in long-

lived wood products represents only a fraction of the carbon that would have otherwise been stored in the forest. Moreover, when a forest is logged, not only is carbon emitted into the atmosphere, but its ability to remove and store carbon is compromised for many decades. Recent, peer-reviewed studies have documented the extent that logging for wood products is contributing to carbon emissions and degrading forests, including carbon sinks.[7] [DA, 162]

111. Some engineering-based technologies are commercialised, for example, "Orca" (https://climeworks.com/roadmap/orca (direct air capture and storage plant). While it is at an early stage and at a small scale, they are expected to rapidly scale and can be implemented in developing countries where renewable energy generation potential and geological storage potential exist. They are expensive at present but are necessary in addition to land-based approaches. Drawbacks exist for land-based activities, as listed in the Land Gap Report[8] (UNFCCC) including: competition for land-use with food production; potentially limited ability to scale up that requires careful assessments; intensive monoculture (e.g. for biochar) leading to biodiversity/ ecosystem-service trade-offs; potential for unintended adverse consequences such as altered water availability; difficulty in verification of removal, thus possibly economically ineffective; time lag between planting and build-up of carbon stocks; cost of long-term (multi-centennial) maintenance, and unavoidable loss caused by, for example, wildfires, disease, drought, among others.[UoEx, 93]

112. Land-based approaches including afforestation face limitations such as land availability, long-term maintenance requirements, and uncertainties surrounding permanence and stresses the importance acknowledging a broader range of innovative solutions, such as enhanced rock weathering. Enhanced rock weathering involves natural process in which, carbon dioxide is captured from the atmosphere and permanently stored in the form of carbonates, while at the same time, enhancing soil quality and agricultural productivity, thus offers a viable and sustainable method of carbon removal that can be implemented globally. [IP, 95]

113. There are scientific data available, such as the IPCC AR6 WG3, that support the fact that engineered removal methods need to be fully integrated to any framework for mitigation. In doing so, a mechanism must be put in place to ensure their use as safe and equitable as possible. [TI, 97]

114. Implied exclusion of engineering-based removal approaches from the mechanism based on their current immaturity of technologies is unjustifiable as technological development tend to follow exponential growth and while the current removal volume is low, it is likely to reach a significant scale in the near future. Some methods are less aligned with sustainable development but that does not apply to all engineering-based methods. [PT, 98]

[7] https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-016-0066-5

https://www.nature.com/articles/nature25138

https://www.nature.com/articles/s41467-020-19493-3

[8] https://unfccc.int/documents/628104

115. Engineering-based removals offer opportunities for scalable, efficient carbon sequestration and can play a crucial role in achieving net-zero emissions, complementing efforts in land-based removals (IPCC and State of CDR). An increasing number of countries are incorporating engineered removals in their climate targets (see also “Cross-cutting”), notably Bio-Energy with Carbon Capture and Storage (BECCS) and Direct Air Capture (DAC), which demonstrate their potential for practical deployment and their importance in achieving our collective climate goals. [CX, 99]

116. The taxonomy of removal activities should be as broad as possible, and allowance should be made for emerging categories so as not to exclude potentially promising carbon removal “pathways”. The distinction between "engineered" and "land-based" is not useful as some level of engineering is required in many land-based activities while nature is an integral part of many of the engineering-based approaches. Instead, each approach should be evaluated by predefined criteria such as additionality, co-benefits, storage duration, among others so as to allow the market to ensure that the lowest-cost pathways that meet all regulatory requirements will be implemented first. In addition, while many of the engineering approach may be at “lower technology readiness levels”, it is likely that some of them will prove efficacious and cost effectiveness at significant scales within the next several years. [CB, 104]

117. Carbon Business Council defines CDR as ”anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products”. The label of “engineering-based activities” is impractical as most CDR approach is a hybrid of nature and engineering. Instead, a set of criterial should be defined based on which a given CDR project eligibility is assessed, including additionality, durability, net-negativity, verification, and equity and community engagement. (See also [CBC, 107]) [CRIA, 105]

118. The distinction between engineering-based and land-based CDR approaches is not useful in discussing different groups of CDR methods. Instead, eligibility of individual “engineering-based” CDR activities for Article 6.4 should be assessed based on requirements regarding monitoring, reporting, accounting, addressing of reversals, avoidance of leakage and avoidance of other negative impacts rather than inclusion or exclusion by label of “engineering-based.” The 0.01 MtCO2 per year of current removals cited in table 3 refers to Direct Air Capture only, not all “engineering-based” methods. Adding removals from BECCS in line with table 4, it is around 1.8 MtCO2 per year. The 2 MtCO2 per year reported in the State of CDR for all “novel” activities includes biochar, which is not defined as “engineering-based” in the Information note. The estimates for what land-based activities currently remove is of 2,000 ± 900 MtCO2 per year. Of all modelled pathways that limit warming to 2°C with a likelihood of 66% or lower, 93% include BECCS while 27% include DACCS “engineering-based” removals. The IPCC states: “Modelled mitigation strategies to achieve these reductions include … deploying carbon dioxide removal (CDR) methods to counterbalance residual GHG emissions.” Risks associated with the large-scale deployment of land-based CDR methods such as threats to biodiversity, food security or water scarcity are not reflected as “cons” in table 3 of the information note. Sustainability implications of land-based CDR methods can be positive or negative depending

on, for example, the implementation practices, the scale of biomass sourcing and other pressures on land. We recommend either adding the "cons" associated with unsustainable practices that are also possible or highlight the potentially positive or negative implications of land-based CDR methods depending on biomass source and level, implementation practices, geographical context and the degree of land competition among others. [SCDRR, 109]

119. On the pros and cons for Engineering-based activities and Land-based activities listed in table 3 of SB005-AA-A09, they depart from what is established by the IPCC, for example, the food and water related challenges for Land-based activities (Table 12.6 in AR6) is not included in cons. Furthermore, it lists BECCS as an emission reduction activity, while it is widely considered a removal activity including under the IPCC. [SE, 111]

120. Not all technology-based removals have sustainability co-benefits beyond SDG 13 but that should not block building the permanent, technological based removal capacity the world urgently needs. [IJ, 113]

121. The label of "engineering-based activities," is not appropriate as most of CDR approaches are hybrid of nature and engineering. A method-neutral, criteria-based framework should be used to assess eligibility of CDR under the Article 6.4 mechanism. In addition, there are many cases of CDR deployed equitably and responsibly in the Global South", thus contributing to sustainable development. [OA, 114]

122. All removals serve the objective of Article 6.4. The comparison of engineered-approaches and land-based approach in Table 3, SB0005-AA-A09 is biased, and assessment of different removal methods should follow The IPCC AR6 WG3 and the State of CDR report . A set of criteria should be defined that a carbon removal project must fulfil under the Article 6.4 mechanism. [MC, 117]

123. The categorisation of measures into engineering-based and land-based activities should be reconsidered as some removal measures, such as their bio-oil production, are hybrid in that they incorporate both activities. [Charm, 118]

124. Land-based removal activities offer many benefits but are often limited in scale, impermanent (less than 100 years), and contain the risk of reversal due to natural disaster and human activities as well as having large footprints and facing trade-offs related to food production and biodiversity preservation. In comparison, some of engineering-based removal activities offer nearly unlimited scale potential and can provide permanent storage with minimal risks of reversal. Several of those have started commercial operations, while others are preparing to scale in the coming years. Engineering-based removal activities also advance sustainable development by providing well-paying jobs and economic benefits, while mitigating climate change with limited environmental impacts. The importance of both land- and engineering-based approaches in the Article 6.4 mechanism. [LT, 122]

125. Engineered approaches have a key role to play in carbon removal, and we support the position presented by the Negative Emissions Platform (see [NEP, 131]). Both nature-based and engineered removal need to be pursued simultaneously to meet the long-term temperature goals of the Paris Agreement.

Engineered based removal activities require technological improvements to scale and excluding it from the Article 6.4 mechanism will risk investors to hesitate to make the necessary investments. [MS, 125]

126. Land-based vs "engineering-based" dichotomy is a result of an incomplete definition of carbon removal. A more complete definition should focus on the movement of carbon from the fast to slow carbon cycle, where the total fast carbon removed exceeds the total slow carbon emitted within a given project boundary (also "Accounting"). Such removal activities could rebalance the natural carbon reservoirs by transferring carbon from fast cycling reservoirs (i.e., the biosphere, the atmosphere, and the upper ocean) to slow cycling reservoirs (i.e., the deep ocean and marine sediments, geologic storage), thereby serving broader goals of sustainable development. Because land-based activities primarily address fast cycle carbon sinks, those activities alone cannot rebalance the greater carbon cycle at a scale that effectively combats climate change. [RT, 130]

127. Additional "pros" that can be considered for engineering-based approaches include:

(a) permanent net removal of carbon dioxide from the atmosphere.

(b) broad range of technologies that can adopt to the local conditions

(c) a removal potential that is many times greater than land-based activities

(d) contribution to sustainable development

(e) permanence and potential decline in the costs in the future. [NEP,131]

128. Classifying CDR methods as either "Land-based" or "Engineering-based" is not constructive. All carbon removal solutions bring risks and benefits, thus excluding them prematurely will lead to technology being locked-in and important research and innovation abandoned. [EQ, 127]

129. The evidence that engineered removals contribute to reducing the global mitigation costs can be seen in the climate scenario models used by the IEA which concluded that to achieve the 1.5C target with least cost mitigation measures would require 70Mt CO2 pa captured by DACCS in 2030 and 600 Mt pa CO2 by 2050 (ref IEA WEO 2022 and IEA ETP 2023). Also, there are more cons of land-based removals than listed in the table that should be considered. [IEAGHG, 128]

130. Regarding table 3 of SB0005-AA-A09, we disagree with the assessment of the current state and potential of removal technologies. A broad and full suite of technologies will be required if the goals of the Paris Agreement are to be met and believes that it should not be excluded from the full portfolio of technology solutions that are eligible under the 6.4 mechanism. (See IETA submission for the details and recommendations) [BCSE, 129]

131. Engineered removals have the potential to significantly lower the overall costs of achieving climate targets, especially because their costs are expected to decrease as they mature and scale up. [NEP, 131]

132. Before dismissing any technology, its full removal potential must be considered, rather than the current capacity. Since many of the engineering-based approaches are still unproven, they should not be ruled out at this point. Land-based activities have the disadvantage of potential reversal while engineering-based removals can be permanently stored which is essential for climate mitigation. In addition, because historical emissions can only be achieved through negative emissions, applications such as Direct Air Capture are crucial. [CCU, 133]

133. The TRL level of engineering solutions is growing rapidly through state- and privately funded research globally, for example in the UK, Germany, USA, China and Canada. Marine engineering solutions have great scalability. [PML, 112]

134. On the economic viability of engineering-based approaches, numerous companies have committed advance purchase agreements seeking to reduce their carbon footprint, facilitating economic returns for those projects. While the economics of large-scale engineering CDR pathways have yet to be demonstrated at the required scale, the cost reduction curves of technology shows that it decreases by learning-by-doing and they will become economically viable. CDR contributes to SDGs by creating jobs, economic growth, expand the affordability of clean energy, decarbonize hard-to-abate industries and reduce global GHG emissions. Furthermore, engineering CDR pathways can be deployed widely using modular-scale technologies in the developing world. [AC, 135]

135. Engineering-based approach seems to include approaches such as direct air capture, enhanced weathering, and ocean alkalinity enhancement, that constitute a significant portion of the relatively small portfolio of methods currently being explored to achieve long-term carbon removal. As such, excluding this category of carbon removal activities from the Article 6.4 mechanism contradicts pursuing the best available science to achieve the temperature stabilization goals of the Paris Agreement. To stabilize global temperatures requires carbon removal and long-duration storage that counters fossil CO_2 emissions while land-based activities offer only temporary storage. Although there are still uncertainties about the realistic potential of “engineering-based” removal activities and how to deploy them responsibly, they can play a distinct and important role in achieving temperature stabilization. Different carbon removal pathways be accurately characterization in terms of the durability. [CP, 138]

136. Methodological issues of land-based removals do not include some approaches that are already used in VCM standards, for example, an ecological indication that is widely used in VERRA standards. [WI, 9]

137. In general, nature-based credits are less likely to represent one tonne of real CO_2e than engineered credits. While nature-based projects can have significant co-benefits, they also have risks of failing to properly engage indigenous people and local communities, displacing people off land, competing for scarce land-based resources, and other impacts. Indeed, with the projects under construction today, both DACCS and BECCS could demonstrate TRL 7 before 2025. Similarly, commercial firms are piloting enhanced weathering and other mineralization pathways today [CD, 143]

138. Drax expresses concern regarding the management of the submission process and synthesis of information by the UNFCCC Secretariat as manifested in the latest iteration of the note. [DG, 145]

139. Neustark calls for a well-established distinction between mitigation in the form of reductions or removals and strongly believe that durability should be prioritised as it is inherent in all the IPCC definitions of CDR. “Anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products.” Accordingly, the definition of a time horizon for this mechanism should be done in a way that does not put the inclusion of highly durable methods at risk. We encourage the A6.4 body to find a well-balanced storage threshold, reflecting both economic and scientific rationales. [N-AG, 141]

140. The removal of CO2 from the atmosphere is not the result of a mitigation activity per se unless the removed carbon is stored. On the contrary, each net increase in forest carbon stocks corresponds to a mitigation activity since it is the result of a net removal of CO2 from the atmosphere and its subsequent storage. That further means that having increasing removals across time is not a condition necessary to identify and quantify mitigation, although desirable given the climate crisis and the lack of global emission reductions. Because of the above, activities under REDD+ refer correctly to conservation and enhancement of carbon stocks, not just to CO2 removals. [PN, 55]

141. It is important to differentiate between conventional geological storage and mineralisation which does not ‘store’ CO2 but converts it into rock, removing CO2 from the carbon cycle forever and ensuring it cannot escape back into the atmosphere. This is an important distinction as it affects safety regulations and potential monitoring and insurance requirements.[44.01, 142]

142. The importance of durable (or permanent) removal of CO2 in a reservoir that is not prone to risk of reversal should be recognised. The rules and methodologies established under the Article 6.4 mechanism should standardize removals with respect to the durability of the storage. [RT, 130]

143. Durability of storage should be given more importance under A6.4 market and a time horizon should be defined in such a way not to exclude highly durable methods. [NEP,131]

144. The focus on the conventional but fundamentally arbitrary time horizon of 100 years is also of great concern. [BF, 159]

145. On the information Note for removal activities, some engineering-based approaches have already been technologically proven. Nearly 20 direct air capture (DAC) plants operate globally today, and currently planned projects alone could achieve deployment of 5.5 tCO2 by 2030, according to the IEA. Additionally, technology-based approaches can support sustainable development goals. By one estimate, a 1 megaton DAC facility could create about 3,500 jobs across the supply chain and support related industries, such as cement and steel production. [NWF, 166]

146. The viability of engineered CDR is demonstrated by pilot projects like Climeworks' and Carbfix's joint Direct Air Capture (DAC) and carbon mineralization project in

Iceland, showcasing technical feasibility and innovation. The demand for durable carbon credits, including those from engineered CDR, exceeds the current supply, which demonstrates its vast economical potential. By implementing appropriate regulations and policies, technologies like Direct Air Capture (DAC) can and will leverage economies of scale to be economically viable. (Fasihi, 2019) · Engineered CDR methods, particularly of a ‘closed system’ approach such as in DAC+Storage installations, pose minimal environmental or social risks. Both Direct Air Capture and CO2 mineralization have been practised at scale for 7 and 15 years, respectively. Other methods of engineered carbon removal such as biochar, enhanced rock weathering, or ocean alkalinization have been practised at some scale, and while their ecosystem impacts need to be carefully assessed, they in fact have great promise for environmental and social co-benefits (IPCC, 2022). Companies like Octavia Carbon or Cella Mineral Storage in Kenya, Takachar in India, and InPlanet in Brazil have pilot safe engineered CDR methods in the Global South, and in their short history have created >50 mid- to highly skilled jobs between them. While applying the highest standards of safety, these companies should be encouraged to keep innovating and driving highly value-adding engineered CDR investment into the Global South. These companies provide templates for green growth to emerging economies in the Global South and have the potential to become catalysts for much larger-scale green transformation in countries of the Global South, by providing new bankable industrial demand for energy that can help accelerate investments in renewables (Mwangi, 2021). [OC, 168]

147. We have already set up an already operational Direct Air Capture (DAC) and already earned substantial DAC-based gold standard credits; Several other DAC companies have made multi-million-dollar sales. In total, 75% of the $200 million or 510,000 tonnes of purchased carbon removal in 2020-2022 were from DAC projects. Moreover, the scale-up of DAC is anticipated to create at least 300,000 high-paying jobs that will support whole communities, which is a major component of “sustainable development. [CCI, 172]

148. The Carbon Capture Coalition argues that there has been tremendous and encouraging progress in this industry over a very short period and disagrees with the above characterization of engineering-based removal activities. Currently, there are 18 direct air capture plants operating worldwide, capturing 10,000 tons of CO2 per year— these facilities are pilot scale, except for Climeworks’ Orca, the world’s first commercial-scale DAC facility. [CCC, 174]

3.1.10. BECCS as removal activity

149. Durable storage is not yet defined, but the note pays recognition to a period of 200-300 years. BECCS delivers on each of the components of the definitions, by drawing down CO2 from the atmosphere through photosynthesis and injecting the CO2 for durable storage in geological formations. BECCS should not be classified as an emissions reduction activity, in contradiction of its status as a removal activity under the IPCC and leading scientific studies. [DG, 146]

150. It is a widely recognised practice that bioenergy based on sustainably managed forest areas is considered renewable energy and hence applying CCS activity to bioenergy based on sustainably managed forest areas can deliver removals, e.g., forest biomass for bioenergy is recognized by the European Union as

renewable energy if it complies with a set of sustainability criteria established in the Renewable Energy Directive. In some cases, it might even be argued, that BECCS based on sustainably managed forest areas might provide greater co-benefits than BECCS based on plantation or energy crops specifically raised for the purpose of producing fuel for the power plant. Such plantation or energy crops might take up land areas for other uses compared to sustainably managed forest areas, which are already established. [ORST, 158]

151. See the assessment of the European Academies' Science Advisory Council. In short, negative emissions would only be possible if local wood processing residues are used (this is already no longer the case in the wood pellets market), serious progress is made in the efficiency of the capture and compression process, and there is an adequate long-term storage site available. Today, BECCS has not achieved negative emissions anywhere yet, and the only significant projects that exist are based on processes using the fermentation of grains (for ethanol production), not the combustion of woody biomass or municipal waste where the cost of isolating the CO2 from the other gases would be prohibitively expensive. [FE, 160]

152. There are advantages to BECCS and other CDR pathways that use sustainable forest and waste feedstocks, with a substantial body of literature on the emissions benefits of BECCS from these sources, including their ability to achieve net-negative emissions at a low cost and with other co-benefits. [EFIF, 177]

153. On the classification of BECCS with sustainable biomass, it should be classified as removal and not emissions reduction activity, in line with the definition of the IPCC. According to the guidelines for National Greenhouse Gas: “If the [CCS] plant is supplied with biofuels, the corresponding CO2 emissions will be zero, so the subtraction of the amount of gas transferred to long-term storage may give negative emissions. This is correct since if the biomass carbon is permanently stored, it is being removed from the atmosphere.” [NEP, 131]

154. Drax invites a concrete re-evaluation of the approach to BECCS within the next iteration of the note so that it better aligns with the positions of the IPCC[9], national governments[10] and the leading academic literature[11]. [DG, 145]].

155. The Dutch environmental organization Leefmilieu does not consider BECCS to be a solution to the climate problem. The technology for CCS in biomass plants is not yet operational anywhere. CCS is expensive and requires energy. BECCS

[9] 2006 Guidelines for National Greenhouse Gas Inventories and 2019 refinement to the Guidelines, Intergovernmental Panel on Climate Change.

[10] Several governments, such as that of the United Kingdom and Denmark, have committed to the importance of carbon dioxide removals from BECCS in delivering their national climate strategies. The United States of America’s Inflation Reduction Act provides fiscal support for removals delivered by BECCS.

[11] 3 The State of Carbon Dioxide Removal: a global, independent scientific assessment of Carbon Dioxide Removal, University of Oxford’s Smith School of Enterprise and the Environment, Smith et al, 2023

requires huge quantities of wood that are not in stock. See the various reports from, for example, EASAC and NGOs as a biofuel watch[12] [LU, 156]].

156. The removal method of BECCS might not be suited for all countries globally but we are convinced that it will be for countries like Sweden. We kindly request the Supervisory Body for the mechanism established by Article 6, to recognize that engineering-based removal activities such as BECCS are essential to achieving the objectives under the Paris Agreement and its Article 6.4. [KLIMPO, 167]

157. Fern have published a briefing that summarises some of the main concerns with BECCS as follows:

(a) BECCS is proposed as a solution based on the assumption that bioenergy would be carbon neutral. But this assumption is incorrect, notably because of emissions from land use and forestry: today, 30 per cent of carbon dioxide in the atmosphere came from land use change (including deforestation), not fossil fuels. Moreover, BECCS itself produces significant emissions while we need to reduce GHG emissions immediately.

(b) BECCS has technical barriers, is indeed unproven at scale, and is prohibitively expensive

(c) BECCS would require a huge amount of land, and push up the price of food

(d) BECCS would most likely harm biodiversity

(e) BECCS would take a huge amount of water and threaten more planetary boundaries - BECCS is a barrier to the energy transition. [FERN, 160]

158. bioenergy with carbon capture and sequestration (BECCS) is often a prominent element of climate models but presents significant downsides that should be accounted for with the Article 6.4 removals framework. In particular, the demand for biomass poses threats to water resources, biodiversity, land conversion and deforestation, and competition with food production. As demand for biomass feedstocks increases to support BECCS, there is a significant threat from both direct and indirect land-use change. [NWF, 166]

159. [PPI, 191] A large body of work shows the ability of forests to continue storing carbon when mature and they do not become “saturated” as indicated; The fact that the majority of managed forests have greatly reduced carbon stocks compared to the carbon stock capacity of natural forests – thus could have hundreds of years of carbon accumulation ahead of them, if left alone, or managed only lightly; and Logging forests causes them to leak carbon in a variety of ways, e.g. removing forestry residues to serve as biomass feedstock – a forest “waste” that is generally assumed to simply decompose if not collected and burned for energy – actually depletes soil carbon stocks (Achat et al, 2015a5 ; Hamburg, 20196) and nutrient stocks (Achat et al, 2015b7), thus putting the

[12] EASAC: https://easac.eu/news/details/look-before-you-leap-european-science-academies-cautionagainst-subsidies-for-bioenergy-with-carbon-capture-and-storage-beccs
- Dutch KNAW: https://www.knaw.nl/nieuws/co2-opslag-wat-kan-en-wat-werkt

carbon balance further into debt and potentially interfering with forest regeneration. [PPI, 191]

3.2. Monitoring and Reporting:

160. The SB 005 Information Note calls for a discussion on

(a) What timeframes and related procedures should be specified for these elements referred to in A6.4-SB003-A03?

(b) For initial monitoring and submission of monitoring reports (paragraph 3.2.14);

(c) For subsequent monitoring and submission of monitoring reports (paragraph 3.2.14);

(d) For monitoring and submission of monitoring reports following an observed event that could potentially lead to a reversal (paragraph 3.2.14); (c) For monitoring and reporting, including any simplified reporting, conducted after the end of the last crediting period of activities involving removals (paragraphs 3.1.10 and 3.2.13).

161. The Info note calls for discussing any further considerations to be given to the core elements for monitoring and reporting in A6.4-SB003-A03; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types

162. Below is a summary of public inputs received.

3.2.1. Principles and Procedures for monitoring

163. Developing a robust approach to the monitoring, reporting, and verification (MRV) of negative emissions is essential to their deployment at scale, to instil public and market confidence, as well as ensuring the climate benefit is being realised, including monitoring in case of reversals so action can be taken. [UK, 54]

164. To support the UK's approach to GGR MRV, in 2021 we established a Task and Finish Group, comprised of experts across government, industry, academia, and regulatory services. The role of the group was to provide advice and guidance of the development of an MRV policy approach for engineered removals. Whilst this work has focused on the development of an MRV policy approach for engineered removals, the UK acknowledges that specific guidance on nature based MRV must also be developed by the Supervisory Body. The work by the Task and Finish Group is currently focused on CO2 however we remain mindful of options focused on non-CO2 GHG removals and will keep these under review. The Task and Finish Group report set out the key challenges in this area, which are relevant to guidance on removal activities under Article 6.4, in particular:

(a) The importance of permanent removal from the atmosphere and determining how this is calculated including the system boundaries of a GGR process, quantifying how much CO2 gets removed, at what rate, and for how long this is stored.

(b) Establishing and addressing gaps in the science of MRV capabilities for each GGR approach, in particular new and novel GGRs, and then developing detailed MRV protocols for these approaches.

(c) Addressing the challenge that certain land-based methods pose particular MRV challenges, especially in cases where captured carbon is challenging to track and measure and carries a risk of being re-emitted back into the atmosphere.

(d) Providing capacity for independent verification, to ensure that the amount, and permanence of removals are quantified, robustly and transparently.

(e) International engagement to share knowledge and understanding, to collaborate on addressing the governance and accounting challenges relevant to GGR, including those associated with international supply chains and encouraging international consistency where appropriate.

(f) Drawing on the MRV Task and Finish Group's advice, the UK identified a set of proposed principles for determining the legitimacy of a negative emission. These factors are also relevant to the Supervisory Body's work and determining the principles to guide considerations around A6.4 activity eligibility. [UK, 54]

165. Monitoring requirements in many offsetting systems refer to best practices for LULUCF by the IPCC [RU, 53].

166. Monitoring should adhere to the principle of stakeholder engagement/consultation, in which women in all their diversity, local communities and Indigenous Peoples, and Afro Descendants living in the programme or project areas should be included in participatory monitoring of the removal activities. From the gender perspective, monitoring should be conducted in a gender responsive manner, including gender budgeting and building the capacity and empowering local women to carry out community/grassroots level monitoring. Activity participants should employ independent third parties to conduct the monitoring to provide independent verification. It is of utmost importance that these third parties are accredited entities as per the requirement of the Article 6.4 mechanism. The latter requirement may need to be developed by the Supervisory Body or incorporated as part of the roster of experts. We welcome that "…monitoring shall also be conducted after the end of the last crediting period of activities involving removals…" in the above paragraph. This is because reversals could occur anytime, including after the crediting period of activities. [...] we would also like to see the following incorporated into this section:

(a) Information to demonstrate the additionality of the removal activity;

(b) Information on how to minimize the risk of non-permanence over multiple NDC implementation periods;

(c) Information to minimize the risk of leakage and adjust for any remaining leakage in the calculation of emission reductions or removals;

(d) For transparency, all reports by the activity participants should be made publicly available and easily accessible on the Article 6.4 mechanism public website;

(e) Shall undergo local and subnational stakeholder consultation consistent with applicable domestic arrangements, in relation to public participation, local communities and Indigenous Peoples, and Afro Descendants;

(f) Information on any grievances that have been filed [LESE, 76].

167. The SB should define the principles for monitoring, e.g. accuracy, completeness, consistency, transparency, etc, in line with the IPCC guidelines and guidance. The monitoring of removal activities should be based on the quantification of carbon stocks based on IPCC guidance. The field measurements are important, especially at the beginning and at the end of the monitoring period to capture the totality of C stock changes, and that these estimations should be verified. [ALLCOT-48]

168. The Article 6.4 mechanism must set out robust monitoring, reporting and verification (MRV) requirements related to the operation of storage sites and methods. It is essential that appropriate monitoring approaches can be introduced for all activities on an equivalent basis (i.e., conferring the same level of confidence) to regularly confirm that carbon dioxide continues to be stored out of the atmosphere. In addition, the rules and methodologies under the mechanism must lay out the responsibilities and liabilities for compensating and remedying reversals of storage. [CCSA, 68]

169. CLARA is also concerned about the order in which these issues are being discussed. While some of the questions for regulating removals are unique, most in fact apply equally to all activities that might be eligible for sale as an offset. It would make the most sense then that the Supervisory Body design the methodology for the whole mechanism first and then address issues specific to removals. The complete governance package, of which recommendations on removals is only a piece, should be presented before anything is adopted. Doing otherwise risks confusion as well as increasing the risk of undermining ecosystem integrity and even the integrity of the Paris Agreement itself. [CLARA, 69]

170. Mechanism methodologies shall require that all removal activities monitor the achieved carbon stocks through their quantification using field measurements or remote-sensing, or a combination of both. This would allow for innovations associated with higher frequency more transparent means of monitoring for events of default and carbon performance. This would also allow for better predictive modelling of effective performance of new innovative ways of sequestering or capturing carbon for varying durations with varying performance expectations. We need 1,000 shots on goal. [CFL, 85]

171. Monitoring requirements for geological storage should rely wherever possible on existing regulatory regimes, where such regimes meet agreed minimum requirements, to avoid a complex layered structure of legal and voluntary market requirements [CE, 39]

172. Monitoring requirements for geological storage should rely wherever possible on existing regulatory regimes, where such regimes meet agreed minimum

requirements, to avoid a complex layered structure of domestic legal and Article 6.4 requirements. (IETA-51)

173. Existing regulatory frameworks and the proven history of geological CO2 storage provide examples of how DAC technology can be deployed in a safe and environmentally sound manner, for example, MRV plans of existing operations that are approved by the United States Environmental Protection Agency for the permanent storage of CO2. [1.5, 123]

174. It is key to create transparency in the market and qualify tangible impacts (net carbon removals) on project levels, national levels and on a global level. Therefore, MRV industry partner working groups, specifically in Direct Air Capture for industrial downstream applications, is recommended. The lack of acknowledgement of CCUS under UNFCCC A6 and therefore methodologies available for technology-based carbon removal (DACCUS) might continue to fragment the market into arbitrary self-certified carbon projects with opaque technology risks and delivery uncertainties - it is imperative to speed up methodology development with industry partners that can accelerate industrial decarbonization through carbon in setting in raw materials. [AD, 87]

175. The emissions reductions associated with removals must be monitored to ensure that GHG impacts are credible and verifiable, as well as to detect and compensate for reversals. Standards typically set minimum data collection thresholds and monitoring requirements, which may be carried out by project owners or with the help of government and local communities. While the monitoring techniques and technologies needed to accurately quantify projected or claimed GHG impacts vary widely across ecosystems and specific NCS pathways, there are two main categories of approaches. The first is direct monitoring, involving physical site visits to record measurements and changes in carbon stocks or other proxies. The second is remote sensing, usually aided by advanced technological sensors and capable of collecting data across vast and inaccessible landscapes. A robust system combines inventory approaches and remote sensing to estimate emissions and removals. [EDF, 80]

176. As we have extensive experience working with host countries in supporting them in their Nationally Determined Contributions, the development of their Measurement, Reporting, and Verification (MRV) systems, and in fostering their GHG inventories, we consider that consistencies in data between, e.g. standardized baselines, and information provided by the host countries under Article 13 and the enhanced transparency framework (ETF) should be better addressed. [CP, 186]

177. The significant complexity and uncertainty of MRV of emissions (and removals) of land-based activities and should be added as a “con” for Land-based methods. This is underlined by the large uncertainty range for assessments of current land-based removals (±45% in the State of CDR report) as well as the broader land use flux (evaluated as ±70% in IPCC 6th Assessment Working Group III report). [SCDR, 109]

178. have developed a model that is based on physical measurements that can track the downstream transport and long-term storage of the carbon while keeping the MRV costs within economic viability. [MCR, 136]

179. All removal activities must be monitored continuously. One could also imagine that if scientific consensus is reached that a certain reservoir is functionally stable, the reservoir's monitoring can decrease in frequency. [SA, 47]

3.2.2. Monitoring in relation to specific CDR technologies (e.g. Modelling approaches)

180. The possibility that Ocean Alkalinity, and perhaps other approaches in the future, are best verified through modelling, indirect measurement, or other approaches as determined by the best scientific consensus at the time. [PT, 2]

181. Some approaches require special considerations in MRV, so the requirements should be flexible enough to encourage all legitimate technologies. For example, monitoring of carbon stocks would be impractical for the Ocean Alkalinity Enhancement pathway, which shows great promise. [CBC, 40]

182. Measurement and monitoring protocols for marine CDR and mineralization have already been demonstrated at small scales, so these technologies should continue to be considered in policy. Mineralization presents another promising pathway for near-permanent CDR, given that about one gigaton of CO2 is already stored annually via natural carbon mineralization; technologically enhanced mineralization (at the surface or underground) could accelerate these removals five to tenfold. The Information Note's discussion of "Methodological issues related to engineering-based removal activities" suggests that no known monitoring methods exist for enhanced rock weathering and ocean-related CDR activities. While monitoring, reporting, and verification (MRV) technologies are not yet well-developed, there is existing proof of concept research and policy proposals for both technology areas that could be used as the foundation for MRV. Therefore marine-based CDR and Mineralization solutions need not be taken off the table for global policy—and action that could stunt innovation and investment. [EFIF, 177]

3.2.3. Addressing uncertainties

183. Discounts to address uncertainty is not a monitoring consideration but an accounting issue, and that it should be relocated. Applying conservative default factors to address uncertainty assumes that the estimate of uncertainty reflects systematic errors. However, almost always, the estimation of uncertainty mostly reflects random errors, i.e. normal variation of C stocks due to inherent natural conditions. This variability is usually mid-high for land-based removals. Activity proponents shall follow IPCC guidelines and guidance to reduce any systematic error in the estimation of C stocks at times 1 and 0, and to report uncertainties, without the need for adjusting the final removals estimate based on uncertainty. This would result in a loss of accuracy and create an artificial reduction of eligible A6.4 removals. Rather, the estimation of C stocks shall be technically assessed to ensure there is no bias in the estimates. [ALLCOT-48]

184. In relation to proposals to discount due to uncertainty, applying conservative default factors to address uncertainty assumes that the estimate of uncertainty reflects systematic errors. However, almost always, the estimation of uncertainty mostly reflects random errors, i.e., normal variation of carbon stocks due to inherent natural conditions. This variability is usually mid-high for land-based

removals, and this is normal. Therefore, we propose to the A6.4SB that activity proponents follow IPCC guidelines and guidance to reduce any systematic error in the estimation of carbon stocks at times 1 and 0, and to report uncertainties, without the need to adjust the final removals estimate based on uncertainty as such would result in a loss of accuracy and create an artificial reduction of eligible A6.4 removals. Rather, the estimation of carbon stocks should be technically assessed to ensure there is no bias in the estimates. [IETA,51)

185. IETA would welcome greater dialogue on the possibilities for, and implication of, using the recommended method of conservative default factors to account for measurement uncertainty. Such methods need to ensure that the environmental integrity of the resultant credits remains high, and that approaches support robust accounting against NDCs. [IETA,51)

3.2.4. Period and Frequency of monitoring and verification

186. Regarding removals by DACCS technologies, monitoring for geological storage can rely on the existing monitoring requirements and regulations of the CCS technology-based mitigation activities of the Clean Development Mechanism. Regarding paragraph 10, the ROK would like to point out that some engineering-based removal activities might not be appropriate for the monitoring after the end of the crediting period. This applies to DACCU activities with low permanence. Some products from DACCU technology-based activities may release their stocked CO2 back into the atmosphere as they are consumed. Yet, the utilization of CO2 captured from the atmosphere replaces unburned fossil fuels, which can lead to a permanent substitution effect. Therefore, monitoring the removal activities by DACCU technologies is required to focus on the manufacturing process for the CO2-utilized products. This means the concept of periodic monitoring after the end of the crediting period is not applied in the case of DACCU technology-based removal activities. Therefore, regarding paragraph 10, the ROK thinks that Supervisory Body needs to elaborate the periodic monitoring requirements on a case by case. In the case of engineering-based approaches, long-lasting (or long durable) products from DACCU technologies require periodic monitoring after the end of the crediting period. Yet, undurable products from DACCU technologies such as synthetic fuels or carbonated drinks (beverage carbonation) does not require periodic monitoring after the end of the crediting period [ROK, 57]

187. Frequency of monitoring could vary for different ecosystems/activities/strata, but could be made at least every 5 years and/or aligned with the NDC cycle. Monitoring plans should take into account harvesting-related implications and include monitoring and reporting loss events. [RU, 53]

188. Monitoring commitments should not be defined as a set number of years but rather be defined as a condition or set of conditions where safe and secure storage can be demonstrated. The monitoring period length should reflect the security of the storage medium chosen for the activity and the risk of potential reversal. As an example, in geologic storage the point at which the CO_2 plume has become predictable and reliably contained in line with reservoir modelling results is an important site closure condition that must be proved by the storage site operator prior to receiving a site closure ruling. Depending on the site and the circumstances, such a state could be reached in a matter of a few years after

injection is complete, or in an extreme case could take hundreds of years. [IETA, 70]

189. On the frequency of monitoring, two “full” measurements are conducted encompassing the full crediting period. “Simplified” monitoring, i.e., remotely sensed forest cover should be allowed within the crediting period to ensure permanence and to understand if corrective actions are needed. In case the activity proponent seeks to verify removals before the conclusion of the crediting period, then a second “full” measurement should be conducted to estimate C stock changes and, from this, removals. [ALLCOT-48

190. The reference to ‘accumulation of stocks’ assumes all removal types increase sequestration over time. This may be the case for nature-based solutions and carbon farming but not for engineered types like DAC and BECCS. The language across most of the consultation documents appears to derive from nature-based solutions and should be made more holistic/agnostic to account for full spectrum of removal types including utilisation/carbon-to-value. [ECP, 27]

191. The Supervisory Body should consider the impacts the timing of verification might have on the financing of projects. Requirements for verification that may delay verification may also delay when a project receives compensation for CDR and impacts the financing of the project. The project proponent should have some ability to verify more frequently or earlier than recommended if they carry the cost of verification as the verification schedule heavily dictates the business model. This is especially true for emerging technologies that are still working through the hurdles of scaling where the production of carbon stock may initially be slower than expected. [CW, 31]

192. In practice and in the case of projects with a crediting period of 15 years developed with smallholder farmers (most probably including about 2 harvesting cycles) , ensuring a permanence period of at least 40 years is unrealistic. [TREEO, 11]

193. It is also not commonplace to require permanence monitoring beyond the project term/end date. We suggest broader stakeholder comment is sought prior to prescribing such approaches. [ACR, 8]

194. The monitoring period should not be underestimated. It cannot be limited only to a crediting period. Instead, monitoring needs to continue at a climate-relevant timescale, as the risk of reversal remains even after the end of a crediting period and unsuccessful removal may pose direct risks to human and natural systems. Monitoring must be transparent and conducted on a frequent basis. People, communities and rights holders affected by removal activities, must be involved in the monitoring in key positions. Monitoring should not be carried out by the proponents of the removal activity alone but should be independently verified by third parties. [HBL, 65]

195. Monitoring of a removal activity must not be limited to a crediting period, but instead should extend far beyond as the risk of reversals will remain. For example, if the crediting period for a forest restoration project is 10 years, monitoring should extend beyond that because the risk of deforestation extends beyond those 10 years. Arguably, monitoring is necessary as long as the offset

emissions will be in the atmosphere, or at least the majority, meaning that a forest restoration project would need monitoring for many decades past the ten-year crediting period. While this is logistically daunting, integrity demands that an offset be as permanent as the fossil emissions it is enabling. This monitoring can and should be conducted in conjunction with people in the project area and third-party monitoring: monitoring should not only be done by project proponents, but also by third parties to provide independent verification. [CLARA, 69]

3.2.5. Reporting

196. The ROK thinks that paragraphs 11~14 well capture the basic requirements for reporting removal activities. Regarding paragraph 12(f) on safeguards and paragraph 12(g) on sustainable development, the ROK thinks that these can be related to paragraph 21. The ROK hopes that reporting rules on safeguards and sustainable development can be aligned with the outcomes from the rule-making process on sustainable development by the Supervisory Body. This will be indicated again at the section 4.7. [ROK, 57]

197. Requirements of the recommendations do not include reporting on activities themselves. They address only reporting on Monitoring. However, all certification procedures include reporting on implementation and requirements to the project documentation. [WI, 9]

198. Reporting “records and logs of events or incidents” during the crediting period is unnecessary in light of the method proposed to estimate removals. Since removals are estimated based on the measured carbon stocks at time 1 - time 0, any C fluxes in between (due to disturbances, events or incidents) would be captured in the final estimation of total C stock changes. Documenting records, logs and providing a “summary of reversals notifications…” is costly and does not affect the final estimate of removals. Reporting any “events or incidents” becomes more important after the crediting period, to ensure permanence of A6.4 removals. It is proposed that A6.4 removal activities occur within local sustainable development plans, led by LCIPs, so that longer-term monitoring provisions are in place to track and counter any drivers of reversals (ALLCOT-48)

199. Data required for the issuance of carbon removal certificates should be limited to measurable and verifiable data of the CDR event of activity itself. Monitoring of co-factors including environmental and social safeguards, contribution to SDGs, monitoring of reversal events should be periodic. [ECP, 27]

200. Reporting should include:

(a) Information on the amount of emissions of greenhouse gases removed;

(b) Information about the additionality of the reduced emissions (i.e., whether the project would have happened in the absence of it receiving support through the carbon market);

(c) Information about ongoing threats that may impact the permanence of the reversal;

(d) Information about the environmental and social impacts of the activities and how any adverse impacts will be avoided or mitigated;

(e) Information on how stakeholders and communities affected are/were involved and consulted;

(f) Information about any complaints filed and how they have been addressed. [HBL, 65]

201. Reporting must be transparent. All reports should be publicly available (at a minimum on the Article 6.4 mechanism's website) and easily accessible. Reporting should also include:

(a) Information on environmental and social impacts, including how any adverse impacts are being prevented or mitigated

(b) Information on how stakeholders were/are being consulted

(c) Information on any grievances that have been filed

(d) Information about ongoing threats that may impact the permanence of the reversal

(e) Information on additionality (i.e., whether the project would have happened in the absence of it receiving support through the carbon market). [CLARA, 69]

3.2.6. Use of digital technologies

202. Whilst the CDM can act as a useful precedent, Article 6.4 and carbon markets more broadly must evolve beyond in-person and manual audits where possible. Increasingly, digital technologies are being used to streamline data collection and processing for MRV processes. The remote verification of data can fast-track issuance of tradeable carbon assets, significantly reducing payment cycles for project developers and increasing their share of value generation, instead of verifiers or auditors. [ECP, 27]

203. Whilst manual data collection and in-person surveys will continue to play a key role, particularly for nature-based removals, their importance should not be assumed for engineered removals and seen as a benchmark for quality. In its requirements for MRV, the UNFCCC should advocate a greater role for automated data collection through IoT, mobile technology and online applications. [ECP, 27]

204. Combining the use of a professional digital tool for monitoring with satellite images can help the project developers avoid the high costs that should be allocated to DOEs. The verification events can also take place, but they will be less expensive and less detailed as the digital tool can simplify and shorten the process of verification [TREEO, 11]

205. We agree that more innovative approaches and technologies should be supported by the mechanism for more accuracy of carbon stock quantification but also more involvement of smallholder farmers. As an example, the TREEO app allows to quantify the carbon from every single tree. The farmers will be empowered to monitor their own trees once a year by measuring the Diameter at Breast Height (DBH) which is linked in the app with an allometric formula allowing to estimate the biomass and the carbon stored. [TREEO, 11]

206. Enabling teams to create and operationalize digital methodologies using defined roles, actors who perform those roles, and data they produce linked back to unique units of value (e.g., 1 metric tonne of carbon dioxide equivalent (mtCO 2 e)) will enable transparent climate-asset tracking like never before. This will drive empirical improvements in climate accounting across a diverse array of methodologies and corresponding verifiers, actors, datasets, and climate-asset classes [HBAR, 14]

207. DLT innovations can help to mitigate fears that it is neither practical nor credible to engage in the kind of robust longitudinal monitoring of nature-based removal activities necessary to verify credit issuance requests and detect reversals. Project-level Measurement, Reporting and Verification (MRV) is often assumed to require significant ongoing human capacity (i.e., boots on the ground), to involve high administrative costs (potentially with equity implications), and to present enforceability and liability challenges that scale faster as monitoring periods grow. Leveraging highly scalable, environmentally sustainable proof-of-stake DLT networks such as Hedera Hashgraph breaks those legacy assumptions and obsoletes traditional manual processes. [HBAR, 14]

208. DLT-enabled digital Measurement, Reporting and Verification (dMRV) procedures employ interoperable standards, are fed in real time by continuous remote sensor, IoT, LIDAR, drone, and satellite data feeds augmented by machine learning to identify data errors and fraudulent behavior, and are secured by verifiable, decentralized, digital identifiers for human or organizational actors. This is not speculative futurism, but a mature technology that is transforming carbon markets with end-to-end digitalization and enabling grassroots participation and granular visibility in asset creation from an international perspective. The World Bank recently illustrated this trend with case studies from across the world, demonstrating how dMRV systems are being used today for monitoring, reporting, and verification of mitigation outcomes and GHG inventories linked to forestry and land-use projects, among others. [HBAR, 14]

209. We urge the SB to consider how best to embed these innovative new DLT-based certification and verification tools into Article 6.4. Success will increase the mechanism’s credibility by enabling for the first time automated, cost-effective, and transparent verification of the performance of any nature- based removal project in the background, even over decades-long permanence periods. [HBAR, 14]

210. All data can then be recorded immutably in an openly discoverable and auditable way, effectively bringing the balance sheet of the planet onto a public ledger. By making progress of climate actors towards their mitigation goals visible, SB will discourage a race to the bottom, galvanize higher-ambition target-setting, and accelerate the impact of climate action in the aggregate without unduly compromising data privacy. [HBAR, 14]

3.2.7. Addressing reversal

211. Ownership of removal activities -- the US gov't defines the "owner" of carbon capture equipment as whoever owns the capture equipment, and then it is their responsibility to ensure it is permanently sequestered. A similar logic could apply

to the CDR/GGR space. Several US states also allow transfer of liability to the state governments to ensure long-term liability is met. [BCG, 190]

212. We suggest that other carbon pools can be linked to the above-ground/ below-ground pool in order to address the reversal. In other words, if the project developers ensure that the harvested trees went to wood construction and the residues were used for producing biochar, a permanence period of nearly 100 years can be ensured. In our vision, smallholder farmers in the global south should be engaged and should benefit from carbon projects and finance and actively contribute to carbon removal. The current requirements will just continue to exclude them from the whole process. [TREEO, 11]

213. Distributed ledger technology (DLT) offers the SB powerful tools to manage going forward, as reversals become more common. By enabling discovery of transparent, traceable climate data in standardized formats, DLT opens new pathways toward inclusive climate governance in a decentralized “digital commons.” [HBAR, 14]

3.3. Accounting for removals:

214. The SB 005 Information Note calls for a discussion on:

(a) Discuss any further considerations to be given to the core elements for accounting for removals in A6.4-SB003-A03; where possible, identifying their applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.

(b) For activities involving removals that also result in emissions reductions, what are the relevant considerations, elements, and interactions between this guidance and the requirements for the development and assessment of mechanism methodologies, including.

215. Below is a summary of public inputs received.

3.3.1. General approach to accounting in particular additionality and baselines

216. Notwithstanding the fact that long-term monitoring for ecosystem-based activities primarily aims to resolve the issue of permanence of mitigation outcomes, it also ensures continuous maintenance of SDG and adaptation-related cobenefits. While removing the liability for long-term permanence, the tonne-year crediting approach discourages consistent, continuous action by the activity participants. The shift of crediting rate to the later part of the crediting period can hinder early action, especially for activities in boreal ecosystems, where lifecycles are more prolonged than in ecosystems of more southern regions. Tonne-based crediting, despite relatively less stringent conservativeness, is widely applied in voluntary carbon markets schemes and has well-developed package of instruments, including non-permanence risk assessment tools. Jurisdictional level safeguards combined with buffering and activity participant level monitoring and insurance requirements can sufficiently ensure the credibility of the outcomes, while non-permanence risk assessment with differentiated buffering can incentivize precaution on the side of activity proponents. The RMPs generally provide for three approaches for baseline setting i.e., best available technologies,

benchmark approach, approach based on existing actual; or historical emissions with downward adjustment. The latter appears to be the most applicable one for the ecosystem-based activities given that the BL takes into account the cycles of changes in the age structure of ecosystems, as relevant. BAT and benchmark-based baseline setting, if applied for ecosystem-based activities, would need to account for the differences in ecosystems, climate and natural zones. Due to low availability of field research data and information with sufficient discretion to reflect the variability of ecosystems such methods are likely to imply high level of uncertainty and therefore should not be recommended at early stages of the implementation of the Article 6.4 Mechanism. Namely, the Forest management reference levels used for CP2 in Kyoto protocol accounting are not applicable for project level activities, especially in the countries with significant variety of climate zones and natural conditions. Activities performed on a local level should account for such factors as soil type, species, lifecycle and harvesting cycle, etc., that in combination can differ even in closely located areas. [RU, 53]

217. A6.4ERs issued to removal activities should be well-aligned with the way in which the same activity is recorded in the national GHG inventory of the host party(ies). A robust accounting framework means that the transfers of A6.4 removal credits between Parties, any related corresponding adjustments, and the stocktake of progress against NDCs, should all seamlessly fit together (e.g., to avoid type I/type II errors that may arise due to methodological inconsistencies). As such, methodologies for carbon removals must be developed cognisant of the recommended approaches in IPCC Guidelines for National GHG Inventory compilation. Appropriate methodological requirements, reporting standards (e.g., requirements for certain higher Tiers to be applied by Parties hosting activities) and/or the use of accounting techniques that can reconcile differences, may all need to be explored to ensure there is consistency in records across issued credits and the reductions and removals recorded by Parties. [IETA, 70]

218. We recommend giving further consideration to the definition of additionality beyond its application to removals. The recommendations do not cover baselines for removals. IETA assumes this is because it is covered in the broader methodological recommendations under discussion by the A6.4SB. We note, however, that any baseline that includes future emissions (i.e., the baseline is >0) will result in credits being awarded for both emission reductions/avoided emissions and removals if net flows go below zero. (IETA-51)

219. The experience with CDM A/R methodologies has been that methodologies ended up being very conservative when it came to the inclusion of emissions from material used and implementation. This resulted in a situation where a lot of effort was required for determining relatively small sources of emissions (such as the carbon in fence posts used or emissions from fuel use for transporting seedlings to the site). We would encourage to apply the approach of using conservative default factors for emissions from equipment and materials used, and the implementation of the activities. In addition, the Supervisory Body might want to consider a threshold that would allow exclusion of certain sources of emissions if relatively small. [MDB WG, 53]

220. The A6.4 rules must ensure that removals activities for which credits are issued ensure the reservoirs are maintained over at least over a time frame comparable to fossil fuel emissions which they may be used to compensate. If the reservoirs

cannot be maintained over such a period with a high likelihood, then temporary credits or other solutions to deal with permanence and reversibility should be issued. This includes avoiding any methodology that creates a false equivalence between temporary or inherently reversible removals and permanent emissions, including some approaches to tonne-year crediting. [WWF, 71]

221. There has been for some time a general agreement that long cycle geological carbon emissions cannot be offset physically by short cycle biogenic removals on a one-to-on ratio. The SB's recommendation to the CMA on accounting for removals and crediting periods should derive from the climate warming potential asymmetry between fossil fuel related emissions and land-based offsets. Carbon Market Watch's advice to the SB to separate the accounting of emissions reductions from the accounting of removals is rooted in recognition of the asymmetry between geological emissions and biogenic removals: "There is not only no equivalence between fossil and biogenic carbon, but also between various 'types' of biogenic carbon. There is a spectrum of natural removals, according to their quality, longevity and stability." Ignoring the differences on the spectrum impedes accounting and crediting that not only reduces emissions but also restores natural ecosystem sinks in ways that are environmentally just, according to an important source of the Carbon Market Watch analysis. [...] [IAP, 72]

222. We would like to reiterate that tonne-year accounting must not be included under the 6.4 mechanism or in the SB's recommendations on removals. While storage of carbon over a few decades has benefits, this is not equivalent to permanent emission reductions/removals and must not in any way be used to offset ongoing/future fossil emissions which will on the other hand have long-term consequences. There are also significant doubts about additionality associated with tonne-year accounting: e.g. one approach is centred around the deferral of timber harvests for one year, which is extremely unlikely to satisfy real additionality tests.[CMW, 78]

223. Failing to appreciate BECCS as a sum of its parts risks the misapprehension that its initial stage – CO2 temporarily stored within trees – is equal to or superior to the full outcome. In practice, BECCS activities involve anthropogenic enhancements to both the amount of CO2 that is drawn from the atmosphere and the duration such CO2 will be sequestered – each fundamental objectives of the mechanism. Proposal to limit the temporal scope of removals to those that occur post registration of the activity would logically lead to significant amounts of CO2 being consigned to less durable biogenic storage, and the foregoing of renewable energy opportunities. [DG, 80]

224. Regarding the accounting for removals, it is of the utmost importance to adopt or accept approaches for the accounting in a way that they are consistent with the net-zero goal under the Paris Agreement. Any of the approaches adopted for accounting and crediting of removals needs to be conservative but at the same time must favour the cost effectiveness of removals activities. [CO, 58]

225. Tonne-year accounting methods based on economic discounting (e.g., Parisa et al. 2022) are also incompatible with achieving long-term temperature targets.." [...].The fundamental flaw of the proposed tonne-year approaches is that it

wrongfully presumes to equate short periods of carbon storage with permanent mitigation. [OI, 62]

226. The tonne-year accounting method proposed fails to reconcile the economic value of carbon removal activities with the physical realities of climate change. As explored further in our 2022 policy brief, Addressing Differences in Permanence of Carbon Dioxide Removal. [...] Accounting of removals must be based on a foundation of physical climate science rather than stylised financial modelling. [BF, 63]

227. It is advised that engineered-based and land-based removals accounting are fundamentally separated [GCCSI, 66]

228. It is crucial to take into account any removal activity that results in the increase of GHG emissions and the need for relevant guidance to be applied in such cases. Any increase on the GHG emissions caused by the implementation of the removal activity must be deducted from the achieved removals. Therefore, transparency and due diligence in monitoring are pivotal. [LESE, 67]

229. The mitigation potential of ‘Land-based activities’ should be reassessed taking into account important and climate-relevant factors in addition to CO2. [PML, 112]

230. To achieve Net-Zero, Ton-Year accounting must be rejected. Instead, accounting methodologies have to reflect the reality principle. This means temporary credits for temporary measures (like NBS) and permanent credits for permanent measures (like mineralization). (also “Addressing Reversal”) [IJ,113]

231. Tonne-year accounting is problematic as it devalues high-quality long-duration CDR approaches necessary to counterbalance residual fossil carbon emissions, and durably remove carbon dioxide from the atmosphere. [OA, 114]

232. Instead of tonne-year accounting with vertical stacking, "Like-for-Like" principle should be applied which differentiates emissions in their impact and permanence. For example, short carbon cycle emissions, such as those from land-use changes, could be effectively offset by biosphere-based carbon removal methods, such as reforestation. In contrast, long-lived emissions, such as those from burning fossil fuels, should require more permanent measures to offset, such as direct air capture with geological storage. The definition of what constitutes long-lived storage under like-for-like removals can be set using a time horizon and a conservative discount rate. For example, using a 1% discount rate makes 200-year storage about 90% as valuable as permanent storage and 500-year storage 99,5% as valuable as permanent. (also “Addressing Reversal”) [MC, 117]

233. [CarbonPlan, 138] The use of tonne-year accounting methods in the context of Article 6.4. risks undermining the temperature ambitions of the Paris Agreement as it makes no assurances about stabilizing long-term global temperatures. No amount of temporary storage can physically compensate for fossil CO_2 emissions when considering long-term temperature stabilization. Verra has paused adoption of tonne-year accounting and the Integrity Council for the Voluntary Carbon Markets has excluded tonne-year accounting from its Core Carbon Principles. Critical questions such as how to set time horizons, apply discount rates, and make trade-offs between short-term and long-term warming should be

pursued in consultation with climate experts to fully understand the risks posed by using tonne-year accounting. (also “Addressing Reversal”) [CP, 138]

234. and several other submissions reject tonne year accounting. There is scientific and political consensus that, while short-term carbon sequestration can play a role in slowing global warming and reducing peak temperatures, it should not be a substitute for permanent carbon removal, which is vital to ensuring future generations are protected from the risks of global warming and climate change. [44.01, 142] [N-AG, 142] [IETA, 143] [CX, 147] [CA, 152] [BEAF, 154]

3.3.2. Specificity of Additionality of removals

235. The notion of additionality for BECCS and DACCS is very different from additionality for traditional carbon credits. Negative emissions with geological storage don’t have any inherent in-value-chain-worth for the project owner. They are only produced for the purchaser of the negative emission rights, without the potential to come about for any other reason. There is, however, one critical limitation to this argument that must be assessed from an additionality perspective. If the project is eligible for state aid and such aid would be comprehensive enough to allow the project to meet its profitability targets without the carbon credit revenues, then – if the project receives such aid – the project would not be additional from the perspective of the voluntary market. [SE, 15]

236. Both DACS and BECCS benefit from government incentives in many jurisdictions, but these are not sufficient for viability on their own. As such we believe its self-evident that engineered carbon removal with permanent geological storage (i.e., DACS and BECCS) should be on the positive lists that you are working on. This is a critical issue to get right in order to enable billion-dollar scale investments. If it is not clear at the outset that projects will pass additionality tests, investors will not go ahead [DG, 29]

237. Carbon removal has the distinct advantage of being directly measurable. One can measure the amount of carbon being removed and the amount of carbon added to a reservoir. This measurability makes carbon removal verifiable. An auditor can independently measure the carbon content of the reservoir and check it against the values reported by the storage operator. This means that accounting rules should move away from using hypothetical "business as usual" baselines - there is no excuse for not directly measuring the baseline, i.e., the carbon content of the reservoir before activities, directly since this is the strength of carbon removal. This observation means that none of the methodologies offered in decision 3/CMA.3, annex, paragraph 36 are sufficient to harness the level of verifiability offered by carbon removal activities. Instead, we would suggest that accounting rules should make the most of this feature to ensure the highest level of verifiability. This means that accounting rules - for all types of removal - must be able to (1) delineate the boundaries of the reservoir, (2) quantify the carbon added to a reservoir, (3) quantify the carbon content of the reservoir, (4) estimate the measurement error in a way that is commensurate across all types of removal. [SA, 47]

238. A distinction between emission reductions and removals does not make sense in the case of wetlands. Long-term sequestration is possible only on the back of emission reduction activities, for instance, rewetting of drained peatlands.

Wetland habitats are the best example for the intrinsic relationship between emission reductions and emission removals. [WI, 9]

239. We suggest that the approach to financial additionality be reconsidered such that financial additionality isn't underpinned by a specific requirement that carbon finance must singularly "shift" project economics from negative to positive. Not only has this approach been widely gamed in the past, but it is also very often the case that carbon revenues by themselves (especially at current pricing) often are not fully capable of shifting these circumstances. Rather, they are used as a revenue supplement, or are part of a blended finance mechanism that allows the project to occur. We suggest the approach is revised to acknowledge forgone revenues and opportunity costs associated with project enrollment and continued monitoring and verification. [ACR, 8]

240. Performance additionality: When the document refers to the average performance of the peer activities in the industry or the sector, it is not clear whether it refers to emissions or production activity. [CCO, 33]

241. Positive lists are determined by many variables and can be very general, which can easily render them useless. Therefore, if it is decided to accept positive lists, it would be ideal to clarify the conditions for periodic monitoring of the variables that define them. [CCO, 33]

3.3.3. Using LCAs

242. The ROK thinks that the life cycle analysis (LCA) approach to engineering-based removal activities (including DACCS and DACCU) needs to be prepared by a group of experts and acknowledged by Supervisory Body. The ROK thinks that there should a separate paragraph that deals with an activity involving removals that results in 'substitution effects'. Substitution effects refer to the practice that carbon-intensive fuels or materials are replaced by captured CO2 from removal activities as alternative resources. In the specific case of DACCU where CO2 is captured from the atmosphere and stored into a product temporarily, CO2 is utilized as alternative resources to CO2 emitting resources. Such activities may realize substitution effects by avoiding emission of greenhouse gas that would otherwise be emitted to the atmosphere. In this case, net CO2 removal can be zero due to temporary storage, but the substitution effects still remain. [ROK, 57]

243. The accounting requirements broadly states "minus emissions attributable to implementation of the activity". This should clearly be defined as based on a cradle to grave LCA and including embodied emissions. As the purpose of the activities is net negative emissions, all emissions from the activity should be considered to avoid over crediting. [CW, 31]

244. Standardisation of LCA's across certification standards are crucial in creating standardised accounting of carbon removal activity. It is recommended that facilities have a simple formula based on a methodology to determine the net carbon removal activity per event to streamline issuing of carbon removal certificates. This would account for Facility-specific lifecycle emissions, equipment and leakage. [ECP, 27]

245. LCAs are very useful when understanding where the emissions come from in a process or comparing the efficiency across different processes of the same type of system. Despite their wide and increasing application in carbon accounting, LCAs are not useful for carbon removal accounting purposes. Three decades of research have amassed a large body of literature on the issues with LCA, some of which are particularly pertinent to carbon removal, and many remain unresolved. The type of LCA will depend on the system being assessed which is problematic when carbon removal accounting spans activities as incomparable as forest growth and direct air capture and injection in geologic formations. Furthermore, they require knowledge of elements that are known only approximately or rely on generic datasets. Drawing boundaries for LCAs is a subjective activity yet a highly important part of the process. This makes LCAs easy to manipulate and frequently inaccurate for accounting. LCAs also rely on large amounts of data that are frequently unknown or modeled, making the attribution of emissions a challenge. [SA, 47]

246. Removal activities should be measured based on a full life cycle assessment, thus accounting for the permanence and potential reversal of the activity. Doing so would require some adjustment in order to harmonize with IPCC guidance on accounting for the AFOLU sector. Tonne-year crediting effectively creates a false equivalence between temporary and permanent carbon storage and by legitimising short-term carbon storage, it poses significant risks to the goal of the Paris Agreement. (also “Addressing Reversal”) [NEP, 131]

247. The accounting of carbon removals should focus on accounting of storage, which can be done by directly measuring the amount of carbon captured and added into a reservoir. This measurability makes carbon storage verifiable as an auditor can independently measure the carbon content of the reservoir and check it against the values reported by the storage operator. The accounting rules - for all types of activities - must be to able to (1) delineate the boundaries of the reservoir, (2) quantify the carbon added to a reservoir, (3) quantify the carbon content of the reservoir, (4) estimate the measurement error in a way that is commensurate across all types of removal. If the accounting focuses, instead, on removals, one needs to measure net outcomes as one needs to know that a project does remove more carbon dioxide than it emits. However, this makes the accounting overly complex, subjective, and inaccurate because it would require a Life Cycle Analysis (LCA). LCAs, which requires use of approximation or generic data and require subjective judgements in some critical elements such as boundaries, are easy to manipulate and frequently inaccurate. In addition, as LCAs include other greenhouse gases, it requires GWPs, that is another source of uncertainties and value judgment on time horizons. The complexity, expense, and time necessary to perform an LCA make it a poor candidate as a tool to account for carbon removal. Accurate accounting for removals should rely on direct measurement of carbon stored, more specifically, what is in storage to account for any loss of carbon from storage. [CNCE, 137]

3.3.4. Double counting of CO_2 removals

248. Double counting refers to a situation where two parties claim the same carbon removal or emission reduction as a result of having counted GHG emissions, or atmospheric CO2 removals, from the same source in both countries. In cities

around the world that consume timber forest products, their use and destination was being accounted again, either as atmospheric CO2 removal, or as GHG emissions from the final destination. In these countries, technologies and processes that reduce GHG emissions and remove atmospheric CO2 through the use of industrial wood generate carbon credit benefits, generating a double count of GHG emissions associated with Brazilian industrial wood that has already been accounted for. [IAV, 22]

249. We support the flexibility for carbon removal projects to register against multiple registries and agree strict protocols must be implemented to prevent double issuance. Integrity checking and transaction processing should be adopted at Issuer level but greater linking, dialogue and communication between registries should be enforced to reduce risk of double issuance. Enabling view-only access for issuing data between registry providers for example may provide an added-layer of integrity checking for Issuers. Ideally, a global VCM registry within the UNFCCC's system of national government registries would be created so corresponding adjustments can be consistent. [ECP, 27]

250. We suggest further elaborating on the notion of "common practice additionality" to create more clarity on how that is understood and demonstrated. [ICLRC, 24]

251. Double counting is the most pressing issue that needs to be solved and corresponding adjustments (CAs) need to be implemented as soon as possible. On temporary crediting, horizontal stacking is superior to vertical stacking which uses tonne-year accounting (TYA). In addition to containing high risk of reversal, TYA involves a choice of discount factors that is a policy rather than scientific decision that is used to discounts the future socioeconomic costs benefits of climate impact. As TYA mixes the economics of discounting with the science of global warming, TYA credits cannot be used to make net-zero claims. In horizontal stacking, crediting period is sliced up in one-year increments and contains zero reversal risks if credits are issued ex-post. Credits are valid for one year, after which they are retired and would have to be renewed, following a simple principle that climate claims are lost if credits are not replaced. (also “Addressing Reversal”) [OXO,115]

3.4. Crediting period

252. The SB 005 Information Note calls for a discussion on further considerations to be given to the core elements for crediting periods in A6.4- SB003-A03; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.

253. Below is a summary of public inputs received.

254. For removals with geological storage, considering the very significant amount of CAPEX and risk associated with the investments in capture, transport and storage, a minimum crediting period of 30 years should apply for this type of removals to allow for necessary investment decisions. [CFL, 38] [SE, 15] [ECP, 27]

255. Crediting period of 15 years renewable twice (15))(twice) needs to be supported. Is this number fitting equally for all activities? Rather than stating the number, state the criteria for determining it for each activity. [CW, 31]

256. Based on our experience and observation from the field, we strongly support a crediting period of 15 years which particularly encourages smallholder farmers to engage in afforestation and reforestation projects because in the majority of cases farmers do not want to commit directly for longer projects (e.g., 30 years). Having the possibility to renew the crediting period is much easier than designing a 30-year project from the beginning. However, requiring monitoring after the end of the project might be discouraging project developers because any monitoring would imply additional costs that might not be covered by the carbon money. [TREEO, 11]

257. The current proposal of 15-year crediting periods, which can only be renewed twice, seems too restrictive. This should be allowed to be renewed multiple times to take into account variations in durability between carbon removal methods. For example, biochar has around 100 years durability and direct air capture has 1,000- or 10,000-years durability. A maximum 30-year crediting period when continued removal is occurring is limiting. [BZC, 43]

258. The suggested crediting period of 15 years, renewable a maximum of twice, should be extended to a minimum of 30 years for durable removal facilities. The development of removal projects requires years to identify sites and storage locations, engage communities, and secure off takers. Further, in the case of durable solutions, facilities are designed for an initial useful life that likely extends beyond the proposed 15-year crediting period. Without certainty around a renewal of the crediting period, the capital costs may outweigh identifiable revenues, risking disincentivizing durable removals. [DACC, 30]

259. In order to provide investors’ confidence in investing billions into engineered removals a 15-year time horizon of certainty of revenues is far too low. We would suggest 30 years would be necessary to provide sufficient confidence and align with investment time horizons. Furthermore, we do not see any rationale whatsoever for the crediting period to only be renewed once for project which have no other economic reason to keep running other than carbon credit revenues associated to continued operations. [DG, 29]

260. The proposed ‘crediting period’ of removal activities is wholly insufficient for the purposes of climate mitigation and should expanded to the magnitude of (at least) centuries rather than decades. It should also be specified that if a removal activity is reversed it ceases to be a removal, unless the reversal has been replaced. A removal which fully reverses should be cancelled, as should any accounting transactions that have been made on the basis of this removal (e.g., an emission which was balanced out by that removal) along with a relevant liability or penalty. [BF, 46]

261. We suggest that maximum renewal shouldn’t be set at 2, but rather should be based on demonstration of continued additionality and confirmation of the baseline. Requiring permanence monitoring beyond the project term for ‘tonne-based’ crediting is not standard practice and would significantly reduce

participation in many sectors of the carbon market. We suggest broader stakeholder input is sought prior to prescribing such an approach [ACR, 8]

3.5. Addressing Reversals

262. The SB 005 Information Note calls, in order to minimize the risk of non-permanence of removals over multiple NDC implementation periods, and, where reversals occur, ensure that these are addressed in full,

(a) Discuss the applicability and implementation aspects of these approaches, including as stand-alone measures or in combination, and any interactions with other elements of this guidance: a) non-permanence risk buffer (pooled or activity-specific); b) Insurance / guarantees for replacement of ERs where reversals occur (commercial, sovereign, other); c) Other measures for addressing reversals in full.

(b) Discuss the appropriate timeframe(s) for applying the approaches, including any interactions with other elements of this guidance and the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.

(c) What risks of non-permanence need to be minimized, and how can these risks have identified, assessed, and minimized?

(d) In respect of risk assessment, how should the following elements be considered in the implementation of the approaches in (a) and any other relevant elements in this guidance? a. Level of non-permanence risk assessment, e.g., activity- or mechanism-level b. Timing for risk assessment(s) c. Entity(ies) responsible for risk assessment(s), e.g., activity proponent, 6.4SB, actuary

(e) How should the following elements be considered in the implementation of the approaches in (1) above and any other relevant elements in this guidance? a. Methods for determining the level of buffer pool contributions b. Composition of buffer pool, including in relation to ER vintages and contributing activity types or categories c. Intentional and unintentional reversals d. Treatment of uncancelled buffer ERs, including after the end of the last crediting period of the contributing activity e. Specifications for ERs that cancelled for compensate for reversals, including in relation to ER vintages and contributing activity types or categories f. Replenishment in case buffer cancellations exceed contributions; slide language on re-raising baseline level of storge before new crediting

(f) In the event of a reversal, what interactions and implementation aspects should be considered in respect of other elements of the activity cycle?

263. Below is a summary of public inputs received.

3.5.1. Risk of Non permanence and Permanence period

264. What type of mitigation activities are associated with material reversal risks? Material risks for reversals occur for any measures that preserve or reduce losses from biogenic carbon stocks. This holds for activities in the land-use sector, such

as afforestation, forest landscape restoration, reducing emissions from deforestation or forest degradation, improved management of forests, rewetting of peatlands, enhancement of soil carbon, and so on. Moreover, reversals risks are material where carbon is stored in geological reservoirs, including different types of carbon capture and storage (CCS) activities, or in other types of reservoirs (e.g., in rocks through enhanced weathering). By contrast, the destruction of non-CO2 gases or the reduction of fossil fuel consumption is not associated with material non-permanence risks within the horizons to address climate change. The EU believes that incentives for preventing reversals from occurring is critical for ensuring that mitigation activities contribute to the long-term goals of the Paris Agreement. We recommend that the Supervisory Body puts appropriate safeguards in place. These could, depending on the type of mitigation activity, include different measures, such as:

(a) Requiring mitigation activity proponents to conduct a reversal risk assessment for the specific mitigation activity, including an assessment of the impact of climate change, following a methodology to be developed by the Article 6.4 Supervisory Body;

(b) Using the outcome of the risk assessment to determine the stringency of the measures to prevent and compensate for reversals, such as (i) excluding mitigation activities with high reversal risks from eligibility under the mechanism or (ii) using the results from the risk assessment for determining the share of Article 6.4 emission reductions that must be set aside in a pooled buffer reserve, with higher shares for mitigation activities with higher reversal risks;

(c) Requiring mitigation activity proponents to have legal titles to the land and/or relevant carbon reservoirs on the land (e.g., timber rights), or requiring that legally binding agreements between the mitigation activity proponent and third parties require the mitigation activity proponent's consent to undertake any measures that may lead to intentional reversals;

(d) Assessing whether there are national or sub-national laws or regulations that would prevent carbon stocks from being lost (e.g., laws that prohibit forest land, once established, to be converted to non-forest land in some Not all of these measures may need to be place at the same time, depending on the type of mitigation activity. How many of these measures are in place could also inform the approaches required for compensating for reversals, as laid out in the following (e.g., where more of these measures are in place, lower contributions to a pooled buffer reserve may be necessary). [EU, 59]

265. Permanence is the most important concept in removal activities. Along this line, reversal, which is the cause of non-permanence, is something to be addressed. In this regard, the ROK thinks that this section on 'addressing reversal' needs to consider the specification of requirement on 'permanence' as well. [ROK, 57]

266. The use of pooled buffers for the crediting of land-based removals activities has been widely employed in other crediting programmes without the need to apply discount factors, and we propose recommendations should be drawn from those experiences. For technology-based carbon sink enhancements, IETA welcomes

the proposal to adopt the 'regulatory safeguards'-style approach for geological CO2 storage, which draws upon approaches previously agreed under the CDM. In addition, IETA has developed a set of principles to govern the development of tradable reductions and removals through the High-Level Criteria for Carbon Geostorage Activities. These include six key core methodological components, as well as ten high-level criteria and supporting safeguards to identify and manage any potential risks associated with carbon geostorage (including reversals). [IETA, 70]

267. Require compensation for all types of reversals by either the carbon crediting program or the mitigation activity developer through the cancellation of other carbon market units. This can be achieved through landowner liability, pooled or non-pooled buffer reserves, and/or insurance. In addition, credits held in a buffer reserve at the end of a program's monitoring period should be cancelled. [...] Encourage the use of financial instruments for risk management, with a view to potentially mandating the use of these instruments at a later stage. This refers to the idea of making insurance or some other backstop (like a bond) mandatory for project managers under contractual design. To discourage risky practices, insurance companies frequently set management requirements for insured projects. In theory, NCS project managers could purchase insurance to cover the risk of reversals, though very few insurers currently provide this service. [EDF, 80]

268. Only permanent net removals should be eligible for crediting under the mechanism. If removals are to be accounted for as an equal and opposite action of the emission of greenhouse gases, the quantified unit of removal must be the amount by which the level of greenhouse gases in the atmosphere has permanently decreased. This requires that:

(a) CO_2 is physically extracted from the atmosphere.

(b) The extracted atmospheric CO_2 is permanently stored out of the atmosphere.

(c) All direct and indirect greenhouse gas emissions associated with the extraction and storage processes are included in the emission balance.

(d) The net removal is what is considered: the amount of atmospheric CO_2 removed and permanently stored that exceeds the amount of associated greenhouse gases emissions. [BF, 63]

269. While different activities can achieve carbon dioxide removal, they will involve different storage timeframes and risks of storage reversal. For example, storage in products and carbon farming activities will typically store CO2 out of the atmosphere for decades to centuries; while storage of CO2 in geological reservoirs offers the opportunity to safely store CO2 for thousands of years. The different timescales and reversal risks associated with the different activities should be reported, ensuring that the market is able to differentiate them (and price them accordingly), recognising the value of geological storage. [CCSA, 68]

270. Some proposed removal technologies come with a large energy penalty which, if produced through fossil fuels, leads to additional greenhouse gas emissions. Therefore, in our view, removal activities that have a medium to high risk of being

reversed and not permanent should not be eligible for crediting under the Article 6.4 mechanism. Conservative assumptions must be applied when assessing the risks. Mechanisms must be built in to assess the risk of reversibility and leakage from a removal activity and to hold the proponents of the activity and certifiers of credits responsible for possible reversals and leakage, forcing greater care in the planning, implementation and maintenance of storage. [HBL, 65]

271. There are many reversal risks – fire, drought, disease, insects, logging – that can cause the temporarily sequestered carbon to be re-released to the atmosphere decades or even centuries later. Many of these risks are increasing dramatically due to the exacerbating impacts of the climate breakdown itself - this trend will continue in the coming decades even if emissions are rapidly reduced. Reversals undermine any offset claim made on the back of a credit involving temporary sequestration. Any recommendation on removals and/or methodological requirements would need to adequately address the issue of reversals if the underlying envisaged mitigation activity types bear impermanence and reversal risks. This should not be delegated to a future decision, since there is a risk that agreement may not be reached in the future and could be indefinitely stalled, possibly meaning no policy for reversals would be put in place. [CMW, 78]

272. Regulators can foster some of the required innovation at scale. The role of insurance as a regulated industry to guarantee risks can reduce the need for large balance sheets and time horizons beyond the capacity of smaller project level actors. [CFL, 85]

273. Reversals in CCS, CCUS and CCU need to be measured, reported and verified through advanced MRV mechanisms including maturing data on the lifecycle of carbon in key applications. Investing in reliable and independent ways to deliver measuring and reporting of engineered carbon removal pathways across CCS, CCU and CCUS will be imperative. It will be necessary to understand project level reversal, durability, additionality, carbon to value, PPP potential and stocktake across NDC's and regional, national and global GHG emission reporting. Reliable MRV will be required to tie into existing data infrastructure under the Climate Warehouse and Climate Action Data Trust across national and VCM levels. [AD, 86]

274. The permanence of storage, over centuries at least, and scalability should be taken into account when considering the full benefits of mitigation activities. The benefits of several of the land-based activity are more at risk of being lost due to natural hazards (e.g., wildfire). The permanence of the storage of engineering-based activities is hugely promising. [PML, 112]

275. The risks of carbon reversal and other risks of not delivering the removal require technical, financial and regulatory innovations such as insurance, which in turn requires coordinated activity among multiple actors and suggest the UNFCCC to establish a dedicated working group to explore removals risks and solutions like insurance. [CFL, 119]

276. Reject the tonne year crediting. Thus, any CO2 reversal must be fully compensated for. Economic discounting-based method assume that impacts further into the future counts less, but this assumption is not in line with the Paris Agreement. [SEI+, 121]

277. Current discussions around the choice of a time horizon and an additional discount factor are not consistent with Decision 3/CMA.3, which specifying that reversals shall be addressed “in full”. CDR methods should be evaluated based on a robust assessments and transparent reflections of climate benefits, including the storage durability. The European CRC-F framework allows for such assessment. [CW, 126]

278. Many engineered approaches result in permanent storage without exposure to natural hazard. Decision 10/CMP.7 can be referred for measures to safeguard against potential risks of geological storage. [NEP, 131]

279. The recommendation for time preference goes against the obligation to intergenerational equity and diminishes the value of permanent storage. To achieve net zero-emission, emission reductions/ avoidance and removals cannot be treated as equivalent. Unless the excess carbon remains stored for thousands of years, removals would only delay climate change impacts and push associated problems to future generations, which this goes against intergenerational equity, the polluter pays principle, and the sustainability of net-zero goals in the long term. The minimum storage period should take into consideration the duration of the lasting damage in the order of tens of thousands of years. Thus, the time horizon choice of 100 years is not justifiable. In addition, all costs of non-permanence must be internalized, including monitoring and remediation costs, which is likely to make temporary activities more expensive. A conceptual framework for the certification of carbon sequestration offers a possible option that explicitly includes temporary storage without compromising future generations through responsibility and a chain of custody. also “Accounting”) [CNCE, 137]

280. C-Capsule recognises the impact of potential non-permanence (uncertainties) from CDR activity over a 100-year time horizon. Reversal of GHG emissions in C-Capsule’s methodology requirements are recognised in two forms: (a) Leakage: predictable reversal events that are accounted for in calculating the eligible volume of certificates per CDR event or activity; (b) Event of Carbon Default (EOCD): unpredictable reversal events that are accounted for in the Insurance Buffer. The risk for an EOCD over a 100-year time horizon is a direct reflection of a CDR activity’s Expected Environmental Effect, which is a percentage-based likelihood for sequestration over a 100-time horizon. Example 500 tonnes sequestered with a 95% certainty for 100 years. By factoring in the risk of an EOCD over a quantified horizon of 100 years, C-Capsule acknowledges the tragedy of the horizon and provides a risk metric for insurance purposes. Normalized Environmental Effect measured with fixed time and certainty dimensions would allow for potential blending of mitigation approaches in portfolios of environmental effect to potentially meet compliance obligation. [ECP, 27]

281. A permanence period of 50 years should be applied. The credits accumulated in the permanence buffer shall be [retained permanently in the buffer] [GCC, 4]

282. We agree that it will be important to specify a minimum duration of storage; we typically have seen 100 years as achieving this goal rather than 200 to 300 years, but support any of them. [BCG, 190]

283. We concur that durable storage be defined as 200 – 300 years. We emphasize that restored forest ecosystems do not just store carbon, but continue to accumulate it, over such timeframes. [PPI, 191]

284. It's noted that the time horizon of 100 years is a commonly accepted normative choice in various climate policy instruments. In the context of bioenergy, however, it should be noted that the biomass industry has often argued that a 100-year timeframe should be utilized for assessing net emissions. Whatever the context for choosing the timeframe, in this context of biogenic carbon accounting, a 100-year time-horizon serves to incentivize logging and burning forests for fuel. [PPI, 191]

3.5.2. Role of Host Parties

285. Certain Options are theoretical, untested, and require market/stakeholder testing: Recommendations such as host Party guarantees for buffers or commercial insurance, which are currently positioned as options to each other, need market testing and stakeholder (including host Party) testing. It is not clear that a host Party would be in a position, from a regulatory or policy perspective, to guarantee a buffer. It is not clear whether commercial insurance is or would be sufficiently available at commercially reasonable prices in all host Parties. Options such as these have a material impact on investment decisions as well as the choice of crediting programme and so this market/stakeholder testing is needed before such approaches are recommended for adoption to the CMA. (IETA-51)

286. Liability transfer, buffers & monitoring: We welcome the proposal for a "guarantee by the host Party or an entity designated by it could assume the liability for intentional reversals and the portion of unintentional reversals exceeding the capacity of the permanence buffer pool". Align the methodology to the stringent requirements which have been developed in leading jurisdictions, in particular: (a) Liability for reversals: Across the EU / UK / US there are incredibly stringent requirements on liabilities and remediation responsibilities faced by storage operators in case of CO2 leaks. (b) National / state-level regulatory regimes often specify when / how liability for CO2 storage is transferred from capture projects to storage owners / operators and eventually to national / state Governments; (c) The requirements in the voluntary carbon market should not cut across those national / state-level frameworks. To exemplify, a capture operator who is the project proponent / eventual credit owner, should not be required to include legal liability for leaks in its contracts with storage operators, as these storage operators are already liable to government to make good. [DG, 29]

287. Integration with ETS / Cap and Trade: As an addition to the above, in countries with ETS systems in place and CO2 leaks included in these, there should be no necessity for any other recompense to be made in the voluntary carbon market in the event of a future leak from a storage site, since this would be double counting. As these overall ETS markets are capped, if a storage owner is required to purchase ETS allowances in the event of a leak, this will result in emissions being reduced elsewhere, because the volume cap on the ETS scheme will control the total number of emissions. This should be sufficient safeguard for a purchasers of carbon credits, knowing that in the event of a future leak, action will be taken by the storage owner / operator, that will ensure that the effect of the carbon credits purchased remains the same (the leak has been compensated for

by emissions being reduced elsewhere, which will have been paid for by the storage owner / operator) [DG, 29]

288. The MDB WG welcomes the addition of the compensation options (Permanence buffer backed up by host Party guarantee and Commercial insurance) but, in case of A6.4ERs that have been authorized for use towards international mitigation purposes, would encourage the supervisory Body to also consider options where the risk could be taken on by the Party that receives the A6.4ERs (so not just the Host Party). Moreover, MDB WG encourages the Supervisory Body to consider the use of a pooled buffer approach whereby buffers from different SDM project activities are pooled together, instead of having individual buffers. This would enable the SDM to better service any risk of reversal across the “portfolio” of registered SDM project activities and reduce the requirements with regard to host Party guarantees. [MDB WG, 53]

3.5.3. Reporting and Transparency

289. To date, there is lack of transparency and data on reversals which has led to arbitrary buffer pool contributions with little to no actuarial basis. It is our recommendation that the UNFCC mandates public disclosure of all Events of Carbon Default (EOCD). These could include volume, causal factor and remediation of the EOCD. Greater access to data would provide many benefits including: (a) Enable enhanced modelling of risks for actuaries and insurers/reinsurers alike to better understand likelihood; (b) Insurers create commercial insurance products for effective underwriting. Suggest reporting of EOCDs should be standardised, including but not limited to causal factors associated with default, magnitude, impact on future defaults etc. Ideally stored in a machine-readable public database. [ECP, 27] [CFL, 38]

290. Suggest reporting of EOCDs should be standardized, including but not limited to causal factors associated with default, magnitude, impact on future defaults, etc. Ideally stored in a machine-readable public database. The treatment of EOCD’s, i.e., recourse is to be determined. Call to action: (i) A body to formally recognize and declare EOCD events globally, (ii) Formal procedure for EOCD compensation or resolution at the NDC level should an EOCD occur within an expected declared time horizon 20,50 or 100 years. [CFL, 38]

3.5.4. Role of third-party actors including insurance

291. We support the use of existing mechanisms (buffer pool approach) to facilitate insurance and compensation of reversals in the short-term but believe the conventional self-insurance approach adopted by issuers is outdated. Their monopoly on risk roles and responsibilities carries multiple conflicts of interest. The recommended solution is to disaggregate the roles by appointing independent, third-party actors to rate and underwrite against risk of reversal. Independence of roles would generate more trust amongst stakeholders and demonstrate the necessary rigour for adoption by governments. [ECP, 27]

292. Transferring administration of buffer pools to independent, third-party insurers would remove Issuers from liability concerns relating to the recourse for carbon default, claim settlement and dispute resolution. The presence of commercial insurance would increase user confidence for project developers exposed to risk

of reversal and buyers concerned about the longevity of their CDR claims. Transition towards financial risk management best-practice would de-risk investments into voluntary carbon instruments and increase stakeholder confidence. [ECP, 27]

3.5.5. Buffers

293. Across the EU / US there are already highly stringent buffer systems / post-closure funds / industry body funds that are required to set aside money for monitoring, mitigation and compensation. These should be taken into account in any standard to avoid unfair double penalization . There should be clear separation between the nature based and geological part of the methodology. This is particularly crucial for the buffer pools, given the vastly differing permanence performance of these two categories, we believe they need to have separately managed buffer pools as well. [DG, 29]

294. Risk mitigation and compensation mechanism: We support the use of existing mechanisms (buffer pool approach) to facilitate insurance and compensation of reversals in the short-term but believe the conventional self-insurance approach adopted by issuers is outdated. Their monopoly on risk roles and responsibilities carries multiple conflicts of interest. Recommended solutions include disaggregating the roles by appointing independent, third-party actors to monitor, rate, declare, report and underwrite against risk of reversal (EOCD). Independence of roles would generate more trust amongst stakeholders and demonstrate the necessary rigour for adoption at scale by governments. Transferring administration of buffer pools to independent, third-party insurers would remove issuers from liability concerns relating to the recourse for carbon default, claim settlement and dispute resolution. The presence of commercial insurance would increase user confidence for project developers exposed to risk of reversal and buyers concerned about the longevity of their CDR claims. Transition towards financial risk management best-practice would de-risk investments into voluntary carbon instruments and increase stakeholder confidence. [CFL, 38]

295. Alternative solutions to buffer pools in the event of carbon default (EOCD) could include: 1. Pre-agreed monetary compensation which could then be applied to Carbon activities. 2. Pre-agreed carbon deliverables due at the vintage of time of default declaration. Insurer would purchase and then deliver 3. Existing buffer pool approach managed using like for like normalized effective carbon in order to create environmental effective fungibility. [CFL, 38]

296. We suggest further elaborating on the potential elements of commercial insurance schemes. In particular, there is need for better understanding of (i) how the risks for buyers would be mitigated with the use of insurance and (ii) the beneficiaries of insurance schemes, (iii) how the compensation will be used. The current wording of the explanation for this option seem to give no clear guidance on that and could only be seen as purporting that the Supervisory Body would be the beneficiary. [ICLRC, 24]

3.5.6. Inputs received in response to call for inputs on methodology requirements[13]

297. With respect to carbon capture and storage/sequestration, methodologies should take into account the specific attributes of mineralization (CO_2 elimination through subsurface mineralization) and separate the requirements appropriate for mineralization as opposed to conventional storage in geological reservoirs).[44.01, 142]

298. Article 6.4 mechanism should address the risk of non-permanence and reversals through the implementation of pooled buffers, which should be based on the actual risk for each specific activity and in each geographical area. [IETA, 143]

299. In REDD+, generally emission reductions are considered as non-permanent when the reported emissions are higher than the baseline at any time after units are issued. In REDD+, this risk is generally addressed through the use of buffers. For Article 6, it is important that a consistent approach is taken across all sectors when it comes to defining non-permanence and requiring addressing the risks (WB).

300. The 2005 Special Report on Carbon Dioxide Capture and Storage by the IPCC states that appropriately selected and managed geological reservoirs are ‘very likely’ to retain over 99 per cent of the sequestered CO_2 for longer than 100 years and ‘likely’ to retain 99 per cent of it for longer than 1,000 years. A variety of monitoring technologies have been successfully deployed to measure, monitor and verify injected CO_2 in the subsurface. Monitoring a CO_2 storage site occurs over its entire lifecycle from pre-injection to operation to post-injection. Operational and research experience over several decades demonstrates that injected CO_2 can be monitored to confirm its containment. [CCSI, 163]

301. Leakage risk is higher in nature-based credits, especially activities where the supply of particular goods is reduced by the GHG mitigation activity. Nature-based projects should be sited in areas with lower risk of reversal, when possible. Physical risks such as fires, hurricanes and droughts threaten nature-based projects. Siting carbon removal projects according to IPCC projections for climate impacts is key to reducing the risk of physical reversals in face of a globally changing climate. Buffer pools to account for non-permanence should be maintained throughout the duration of low-durability project lifetimes as should monitoring for reversals. Tonne-year accounting is not advised for low durability or nature-based carbon removals. Tonne-year accounting cannot be used to support an equivalence to permanent removal (MS).

302. Mitigation activities that lead to short-term sequestration of carbon should not be eligible to issue offsets under Article 6.4. This includes activities such as forest protection, afforestation, reforestation, soil carbon management, improved forest management, etc. (CMW).

303. Storage methods and products suited to utilizing CO_2 are heterogeneous. CO_2 stored in the biosphere is characterized by low permanence, while methods such

[13] These inputs were not specifically received in relation to removals, nevertheless, may be useful to consider due to overlaps in issues.

as geological storage potentially lock away CO_2 for longer timescales. Similarly, utilization of CO_2 in some products (e.g. in fizzy drinks) lead to almost immediate re-emission, while others (e.g. in cement) are long-term. Storage and utilization methods including a high risk of re-emission must be treated carefully for real emission reductions to be achieved (CCSI).

304. Verra´s Non-Permanence Risk Tool for Geologic Carbon Storage establishes procedures to assess a project's non-permanence risk and determine the project's contribution to Verra´s buffer pool reserve for geological carbon storage. Depending on the risk assessment, a share of credits generated by the project is deposited in Verra's Geological Carbon Storage buffer pool reserve to be available to equalize re-emissions should they occur (CCSI).

305. Carbon dioxide removal methods have different risks of reversal, thus biological and geological carbon cycles should be managed separately. Different approaches for carbon accounting shall ensure that carbon removed is not re-emitted at a later stage and that it leads to effective climate mitigation. Temporary storage will always have a climate benefit, even if reversals were to happen at a later point in time. There may be a need to calculate an "equivalence period", after which storage for that period is deemed equivalent to an emission reduction. After the calculated period has expired the reversal would be no longer considered to have a negative impact on the climate (PCR).

306. Equivalence periods to emission reduction: many baseline and crediting mechanisms apply a 100-year period based on the global warming potential (GWP) for GHGs that is used in the Kyoto Protocol and Paris Agreement. However, other ranges have been suggested: from as little as 30 years (TSVCM 2021) to 55 years (Moura Costa and Wilson 2000) and even as far as 1,000 years (Carbon Plan 2021) (PCR).

307. CARB has adopted two approaches for permanence in situations where there could be a potential reversal. All projects in this category contribute to a buffer pool. For intentional reversals, the party that surrendered a credit is obligated to replace any reversed credits to maintain environmental integrity. For unintentional reversals, the credits are replaced from the buffer pool to maintain environmental integrity (CARB).

308. Nature based solutions have avoidable and unavoidable reversal risks. Current approaches can be improved. Nature Based Solutions should make use of the data, technologies and methodologies that are fast emerging that take account of reversals risk and non-permanence. Companies buying credits to offset the damage of an emission should purchase sufficient credits upfront to achieve equivalent permanence (CCC).

309. Forest-based project reversals are typically dealt with through buffer reserves to mitigate the issue on the buyer end. In addition, legal paths for reversals should be made available to foresters. Bringing more transparency to the issue and providing support to the foresters would deter reversals in the long run (44M).

310. In the forest-based project sphere, the risks for non-permanence and reversals often lie in the duration of projects and the lack of collective accountability around the way reversals are handled (44M).

311. The physical longevity of carbon storage over time, or durability, can be grouped as low (fewer than 100 years), medium (100 to 1000 years) and high (thousands of years or longer). Each durability category has its own benefits and challenges, and the development of all three categories are needed to have a chance at achieving global net-zero goals by mid-century (MS).

312. When it comes to buffer pools, which are currently the most common way to purportedly address impermanence, the contribution rates are not necessarily scientifically robust and can risk leading to undercapitalisation of the pool. Research of California's buffer pool suggests it is heavily undercapitalised. In addition, for buffer pools to work, one would need to monitor the project area well beyond the end of the crediting period (over 100 years) in order to actually detect any reversals, which is difficult (if not unrealistic) to guarantee and which also raises real questions of liability: reversals could occur many decades later (the project developer could be out of business), they could be on a huge scale (beyond the ability of a project developer to compensate for even if they're required to do so in principle), they may not be detected (even by national GHG inventories depending on granularity of measurement), and it may not be possible for the Supervisory Body to legally require proponents to address reversals if they refuse. These issues raise significant integrity questions regarding the long-term viability of buffer pools to address impermanence of credits used to offset actual emissions (CMW).

313. Some projects on today's voluntary carbon market operate without any permanence-risk mitigation measures despite presenting real permanence risks. That is the case, for example, of many cookstove activities which often aim to reduce the combustion of biomass. These activities aim to reduce forest degradation/deforestation levels and bear non-permanence risks since the credited emission reductions entail sequestration in natural ecosystems that are vulnerable to various reversal risks. The non-permanence risk tied to cookstove projects are typically not accounted for, however. Cookstove project developers on the voluntary market (Verra and Gold Standard) and on the CDM do not need to contribute to a buffer pool. More generally, for efficient cookstove project types, the CDM, Verra and Gold Standard do not have "approaches for accounting and compensating for reversals [or] approaches for avoiding or reducing non-permanence risks" (Source: Carbon Credit Quality Initiative (May 2022) (CMW).

314. Tonne-year accounting must not be included under Article 6.4 as a method of addressing non-permanence since it creates a false equivalence between temporary carbon storage and (permanent) reductions or removals and is at odds both with the IPCC and the Paris Agreement's long-term temperature goals (CMW).

3.6. Avoidance of other negative environmental, social impacts

315. Discuss considerations to be given to core elements for avoidance of other negative environmental, social impacts; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.

316. Below is a summary of public inputs received.

317. We recommend that the Supervisory Body establish the following requirements for addressing negative environmental and social safeguards:

(a) Establishing a list of specific safeguards that must be considered by mitigation activity proponents in identifying, monitoring and mitigating potential negative environmental and social impacts, including with regard to:

(i) Violation of human rights;

(ii) Gender and women empowerment;

(iii) In the case of mitigation activities affecting Indigenous Peoples and Local Communities, ensuring their free, prior and informed consent to the mitigation activity;

(iv) Preserving and protecting cultural heritage;

(v) Health, safety and security;

(vi) Physical and economic displacement;

(vii) Labour rights;

(viii) Environmental issues, such as air pollution, water pollution, soil and land protection, waste management,

(ix) and biodiversity;

(b) Introduction of invasive non-native species;

(c) Clearly excluding from eligibility activities that do not fulfil these requirements (e.g., short-term rotation monoculture plantations);

(d) Requiring mitigation activity proponents, prior to the registration of the mitigation activity, to systematically identify potential negative environmental or social impacts, using a methodology to be developed by the Supervisory Body. The assessment should be audited by a designated operational entity and be made publicly available and address the safeguards described above;

(e) Requiring mitigation activity proponents to develop an environmental and social management plan to monitor and mitigate any identified potential negative environmental or social impacts, including by including relevant parameters on important potential negative impacts in the monitoring plan of the mitigation activity. The mitigation activity proponents should also be required to assign roles and responsibilities for implementing the plan and managing the relevant risks;

(f) Requiring mitigation activity proponents to demonstrate, prior to each issuance, that important potential negative impacts have been appropriately monitored and mitigated to the extent possible;

(g) Requiring mitigation activity proponents to identify and adhere to any national or local legal requirements which may be relevant to the project;

and• Establishing an appropriate grievance mechanism that allows stakeholders to submit grievances throughout the lifetime of the project without any barriers (e.g., liability for expenses associated with the investigation). Such grievances should be duly considered by the Supervisory Body. [EU, 59]

318. The UK recognises the key role the Article 6.4 Supervisory Body can play in ensuring environmental and social safeguards are developed and implemented in practice for the Article 6.4 mechanism. Eligible Article 6.4 activities should have overall positive environmental and social impacts. Any guidance on removals developed should as far as possible actively promote the scaling of removal activities with positive environmental, social, and economic co-benefits. In addition to promoting co-benefits, guidance on removals must simultaneously ensure that removal activities that technologies do not create new environmental and social risks when deployed individually and at scale. For instance, feedstock production for BECCS, biochar and wood in construction have potentially significant land requirements which, if mismanaged, could pose risks to biodiversity, or misalign with other incentives and domestic schemes to reward environmental land management. Impacts on local ecosystems including soil, water and air quality must also be taken into consideration, to minimise any potential adverse effects. The UK considers that understanding and ensuring the sustainability of GGRs is crucial and will differ across the different types of GGR methods. A tailored approach to safeguards will be required. The UK has commissioned research on resource intensity for DACCS, and, relevant for biomass GGRs, is committed to publishing the Biomass Strategy in 2023. This will review the amount of sustainable biomass available to the UK and how this resource could be best utilised across the economy to help achieve the UK government's net zero and wider environmental commitments while also supporting energy security. This will outline the role that BECCS can play in reducing carbon emissions across the economy and set out how the technology can be deployed. These findings could help inform the work of the Supervisory Body (e.g. in incentivising the use of sustainable biomass). Regarding risks to biodiversity specifically, the UK believes the Supervisory Body should design guidance in a manner that ensures activities align and support the goals and targets of the KunmingMontreal Global Biodiversity Framework adopted in December 2022. In addition, the Supervisory Body's work should also look to conduct further work that draws from relevant parts of decisions by the Parties to the Kyoto Protocol and under the Warsaw Framework for REDD+ (incl. the Cancun safeguards). [UK, 54]

319. The ROK would like to suggest a new formulation by 'Consideration of environmental and social impacts'. With this new formulation, the ROK suggest that paragraph 21 needs to insert the efforts to pursue positive environmental and social impacts for a balanced approach between positive and negative effects. In addition, currently, the Supervisory Body reviews sustainable development tools in use in existing market-based mechanisms with a view to developing similar tools for the mechanism UNFCCC 2021, para 5(c) . The ROK thinks that tools to be developed can be utilized to the removal activities. [ROK, 57]

320. The recommendations should take into account the necessity of safeguards with regards to biodiversity, natural habitat conservation, water conservation and

security, soil conservation, food and energy security, employment, land ownership rights. The provisions for stakeholder consultations should be incorporated. Safeguards for biodiversity and adaptation co-benefits, as well as sustainable and responsible environmental management should be ensured consistently and durably. [RU, 53]

321. IETA recommends that more consideration be given to this issue in order to keep the Article 6.4 Mechanism aligned with best practices from other programmes. Whilst acknowledging that the enforcement of environmental and social protection laws is a national prerogative of the host Party, it is important to ensure that all activities under the Article 6 Mechanism are aligned with international principles on environmental and social considerations. If a country or region does not have specific guidelines or processes, an impact evaluation before project initiation may be a feasible option. Such evaluation should be verified by a third-party assessor and may lead to the modification or rejection of the project. To strengthen this aspect, an independent and well-defined grievance redress mechanism should be established in accordance with the RMP and remain accessible, robust and with clearly defined scope to do no harm. [IETA, 70]

322. To avoid negative environmental and social impacts, the Supervisory Body can draw from existing COP decisions on REDD+ (e.g., the Cancun Safeguards), as well as multiple international REDD+ programs, bilateral and multilateral agreements, and other experiences. While poorly designed or outright predatory projects have resulted in land grabs, forced resettlement, loss of resource access, and deceptive legal agreements, carbon credit standards have generally addressed these risks through a combined approach of avoiding negative social outcomes and ensuring positive ones. Most requirements to date have focused on the former, with more work needed on the latter, in addition to enhancing Indigenous Peoples' and local communities' right to own and transact carbon credits—or to opt out of carbon markets if they wish. [EDF, 80]

323. Preventing negative environmental and social impacts of any activity involving removals including impacts on biodiversity and natural spaces, land and soils, water, atmosphere, ecosystem health, as well as ensuring the protection of human rights, rights of local communities and rights of indigenous people is of the utmost importance for us. In this line, any recommendations provided by the Supervisory Body on removals to the CMA must include this issue as a central topic. For us, an added value could be generated if not only negative impacts associated with removal activities are avoided but also a fair distribution of social and economic benefits is promoted (through guidelines that the Supervisory Body could develop in this regard). [CO, 58]

324. All climate action measures, including activities under the Article 6.4 mechanism should respect and protect human rights including the rights of Indigenous Peoples and local communities, and safeguard the environment from adverse impacts of these activities. They also should respect and comply with international law and standards. Prior to approval there should be meaningful public participation and consultation with rights holders that complies with international law and standards including complying with Indigenous Peoples' and local communities' right to free, prior, and informed consent. As such the Supervisory Body should present a complete governance package including modalities for all potential article 6.4 activities and recommendations on removals

as well as establishing the policies necessary to protect human rights including the rights of indigenous peoples and safeguard the environment from the adverse impacts of these activities. The Article 6.4 mechanism must be equipped with robust rules for meaningful consultation and a robust, independent and accessible grievance redress mechanism, that provides affected rights holders with instruments that allow violations of human and social rights as well as violations of environmental integrity to be sanctioned or prevented in advance. [HBL, 65]

325. Land-based and engineering-based removals are known to pose significant negative environmental and social risks to the communities, including the infringement on human rights, particularly those of Afro Descendants and Indigenous Peoples. In addition, appropriate meaningful consultation processes prior and throughout action with rights holders and relevant stakeholders–particularly the local communities and Indigenous Peoples, and Afro Descendants, and marginalized groups–must be ensured. Compliance with international laws and commitments, including respecting and protecting the Indigenous Peoples' right to free, prior, and informed consent. Also, a robust and independent grievance mechanism must be established for the overall SDM, which is applicable for activities involving removals. [LESE, 67]

326. The climate benefit of carbon removal activities must be viewed together with wider sustainability objectives – from biomass use and biodiversity protection to land use and energy input requirements. It is essential that projects are designed and implemented in a manner that does not compromise environmental and sustainability safeguards. [CCSA, 68]

327. Key points: (i) climate action measures, including any activities approved under the article 6.4 mechanism, should respect and protect human rights including the rights of Indigenous Peoples, local communities and women; (ii) Activities should comply with international law and standards; and (iii) Prior to approval (and throughout the life of any given project) there should be meaningful public participation and consultation with rights holders that complies with international law and standards including complying with Indigenous Peoples' right to free, prior, and informed consent. [CLARA, 69]

328. Exclusion of sustainable feedstock. The note contends that only use of dedicated feedstock in a BECCS facility can deliver a CO2 removal, and conversely that most sustainable feedstock, such as wastes, residues and by-products, lead only to avoided or reduced emissions. A sole reliance on dedicated feedstock for generating removals could place increased pressure on land resources. Drax would encourage instead that the mechanism includes the use of non-purpose grown feedstock where possible to leverage climate positive outcomes. [DG, 82]

329. Removal options that rely heavily on technology are not ready and we don't know if they would ever be in the timeframe and in scale we need to drastically reduce emissions (next 2-7 years) in order to avoid further catastrophic climate change impacts and to stay below the 1,5C limit, such as DACCS or BECCS and other forms of carbon storage are risky and pose considerable environmental and social risks as well as violations on human rights o technology is unproven and cannot scale up in time to remove the amount of carbon expected. While removals are different from reductions, both can and do affect human rights and

cause environmental harm, thus, there are overlaps in the requirements that all article 6.4 activities must follow:

(a) It is crucial establishing the policies necessary to protect human rights including the rights of indigenous peoples and safeguard the environment from adverse impacts, including establishing rules for meaningful consultation and a robust and accessible independent grievance mechanism.

(b) In general, Article 6.4 mechanism, which is supposed to facilitate increased ambition, should focus on incentivizing the increased reduction of emissions now rather than focusing on removals. [FoE/BUND, 83]

330. Removals adversely impact biodiversity, indigenous and human rights. Removals based on land, ecosystems, geoengineering or technological approaches all risk large scale undermining of human & indigenous rights and sustainable development as well as environmental degradation: Impacts on food systems and land rights - the amount of land required for tree-based carbon stores or growing monoculture bioenergy crops is huge and is likely to result in competition with cropland fuelling increased foodprices, and displacing peasant farmers. REDD+ type schemes and 'Nature Based Solutions' also mean a vast demand for land and will impact on land and food sovereignty especially in developing countries. [FoE UK, 84]

331. The texts fall extremely short in their requirements and guidance on avoiding negative environmental and social impacts. This is not surprising considering that the annex to decision 3/CMA.3 states that A6.4 activities "minimize, and where possible, avoid negative environmental and social impacts". This approach will not result in sustainable (permanent) mitigation outcomes. We propose that it is insufficient to "minimize impacts, if possible". Further, Local Communities and Indigenous Peoples (LCIPs) should not simply be consulted but take ownership of A6.4 activities in a larger framework of local sustainable development . The SB should draw from existing COP decisions on REDD+ (decision 1/CP.16) outlining social and environmental safeguards (which also apply to land-based removals). This is a relevant precedent under the UNFCCC; Article 6.4 must not fall below this level of safeguarding. Further, there are multiple international REDD+ programs, bilateral and multilateral agreements and other experiences that the SB may draw from to inform this section on environmental and social safeguards. (ALLCOT-48)

332. To address this, the SB may draw from the Information Note (paras 178-195), including: 1. Preventing monocultures, and promoting the re-growth or plantations of native species (para 181); 2. Managing trade-offs between food production, biodiversity conservation and forest restoration(para 182); 3. Planning mitigation activities as part of local sustainable development plans (para 184); 4. Ensure soil health and productivity (para 183); 5. Prioritizing local objectives for land use as defined by LCIPs (para 184); 6. Requesting an assessment –prior to activity registration– of potential impacts, trade-offs and how they were addressed in coordination with LCIPs (para 191); 7. Setting up dispute and grievance redress mechanisms and procedures as defined by IPLCs (paras 194-195); Additionally, we would like to propose the following principles to the SB when improving this section. Thus, removal activities: 8. Provide solutions to societal challenges that involve working with nature as prioritized by IPLCs; 9.

Support a wide range of Sustainable Development Goals; 10. Do not cause additional costs to non-participants; 11. Promote food and income to increase resilience to climate change; 12. Are continuously adjusted to learn from current events, promoting adaptive capacity; 13. Are consistent with cross-sectoral goals in an integrated strategy; 14. Are designed, implemented, managed, and monitored by IPLCs, promoting full ownership; 15. Incorporate risk identification and management beyond the intervention site; 16. Are economically viable and sustainable, costs and benefits are known ;17. Are cost-effective, considering alternative solutions and potential externalities; 18. Make use of a wide range of financial sources to increase resilience and sustainability; 19. Safeguards are jointly and periodically reviewed to ensure mutually agreed trade-offs limits and strategies; 20. Are designed with a view of long-term sustainability 21. Seek to enhance current policy and regulation frameworks; 22. Restore or manage natural, semi-natural or novel ecosystems; 23. Do not cause higher emissions, loss of biodiversity or social grievances; 24. Are not based on large-scale planting on monocultures; 25. Consider a wide range of ecosystems, not just forests 26. Promote the sustainable management of lands 27. Provide a quantifiable benefit for biodiversity 28. Make ecological sense and work with nature in-situ 29. Adopt a landscape approach that consider the connection of multiple habitats 30. Respond to the current state of ecosystems and prevailing drivers of degradation and loss 31. Focuses on increasing biodiversity at gene and ecosystem levels 32. Promote ownership, empowerment and well-being of local stewards 33. Tap into relational and moral values, including intangible connection to nature 34. Fully respect the rights of LCIP and local stewards, including tenure rights 35. Promote social organization and enhanced governance structures 36. Support and develop locally controlled enterprises 37. Promote the inclusion of women and disadvantaged groups 38. Are designed to build human capacity 39. Result from good faith negotiations among local stewards and stakeholders 40. Promote harmonious social change 41. Distributive (who gains, who loses), procedural (who decides), and recognition of justice are clear and just 42. The full range of benefits, trade-offs and conflicts are assessed and managed 43. A fully agreed upon feedback and grievance mechanism is available to all stewards and stakeholders 44. Participation is based on mutual respect and equality and upholds to Free, Prior and Informed Consent 45. Stakeholders who are directly or indirectly affected are identified and involved 46. Decision-making respond to the rights and interest of all participating and affected stakeholders This list is not exhaustive and helps illustrate how short the current text falls from providing safeguards against negative environmental and social impacts. (ALLCOT-48)

333. Avoidance of other negative environmental and social impacts: Over the past decade, many advances have been made in regard to the use of safeguards to minimize negative impacts and/or enhance the positive benefits of land-based projects. Standards such as the Climate, Community Biodiversity (CCB)s are widely accepted and have international legitimacy. Along the same line, significant efforts were put into adopting the Cancun Safeguards for REDD+, as well as promoting their understanding and implementation in countries. Also, Jurisdictional REDD+ methodologies recently created (e.g., Art TREES) require activities to be implemented in conformance with the Cancun Safeguards. We advise to build on the approaches developed in the VCM and REDD+ national programs for how to address these risks. The working group should consider

whether i) certain existing methodologies, e.g. CCBs, could be suggested as an accepted approach/methodology to deal with environmental and social risk, and ii) whether it may recommend a list of risks/safeguards (following the REDD+ Cancun safeguards approach) that all removal methodologies would need to address and iii) explore how the requirement for addressing social and environmental risk in removal projects could interoperate with Safeguard Information Systems that countries are developing for REDD+. These approaches require more study – it is advisable for the SB to continue working on the matter of social impacts and safeguards throughout 2023. [PTV, 18]

334. The avoidance of negative environmental and social impacts should consider the full value chain, not just within the operations of the activity, with the same activity boundary as mentioned in the previous point. [VA, 10]

335. CCAP proposes to enhance the methodological requirements for maximizing local communities' welfare and improve the track of accurate mitigation results of forest actions. [CCAP, 34]

336. Part of avoiding the social impact is creating a mechanism that maximizes its functionality, performance, and tangible effects on terrain. The methodologies could offer concrete requirements to promote financial and social performance. This pass guarantees that the expected finance through Article 6.4 do not remain unnecessarily in the intermediation and bureaucratic steps. [CCAP, 34]

337. Methodologies should include a monitoring system to measure the avoidance of other negative environmental and social impacts over time and the actions to maximize social welfare throughout the activity implementation. The Reports shall be submitted soon enough after quantifying the achieved carbon stocks and social effects to allow the DOE to visit the site and conduct sample checks as needed. Avoidance of other negative environmental and social impacts: A removal activity shall maximize the community welfare through its implementation, based on fair agreements between communities and technical intermediaries (under just benefit-sharing models). [CCAP, 34]

338. Regarding the Ocean Alkalinity Enhancement experiments being carried in their local bay. The local community is concerned about the potential for funding related to carbon market resulting in numerous such experiments. More specifically, as such experiments rely on modelling and there are many uncertainties regarding the actual removal, as well as potential impacts on the ocean ecosystems, it is not clear whether it justifies the “possibility for millions of tonnes of materials to be added to the ocean”. In addition, it is not clear if there is any community consent for such process. [KOSCF, 116]

339. In reference to the land use required for DAC, it should be deployed in a manner that minimizes the impacts on local resources. Because DAC technology’s net CO2 capture land efficiency is very high, it is able to capture large amounts of CO2 from the atmosphere without imposing a large footprint. [1.5, 123]

340. Environmental and social risks associated with engineering-based CDR activities are different for each technology employed and suggests creating a mechanism for addressing them. In many cases, existing regulations and standards are generally applicable to CDR, in which case, UNFCCC may ensure that they are

applied either through national law and/or international finance risk management requirements. [AC, 135]

341. We have conducted comprehensive studies on the environmental and social impacts to identify any potential adverse effects, devise strategies to mitigate them, thus Enhanced Rock Weathering (ERW) should not be considered as “unproven”. [MCR, 136]

3.7. Avoidance of Leakage

342. The SB 005 Information Note calls for discussing any further considerations to be given to the core elements for leakage avoidance in A6.4-SB003-A03; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types

343. Below is a summary of public inputs received.

344. Leakage should be avoided and minimized, where possible, and any remaining leakage should be deducted in the calculation of emission reductions or removals. The EU believes that all potential sources of leakage should be considered, including, inter alia, upstream and downstream emissions, activity-shifting, rebound effects or ecological leakage (mitigation activities that affect other areas that are hydrologically connected). Similarly, we believe that the consideration of leakage should not be geographically confined. Jurisdictional or sectoral approaches can reduce leakage risks, as any leakage within their scope would be fully accounted for; however, they do not address leakage beyond the scope of the jurisdiction, which can, for some type of activities, be significant. We further believe that smaller leakage sources may be excluded in the calculation of emission reductions or removals if overall conservativeness is ensured (for example, because some baseline emission sources are also excluded). This is common practice under all carbon crediting programs. Moreover, only net positive leakage should be accounted for, i.e., no additions should be made to emission reductions or removals to account for negative leakage. [EU, 59]

345. The issue of leakage should be addressed based on a presumption that although it should be avoided as much as possible, although under certain circumstances leakage is unavoidable. Therefore, the primary issue is proper assessment of leakage. After such an assessment is made, certain sources could be pronounced de minimis according to clear present conservative criteria, which could be activity specific. Under the CDM and several voluntary markets schemes the Tool for testing significance of GHG Emissions in A/R CDM Project Activities was used. This tool, or its revised version can be employed for the A6.4 Mechanism. The practice of tools for leakage risk assessment and relevant discounting estimations will be discussed further under the next section. Leakage monitoring needs to be included in the regular MRV procedures. [RU, 53]

346. We proposed that removal activities that are assessed to pose medium to high risk of leakage should be catalogued in the negative list. [LESE, 67]

347. When it comes to leakage caused by resource competition for technology-based removal activities, IETA recommends this to be reframed in the context of environmental safeguards and green energy procurement guidelines. In order to

enable technology-based removal activities to scale up, criteria may require project developers to procure renewable power which allows them to be expanded into power grids where they have optimal climate conditions for generation. This guidance would allow project developers to rely on existing contractual frameworks, developers, and supply chains, and allow for flexibility in environmental accounting for climate-based mitigation systems on a broad yet still auditable scale. The need to consider the overall GHG effects across the whole lifecycle of some removal activities (e.g. embodied emissions in material usage) may also be an important aspect that warrants deeper consideration. [IETA, 70]

348. Leakage refers to the risk that mitigation actions displace production, and directly or indirectly increase emissions elsewhere. For example, a project developer of a peatland conservation project needs to ensure that the degradation drivers (e.g., palm oil production) do not simply move into peatland areas outside the project perimeter. Similarly, reforestation of productive agricultural land can lead to deforestation, if agricultural production shifts elsewhere. Leakage considerations are, among others, behind the drive to move from projects to jurisdictional programs and to find transformational solutions for structural degradation problems. They may be addressed through conservative estimation, rather than calculations based on empirical data, or calculated and accounted for in the crediting process. Scale can be an important determinant of the environmental impact of credits, regardless of sector. Larger-scale programs are better positioned than individual projects that are not nested into jurisdictional-scale crediting to mitigate risks of leakage and non-additionality, as well as reversals. [EDF, 80]

349. The question of leakage can become very complex for industrial solutions, such as BECCS and DACCS. It is not recommended, at least for industrial solutions, that Art 6.4 develops its own LCA criteria. It should instead rely on the certification methodologies for CCS currently being in development [SE, 15]

350. We agree that carbon offsets should be credited net of leakage. However, leakage often cannot be directly quantified and deducted, and the language should not be so specific in this regard. Instead, we suggest that leakage shall be ‘mitigated’. We agree with the conservative leakage ‘adjustment factor’ approach. [ACR, 8]

351. IETA notes the recommendation to use of adjustment factors as a simplified method to account for leakage. However, we also note that there is limited experience with these factors, their use can present opportunities for regulatory arbitrage, and can impact upon the robustness of accounting of transfers against NDCs. IETA would therefore welcome a wider dialogue on the range of potential approaches to manage leakage risks. (IETA-51)

3.7.1. Inputs received in response to call for inputs on methodology requirements[14]

352. Carbon leakage has two definitions: (1) it can refer to the relocation of emission-intensive activities from jurisdictions with a higher cost to emit CO_2 to jurisdictions with a lower cost to emit, and (2) it can refer to an increase in fossil emissions outside the boundary of the project caused by the project activity itself. The Article 6.4 mechanism should be focused on minimizing any potential increase in fossil emissions outside the boundary of a project (with respect to the second definition of carbon leakage, above). In the case of removals, guidance on leakage can be specified as "Removal supplier shall assess all potential sources of leakage (i.e., increase of fossil emissions) outside of the project activity boundary but due to the activity as specified in the methodology. In the case where leakage potential is identified it shall be quantified and deducted from the CO_2 removals" (PE).

353. Leakage describes a situation where a project activity has impact outside of its boundary. This impact can be physical, economic, or social (44M).

354. The Article 6.4 mechanism should minimize the increase in emissions outside the activity boundary. Nesting of activities and jurisdiction-level crediting are proving to be effective approaches. A thorough lifecycle assessment of the impact of an activity should be the starting point to address the risk of leakage. Robust MRV systems and integrated registries are also key to identifying carbon leakage and reducing such risks across different types of activities and countries (IETA).

355. Leakage should be avoided where possible and discounts should apply when leakage risk exists. Methodologies can determine certain discount factors attached to different leakage risks. Jurisdictional approaches can help tackle leakage within the borders of a territory. Market leakage is seen by economists as inevitable for any genuinely additional project, suggesting issuing entities must seek to accurately quantify and account for (i.e., apply discounts for) this (SR).

356. Innovation is needed to improve estimation of leakage, to better avoid leakage, such as increased emissions elsewhere due to displacement of food or timber production to non-project areas. At present many leakage assessments focus on rough estimates of local-scale (or "direct") leakage and ignore or greatly underestimate longer-range ("market") displacement of forgone production (CCC).

357. For forestry-based solutions, the greatest risks of negative leakage occur when a nation's timber industry policies do not account for the industry's intersection with the carbon market. On the other hand, a strong benefit of positive leakage is a shift in sustainability trends of the timber market. With lower barriers to entry, carbon projects provide an alternative to low-grade timber harvesting (44M).

358. On the project level, leakage can be addressed by thorough inspection of the area surrounding a project. Some project developers create a "leakage belt" to assess this element of a project over time and account for it through discounting

[14] These were not submitted in relation to removals nevertheless may be useful to consider as there are overlaps

of offsets. Providing foresters with a cost-effective alternative to timber harvesting reduces leakage in the long run (44M).

359. Activity carbon leakages should be addressed in cases where the effect is negative to the jurisdiction with less stringent climate policies. This is often the case when project developers from Annex I countries create projects in Non-Annex I countries, of a lower quality than they otherwise would. Stricter national policies outlining the parameters for which carbon projects by foreign entities can exist could help with this. Another approach, on a larger scale, could be to increase cross-national policies or matching commitment agreements as proposed by the authors of “Combating climate change with matching-commitment agreements” (44M).

360. Leakage involves the risk of displacing activities that cause GHG emissions from the project site to another geographic location (including across international boundaries) for economic reasons. Economic leakage occurs when the market demand for an emitting activity is sustained despite the development of a carbon dioxide removal project. Note: these concepts are distinct from physical leakage (reversals), which occur when carbon that is stored throughout the course of a carbon offset project is re-released into the atmosphere through either avoidable (for example, a failure to maintain sequestration wells) or unavoidable (for example, extreme weather events) means (MS).

361. Leakage occurs when efforts to reduce GHG emissions in one country or sector led to an increase in emissions in another country or sector. This can happen, for example, if a country imposes a tax on carbon emissions, which leads to the relocation of carbon-intensive industries to countries with less stringent regulations. In this case, the emission reductions achieved in the country that imposed the tax is offset by the emissions increase in the country where the industries have relocated. The greatest risks of leakage occur when mitigation policies are implemented in a way that is not globally coordinated or when there is a lack of global cooperation on climate change. For example, if a group of countries agree to reduce their emissions under the Paris Agreement, but other countries do not follow suit, the emission reductions achieved by the first group of countries could be offset by emission increases in the nonparticipating countries. Another risk of leakage occurs when mitigation policies are not comprehensive and do not cover all sectors of the economy or all types of emissions. For example, if a country imposes a tax on carbon emissions from electricity generation but does not regulate emissions from transportation or agriculture, emission reductions in the electricity sector may be offset by emissions increases in the other sectors (CP).

Part II. Inputs received in response to the structured consultation

1. Elements for structured consultation – cross-cutting issues

1. *Discuss the role of removals activities and this guidance in supporting the aim of balancing emissions with removals through mid-century*

2. Quoting IPCC and IEA: [IEAGHG, 267]

   (a) The deployment of CDR to counterbalance hard-to-abate residual emissions is unavoidable if net zero CO2 or GHG emissions are to be achieved;

   (b) DAC plays an important and growing role in net zero pathways and provides a way to balance emissions that are difficult to avoid. In the IEA Net Zero Emissions by 2050 Scenario, DAC technologies capture more than 85 Mt of CO2 in 2030 and around 980 MtCO2 in 2050, requiring a large and accelerated scale-up from almost 0.01 MtCO2 today;

   (c) Carbon dioxide removal (CDR) is not an alternative to cutting emissions or an excuse for delaying action but is part of a comprehensive strategy for "net" zero, and ranges from nature-based solutions (such as afforestation) to technology-based approaches underpinned by carbon capture and storage. DAC with geological CO2 storage has several advantages as a CDR approach, including a relatively small land and water footprint, and high degree of assurance in both the permanence of the storage and the quantification of CO2 removed.

3. As reflected in the IPCC AR6 report, carbon removal alongside strong global efforts to reduce greenhouse gas emissions are indispensable. To ensure the effectiveness of carbon dioxide removal (CDR), clear national and international targets for large-scale CDR by 2035, 2040, and 2045 should be established, should be distinct from emission reduction goals and aligned with the objective of limiting global temperature rise to 1.5°C. [CFUT, 245]

4. To achieve the net-zero emission status by around mid-century, up to 10 Gt of removals will be required. Certain sectors pose greater marginal abatement challenges due to the inherent technical or economic difficulties in mitigating emissions and will have to rely on carbon removal to counterbalance their residual emissions. Many carbon removal technologies are in early development stages and need capital to research, develop, and scale, and Article 6.4 can play a pivotal role by creating a framework that promotes cooperation, stimulates investment, and facilitates access to capital and carbon markets. It is, therefore, essential that carbon removals are not perceived as a distraction from emissions reduction efforts, but rather as a complementary strategy that enables us to meet our ambitious climate goals. [CCAP, 246]

5. SB should follow the lead of the scientists and experts who contributed to the IPCC AR6 report and concluded that CDR is "unavoidable" and in fact will be required at Gt scale by mid-century to reach net zero and have a chance to limit warming to 1.5ºC or even 2°C –

this conclusion should be accepted as a foundation of the Article 6.4 deliberations, and not to relitigate the need for CDR. [NPBC, 253]

6. Carbon dioxide removal (CDR) at scale has become a necessity for the world to return to a 1.5°C or 2°C climate path. In fact, the latest IPCC report shows that for a 1.5°C world, we need to deploy CDR technologies starting now and increase volumes to 10-20 $GtCO_2$ removed per year until 2100 latest, but probably already until 2050. For that, we require long-term carbon removal technologies that prevent the release of the captured carbon for as long as possible; ideally for centuries to millennia. In addition to permanence, CDR technologies must be evaluated by their potential to already deliver significant removals in the near future. [ELG, 235], [REW, 219]

7. The need for carbon removals to reach net-zero GHG emissions at global level is a science-based fact. Carbon removals, including solutions such as DACCS, are required to achieve net-zero emissions by 2050 at global level, and are key contribution to neutralize residual emissions from hard-to-abate sectors, including aviation. It will play a critical role in the decarbonization of aviation by supporting in-sector measures aimed at avoiding or reducing emissions (including through the use of captured CO2 as a feedstock for sustainable aviation fuels), by supporting the balancing of aviation's residual emissions – IATA estimates that more than 700 million tCO_2/year will need to be extracted from the atmosphere in 2050 with carbon capture technologies, either to produce sustainable aviation fuels or for permanent storage, and even if conventional aviation fuel was fully replaced by SAF by 2050, this SAF won't be fully carbon circular, so carbon removals will still be required to compensate for any residual emissions. [IATA, 255]

8. The operationalization and guidance on removal activities under Article 6.4 is expected to provide an international framework to trade carbon dioxide removals credits. Establishing such a framework will be instrumental in enabling the scale-up of carbon removal technologies, while guaranteeing environmental integrity. Ensuring that the framework includes technology-based removals will enable the necessary financial flows to scale-up promising technologies, so they can meet the demand required for meaningful impact on aviation decarbonization. [IATA, 255]

9. Tackling climate change will require a plethora of approaches. While removals must never be used as a substitute to emissions reductions, the development and deployment of carbon removals is an essential part of that portfolio and is necessary to counterbalance both residual and historical CO2 emissions. The IPCC highlighted that carbon removals are crucial element on the road to net-zero, to enable net-zero and to achieve and sustain net-negative emissions, and that requires the deployment of large volumes of carbon dioxide removals, to be achieved through the various methods available – both land-based and engineered. The overwhelming proportion of IPCC scenarios compatible with the temperature targets of the Paris Agreement require the deployment of carbon dioxide removals, primarily BECCS and/or DACCS. [ZEP, 263]

10. Removals traded under Article 6.4 should not be allowed to impact NDC ambitions for emissions reductions. Thus, removals – land-based or technical – should only be applied towards dedicated removal trajectories which aim to neutralize the hard-to-abate emissions of the total volume of unabated emissions. A pre-requisite to acquire removals should be first to estimate the amount of hard-to abate emissions a nation or a company has and in what sectors. Land-based removals should only be applied towards hard-to-abate emissions in the AFOLU sector. For other sectors, permanent technical removals, such as BECCS and DACCS, should be applied as a condition to claim net-zero. [SE, 244]

11. There should be explicit recognition of the primary role of emissions reductions, the risks of mitigation deterrence from removals, and the likely constraints on removals. Even with concentrated efforts, removal activities will be small relative to needed emissions reductions over the next three or four decades. While the IPCC clearly spells out the fact that CDR will be unavoidable, it also stresses the need for significant emission cuts as a pre-requisite. [BF, 252]

12. With regards to the availability of CDR to balance out residual emissions, the oft-cited range of 'required' CDR deployment from the IPCC's scenarios should be taken with a grain of salt since they often do not include real life constraints to the deployment of CDR approaches, such as limited biomass availability, energy requirements and infrastructural needs to achieve the temperature targets. These modelling exercises should not be understood as being prescriptive. With this in mind, Article 6.4 (and other climate governance frameworks) should ensure that removals are deployed on top of emission reductions and are not used to balance out emissions which could otherwise have been abated. [BF, 252]

13. It must be expected that a portfolio of CDR approaches will be deployed to reach net zero emissions. At this stage of research and development, CDR approaches have to be evaluated considering their interplay with all potential positive and negative side effect, e.g. the combination of biochar and enhanced weathering provides benefits exceeding the CDR potential from the single methods and including benefits beyond such as emissions reduction, increased permanence, implementing and cultivating traditional regenerative agriculture and driving positive environmental and social impacts by, e.g., increasing food security. At the same time the single but also combined methods are not in competition to the former land use but have the potential to improve the productivity and quality of a region. [UOH, 236]

14. This guidance is essential to provide clarity and credibility in carbon markets through the development of a well-designed, enabling, and transparent regulatory system, namely monitoring, reporting, verification and governance mechanisms – and can stand in as a gold standard guidance for carbon markets. It should also be noted that this guidance is being developed alongside other initiatives (e.g., European Union's certification scheme for carbon removal activities) and that consistency in carbon removal accounting is essential to build trust in carbon markets, establish a global level-playing field and unlock further opportunities for developers. [ZEP, 263]

15. We advocate for clear national and international targets for large-scale CDR by 2035, 2040, and 2045, distinct from emission reduction targets and aligned with the goal of limiting global temperature increase to 1.5°C. […] the need for the implementation of a range of regulatory and financial incentives, such as direct procurement, project-based support, or outcome-based subsidies. …clear quality standards for CDR credits must be established, based on the principles of permanence, verifiability, sustainability, additionality, and quantifiability, while being technology neutral. [NC, 206]

16. Both emissions reductions and emissions removals are essential to meeting the goals of the Paris Agreement and can complement one another through synergies. For example, using renewable energy to power our DAC facilities to the extent possible. Emissions reductions should be the primary response, however, emissions removals are also needed to account for legacy CO2 and emissions from hard-to-abate sectors. The IPCC has stated that carbon removals need to reach the 100-1,000 gigaton-scale over the 21st century to limit warming to 1.5°C above pre-industrial levels. To reach gigaton-scale carbon removal this century, both nature-based and technical carbon removal solutions, such as DAC, are

needed. We firmly believe both carbon removal solutions should be pursued and included under the Article 6.4 mechanism, provided that technical carbon removal is fully measurable, reportable, and verifiable and contributes to the SDGs. [CAP, 207]

17. The Article 6.4 is widely expected to deliver a global standard for methodologies for carbon removal activities, especially for novel removal activities where a lot is still being developed. […] an increasing number of countries rely on engineered removals, to achieve their climate targets. Leaving such removals left out of the Article 6.4 mechanism scope makes it more difficult to achieve the increasingly ambitious NDCs over the coming decades. High-quality carbon removals play a crucial role to avoid overshooting climate targets and reaching net zero emissions. [CCE, 218]

18. More guidance on CDR projects on international waters is needed. One third of the world's ocean is in international waters, and as the ocean contains 93% of the carbon on Earth, an effective legal framework that can be applied to activities in these waters, will be important to scale of removals. We look to the UN to engage with the global community and set the tone for removals in international waters, taking lessons from legislation of international fishing and other existing activities. [SWG, 226]

19. CDR should be an avenue to invest and not for profit. An international CDR bank should be founded to control, monitor, diversify and approve CDR activities. We advise to promote CDR methods that are safer and more expensive. [CDR, 230]

20. The latest climate science shows the necessity of deploying carbon removals at scale to achieve net zero by mid-century. Removals should focus on activity types that offer permanent storage of CO2 to yield the greatest climate mitigation benefit. This means that the Article 6.4 mechanism should incentivise projects offering durable storage of CO2, such as through BECCS. The requirements for crediting periods, monitoring and reversals should: [DG, 271]

    (a) Be appropriate to the project characteristics;

    (b) Be proportionate to project risks; and o Enable projects to be developed and financed.

21. It is required to have a careful, conservative, and demonstrably rigorous approach to crediting mitigation from removals. In general, crediting practices in both voluntary and compliance markets thus far have not achieved either scientific or public credibility. To overcome this problem, policymakers must now focus on identifying and crediting only those removal activities that have a known and demonstrable mitigation impact. [GRI/LSE, 275]

22. Carbon Dioxide Removal from the atmosphere through the sequestration of biochar in soil is a critical "must have" for the planet. If carbon removal is seen as a way to offset emissions, it could lead to people and businesses believing that they can continue to emit greenhouse gases without taking action to reduce them. [CM, 277].

23. An exclusive focus on removal-based carbon offsets today could potentially result in less, rather than more, mitigation. This is for three reasons: nature-based carbon removals can be less reliable than other offsetting options, geologic removal methods are unproven at scale, and avoiding emissions is just as important – if not more so – than removing them. Ideally, organizations (along with the rest of the world) will reduce their own emissions in line with what is needed to limit global warming to 1.5°C or 2°C. If they use carbon offsets

to achieve even more mitigation, they should strongly consider investments that avoid GHG emissions – ideally prioritizing those that accelerate decarbonization. It does not make sense to limit investment to sequestration offsets based on an idealized notion of what "net zero" emissions should look like in 2050. Therefore, it is important to avoid prioritizing removals over emission reduction activities through Article 6.4 in the lead-up to 2050. Rather, activities that produce high-quality credits (i.e., credits for which there is high confidence in their environmental integrity) should be prioritized regardless of whether they reduce or remove GHG emissions from the atmosphere. [OI, 285]

24. While removals must never be used as a substitute to emissions reductions, the development and deployment of carbon removals is an essential part of that portfolio and is necessary to counterbalance both residual and historical CO2 emissions. [CCSA, 287]

25. As different carbon removal activities can achieve different storage timescales, with different reversal risks involved, it may be difficult to establish one-size-fits-all rules, without implicitly prejudicing certain activities in relation to others. Therefore, it may be more prudent to make some elements of these definitions and applicable timeframes – particularly in the case of monitoring periods and timeframes for addressing reversals – activity-specific. [CCSA, 287]

26. Carbon removal solutions that can play a role in addressing our collective climate challenges are numerous and encompass a range of pathways, storage mechanisms and levels of technological maturity. There is a false dichotomy in presenting "land-based" and "engineering-based" solutions (often also referred to as "nature-based" and "technological" solutions) as distinct categories, and both will be critical at scale if we want to avoid the worst impacts of climate change. The time and maturity component of these solutions is an important consideration here; while many nature-based solutions are subject to reversal risk, thus limiting their mitigation value, they are available today and can be scaled up rapidly, which can help to buy time for durable solutions with little-to-no reversal risk to be iterated upon and deployed. [RT, 288]

27. Removal activities fulfil an additional, complementary role from emission reductions, but they remain critical for the achievement of the long-term temperature targets. This guidance should thus be safeguarding that removal activities are not treated as a substitute to unprecedented and fast emission reductions. To the contrary, it shall safeguard that removal activities are being treated as a complementary tool in climate change mitigation, following a distinct framework wherever needed to safeguard the achievement of the long-term temperature targets. Thereby, removal activities will be able to meaningfully fulfil their roles specified in e.g., the AR6. [CWORKS, 302]

28. The need for carbon removals to reach net-zero GHG emissions at global level is a science-based fact. The IPCC and the IEA both clearly state that carbon removals, including technology-based removal solutions such as DACCS, among other developing removal-based technologies, are required to achieve net-zero emissions by 2050 at global level, and highlight their key contribution to neutralize residual emissions from hard-to-abate sectors, including aviation. Carbon removals, and in particular technology-based removals, will play a critical role in the decarbonisation of aviation. [ICCAIA, 303]

29. In the near term, avoidance, removal and emissions reductions will all be necessary. A shift to removal in carbon markets is likely in the long-term. As outlined in the Oxford Principles for Net Zero Aligned Carbon Offsetting, not only is a shift to 100% carbon

removal needed by the mid-century, a shift to long duration storage is also necessary. [BEZERO, 304]

30. Beyond 2050 we will need net zero emissions to the atmosphere, and probably even negative emissions. The IPCC recognizes that carbon dioxide removals (CDR) will be essential for this because even by 2050 we will not have developed sufficient technology to avoid 100% of emissions worldwide. Removals from both nature-based solutions (NBS) and technical-based solutions (TBS) will be needed. [SYRA, 305]

31. According to the IPCC, “Carbon dioxide removal (CDR) will be necessary to achieve net-negative CO_2 emissions”. Nature-based removals are particularly important in the near term as ready-to-go, proven climate solutions. The majority of existing removals activities are biological in nature and methodologies for these types of removals have already been widely tested and monitored over several decades and can deliver significant climate mitigation in the coming decades and can deliver additional benefits: “Reforestation, improved forest management, soil carbon sequestration, peatland restoration and coastal blue carbon management are examples of CDR methods that can enhance biodiversity and ecosystem functions, employment and local livelihoods, depending on context”. Other examples of co-benefits include increasing soil fertility and water security. [CI, 307]

32. There is a need to clearly distinguish between mitigation impacts/outcomes based on their expected durability. If the objective is to “balance” emissions with removals, then the guidance on the role of removals under 6.4 should ensure that only removals which have a high likelihood of very long-term storage (multiple centuries to millennia) can be considered as adequate activities under the article 6.4 mechanism. Medium-term storage has some value when it comes to climate mitigation. Some nature-based solutions deliver very valuable benefits that are far more important than their ability to sequester carbon, such as biodiversity or adaptation and resilience benefits. However, these activities should not be included under the article 6.4 mechanism because the quantification, and long-term guarantee, of their impact is extremely difficult, and to some extent impossible to achieve. Nature based solutions should not be used to meet specific GHG targets in a manner that implies their equivalence to GHG emission reductions. We therefore believe that any guidance on removals should clearly reflect the different ranges of durability associated with different types of storage, and no removal, particularly those with the shortest durability, should be considered as a way to “balance” emissions. In addition, mid-century is still several decades away, so this mechanism should not be aiming at balancing at all: no country, region or sector has reached low ‘residual’ emissions. The urgent focus for the coming days, years and decades is steep and sustained emission reductions. [CMW, 308]

33. Modelled mitigation pathways that limit warming to 1.5°C, and well below 2°C, involve deep, rapid and sustained emissions reductions. Both emission reductions and removals are needed to get on a Paris-aligned pathway. This limits the role and space for offsetting as aggregated NDCs are not currently consistent with 1.5°C-consistent pathways and total CO_2 emissions will need to go to net zero within the next thirty years. Due to the current insufficiency of mitigation ambition, to be consistent with Paris Agreement goals any use of Article 6 should come in addition to, and on top of, not instead of, rapid decarbonization and should target reductions that the Host Party cannot realize through domestic support alone. [CA, 312]

34. SB shall also consider that removal projects can be of multiple types, each with different characteristics and each may need to be treated differently (from one perspective or

another). Some might even fit the existing RMP of CDM (e.g., CDM sectoral scopes) while other may warrant operationalization of newer sectoral scope (CCS). [SP, 313]

35. CDR counterbalances hard-to-abate residual emissions and include options such as DACCS and BECCS, where CCS provides the storage component of these methods. [GCCSI, 314]

36. This guidance will enable global markets to trade on removals credits, and should aim to ensure:

    (a) Removals are not used as an alternative to reducing emissions;

    (b) Removals are defined according to the IPCC Sixth Assessment Report (AR6);

    (c) Monitoring, accounting, permanence and risk of CO2 capture, transport and storage is handled appropriately, with reference to significant work done by experts. [GCCSI, 314]

37. Removals have an essential but limited role of meeting the Paris Agreement goals, including the goal of reaching a ‘balance of sinks and sources’. Removals include only activities that actually remove net carbon from the atmosphere, so that CCS attached to fossil fuels or CCU with re-release of carbon cannot qualify. BECCS that uses forest wood as a feedstock likewise is highly unlikely to deliver net removals in a timeframe consistent with the urgent need for climate mitigation. Removal activities need to be able to ensure the permanent storage of carbon in non-atmospheric carbon sinks; critical to ensure a precise and science-based definition of carbon removals so that activities that do not live up to these characteristics are not falsely identified as carbon removals. Speculative technologies where environmental and social impacts are largely uncertain or likely negative, or where carbon removal and its permanence are not demonstrated, should be eliminated. Any removal technologies or approaches with negative impacts on biodiversity, environment, climate and communities should be eliminated. There must be strict additionality criteria to ensure that the results of ongoing natural processes cannot be claimed and traded. [CLARA, 316]

1.1. Roles of entities

38. *What are the roles and functions of the following entities in implementing the operations referred to in this guidance: Activity proponent(s), Article 6.4 mechanism Supervisory Body (6.4SB), 6.4 mechanism registry administrator, Host Party, stakeholders?*

39. CDM examples are followed in the roles and functions of these entities. [IEAGHG, 267]

1.1.1. Activity Proponent

40. The activity proponent(s) are those fulfilling the role of the project owner(s) and have the overall control and responsibility for the project. This includes bearing the responsibility for ensuring the project meets the rules, modalities, and procedures set both in terms of project implementation and monitoring as well as project documentation to allow verification of results. [STX,282]

41. An ‘activity proponent’ is an entity that registers a carbon dioxide removal facility with an eligible 6.4 mechanism registry administrator against and accredited methodology [CCAP, 246]

42. In regard to the roles and functions of entities involved in implementing Article 6.4 guidance, it is critical that carbon removal practitioners are actively involved in the decision-making process. Connecting these practitioners with academia, governmental and UNFCCC partners will help to break down information silos, enable shared learning and ground climate projections and models with real-world data and testing. We encourage the Supervisory Body to continue to provide avenues – such as meetings, webinars, learning sessions and smaller advisory groups – for direct engagement between the Supervisory Body, Activity Proponents and other key stakeholders [RT, 288]

43. Activity proponents: Understand and follow the guidelines when designing and implementing activities to be traded under the Article 6.4 mechanism [SYRA, 305]

1.1.2. Article 6.4 mechanism Supervisory Body (6.4SB)

44. The 6.4SB fulfils the role of control body ensuring that implemented activities sufficiently meet and follow the rules, modalities, and procedures set and ensures the removal claims are validated to ensure these are accurate and appropriate. As well as the role of defining, with input of stakeholders, what the rules, modalities and procedures should look like and ensure these are in line with the latest scientific supported standards. [STX, 282]

45. The Article 6.4 mechanism SB govern the Article 6.4 crediting mechanism and overall operations, including creation and approval of methodologies. [CCAP, 246]

46. The role of the SB, in other words, is not to be limited by self-imposed constraints of the best guess as to safe levels of eight years ago nor by offset markets or cap and trade or cap and tax systems but to assist those and go beyond those to restore the healthy environment to which all the world is entitled. The SB can fulfill its specific mandates from the Paris Agreement and go beyond in responding to current experience at the same time. [JMF, 270]

1.1.3. 6.4 mechanism registry administrator

47. The Article 6.4 mechanism registry administrator provides an accredited database that of Article 6.4 CDRs that includes records for the full lifecycle of ownership and use of such certificates. The registry administrator should be independent from the market and act as a single source of truth to support multiple types of removal certificates and end-user claims. [CCAP, 246]

48. The mechanism registry administrator fulfils the role of ensuring that there is a functioning platform in which removal activities, their underlying documentation and results including buffer pools accounted for are recorded. Furthermore, it should fulfil the function of preventing double counting of results through ensuring the removal activities registered are unique and do not overlap with existing implemented activities. [STX, 282]

1.1.4. Host Party

49. The host party should fulfil the function of providing guidance on how to develop removal activities within their country to ensure developed activities are in line with the host party's objectives of activity development. [STX, 282]

1.1.5. Stakeholders

50. The roles and functions of the stakeholders involved in implementing the operations can differ across types of removal activities. Hence, the categories of removal activities would need to be defined prior to defining the roles and functions that stakeholders fulfil in implementing the removal operations. [STX,282]

1.2. Interrelationships between monitoring and crediting period and reversals

51. *How are these elements understood, in particular, any interrelationships in their functions, timeframes, and implementation? (a) Monitoring period (b) Crediting period (c) Timeframe for addressing reversals*

1.2.1. General Aspects

52. Crediting period process also allows for the re-evaluation of the project within the latest climate context. [DG, 271]

53. … the EU's carbon removal certification framework's impact assessment report contains two points for permanence i) certainty in quantification, and ii) corresponding liability regime or insurance mechanisms to cover reversals. … [CCE, 218]

54. Use technology to monitor and report at a high level of detail and accuracy. Measurement of CO2 removed should be accurate to the tonne. Proof of sequestration and measurement should be provided at issuance …Verification of the removal should be performed yearly, until permanence is proved beyond reasonable doubt…….a certified, peer reviewed life cycle analysis is critical. Every CDR solution and implementation should undergo a detailed LCA... …, insurance of reversal should be a requirement. [REW, 219]

55. Annual monitoring and reporting should occur if a long-term project produces carbon removal. In the case of one-off projects, one-time monitoring upon input and/or at certain time intervals depends on the ecosystem and environment of the project. [TFI, 214]

56. For monitoring, reporting, and verification (MRV) process for biochar several robust methodologies exist: Verra, puro.earth and European Biochar Certificate C-sink. [ECOERA, 209]

57. Combinations of carbon removal solutions can also offer more flexibility and greater impact in various ways, such as through "horizontal stacking" or replacement of mixtures of removals over time. … concept called the "blended tonne", which combines ex-post soil carbon removals that have a guaranteed 10-year permanence with ex-ante long-storage duration removals is described [NORI, 212]

58. MRV is .. a work in progress across the CDR sector… SB should engage with the EU Carbon Removal Certification Framework process, the work of the U.S. Department of Energy Office of Fossil Energy and Carbon Management, Japan's Joint Crediting Mechanism, … to create and advance a cohesive MRV framework across carbon markets ….[OAIR, 210][CBC, 211] : 1) all CDR projects must be verified by reputable independent third parties, with an openness to new entities and standards bodies that emerge as the sector develops; 2) the cost of MRV for any transaction be listed separately from the aggregate purchase price for credits; and 3) that MRV be contracted and paid for by the buyer (or receiving party) of the credits. .. streamline and systematize what is currently an opaque and muddled process, and critically, to align all parties' incentives towards the

highest possible quality standard [OAIR, 210] CBC produced an issue brief on MRV of CDR [CBC, 211]

59. For creating a methodology for generating carbon credits from increased production, use and disposal of industrial wood...... submission proposes baseline, MRV, additionality, equations, permanence period for each parameter and pools i.e. forest growth, forest operation, industrial/construction wood, biochar, soil stocking …… [RBI, 204]

60. An idealized MRV+ governed and engineered for marine CDR operation would have overlapping reporting time frames… real-time ship-to-shore communications can be made available for 24/7 data exchange to monitor …every operational aspect, and a wide range of on-going environmental data streams ……..suggests to follow what the NOAA mCDR team recommends…… The use of a NOAA/USDA approved MRV+ value scale by UNFCCC, can likely be approved by the other parties…. [MHS,200]

61. Monitoring must be continuous during the monitoring period. Some form of monitoring mechanism is required which is able to identify removals on short notice. All monitoring data for reversals should be made public in near real-time by all projects. [SE, 244]

62. More guidance on CDR projects on international waters is needed. One third of the world's ocean is in international waters, and as the ocean contains 93% of the carbon on Earth, an effective legal framework that can be applied to activities in these waters, will be important to scale of removals. We look to the UN to engage with the global community and set the tone for removals in international waters, taking lessons from legislation of international fishing and other existing activities. [SWG 226]

63. The monitoring period should begin with the initial capture of CO2, continue through its storage and sequestration, and only finish if/when the CDR provider can demonstrate that it is no longer possible for the CO2 to be re-released back into the atmosphere, for example after CO2 has been mineralised. Exact monitoring requirements will vary across different carbon capture and sequestration technologies and the frequency of monitoring reports might decrease over time if the risk of reversal decreases, but some form of monitoring and reporting should always be required unless and until a sequestration provider can demonstrate permanent carbon disposal/removal. For carbon mineralisation, we would propose the injection site should be monitored continuously from the point of injection until all the CO2 has been mineralised. Data from this monitoring should be reported once a year for verification purposes. Further a method is proposed for data confidentiality. [44.01, 248]

64. Performance based monitoring periods are recommended, safeguarding that i) monitoring is continued to the point where there is "proof of permanence" (e.g., via a transfer of liabilities as specified in the European CCS directive) whilst ii) not overburdening project developers following best practice that is following scientific assessments of what is happening to CO2 once stored in a geological reservoir. Given that the A6.4SB is requested to allow for reporting of reversals and addressing them "in full" for all A6.4ERs, the above logic pertinent to geological storage could also be "transferred" towards CDR methods not reliant on geological storage. [CWORKS, 302].

65. High quality monitoring, reporting, and verification (MRV) is the key deliverable for any carbon removal project and essential for building trust in carbon markets. The Carbon Business Council recently published an Issue Brief outlining the key criteria for high-quality MRV. These Article 6.4 deliberations offer an opportunity to enshrine high-quality MRV as

foundational to global carbon removal markets, and we encourage the SB to take steps to engage with the EU Carbon Removal Certification Framework process, the work of the U.S. Department of Energy Office of Fossil Energy and Carbon Management, Japan's Joint Crediting Mechanism, and other key global public sector efforts (multilateral and bilateral) to create and advance a cohesive MRV framework across carbon markets – and avoid a fragmented, patchwork outcome that will be difficult for all stakeholders to navigate. [NPBC, 253]

66. Monitoring, reporting and verification mechanisms must take into account the characteristics of the different types of carbon removal methods as they vary greatly in terms of the storage timescales that can be achieved and in the reversal risks involved. These differences will result in different requirements for (i) monitoring periods, (ii) crediting periods and (iii) managing reversals:

(a) Crediting periods should be aligned with the achievable storage timeframe. Longer crediting periods should be assigned to activities that achieve permanent storage, recognising the longterm climate value of geological storage methods, capable of storing CO2 for thousands of years;

(b) Monitoring periods must be in line with storage timescales and reversal risks. As general principle, the monitoring period should be at least as long at the crediting period (in the case of geological storage, monitoring continues after the end of injection). Monitoring requirements must be defined accordingly, taking into account the potential for reversal through time. [ZEP, 263]

67. Regardless of the sector of removals, monitoring is fundamental to ensure that GHG impacts are credible and verifiable, as it enables the detection of reversals. While the monitoring techniques and technologies needed to accurately quantify projected or claimed GHG impacts vary widely, the most robust systems usually use a combination of two types of approaches to monitoring: (1) ongoing/automatic monitoring, e.g., on-site and/or remote sensing to detect any changes and (2) site visits to validate ongoing monitoring, check equipment function, record in-person measurements. There is a minimum threshold of data and monitoring requirements that are set out by standards and carried out by the project proponents with support from the government and local communities. These should be vetted by the 6.4SB for every relevant methodology to ensure high quality [CI, 307].

68. Monitoring capacity should be in place at the onset of any activity that is intended to generate credits to be used under Article 6.4. Under no circumstance should credits be generated for results that may have occurred before monitoring was in place. Monitoring should continue over the course of the period in which the activity seeks to generate credits, and it should be sufficiently robust to verify that the activity is ongoing and to detect and quantify any reversal that occurs [CI, 307].

2. Elements for structured consultation – specific elements

2.1. Definitions

69. The SB 005 Information Note calls for a discussion on the role and potential elements of definitions for the guidance, including "Removals".

70. Below is a summary of public inputs received on these issues.

71. Removals are best understood as a measure to lower the concentration of CO_2 in the atmosphere. A permanent removal is a measure where, based on scientific consensus, the likelihood of reversal is very close to zero if industry best-practices are applied. A non-permanent removal is a postponed emission. [SE, 244]

72. In our view, "removals" should be defined as the process that effectively subtracts carbon dioxide from the atmosphere. Importantly, this definition must incorporate a long-term perspective. We propose that, to qualify as a removal, the action should result in the extraction of carbon from the atmosphere for a period of 100 years or longer. This definition sets a stringent standard that encourages meaningful and lasting efforts towards carbon dioxide removal (CDR). Further, the risk of reversal or, Event of Carbon Default (EOCD)— the potential for the stored carbon to re-enter the atmosphere — should be minimised to the greatest extent possible. This risk management is crucial to ensure the integrity and effectiveness of removal activities over the long term. C-Capsule views risk assessment agencies such as Sylvera and BeZero Carbon, as essential to the evaluation of risk. Moreover, it's important to recognise that "removals" should not be considered exclusively as a pathway towards storage, but also as an avenue to make use of captured carbon in a manner that continues to keep it out of the atmosphere in the long term. For instance, integrating captured carbon into construction materials such as cement could qualify as a removal, given that it results in the long-term sequestration of carbon. However, we need to draw clear boundaries on what constitutes a removal. For instance, while captured carbon can be utilised in various ways, its use as a fuel should not qualify as a removal. This is because burning captured carbon as a fuel would reintroduce it into the atmosphere, contradicting the requirement of the 100-year sequestration benchmark we propose. In summary, it is paramount to construct clear and robust definitions for terms like "removals" to ensure a common understanding and strict adherence to the long-term goals of carbon dioxide removal. By setting these high standards, we can ensure that every removal contributes effectively and enduringly towards the balance of emissions by mid-century. [CCAP, 246]

73. We encourage the Supervisory Body to consider including CO_2 captured from the ocean in its definition of removal activities, i.e., “Anthropogenic activities removing carbon dioxide (CO_2) from the atmosphere or ocean and durably storing it in geological, terrestrial, or ocean reservoirs, or in products”. The ocean plays an important role in regulating Earth’s climate by absorbing 30% of anthropogenic CO_2 from the atmosphere and thereby slowing the rate of atmospheric warming. Without this, “atmospheric CO_2 would be approximately 450ppmv today, a level of CO_2 that would have led to even greater climate change than witnessed today”. However, this CO_2 uptake by the ocean has not been without consequence and has led to a decrease in seawater pH and carbonate ion concentration, in a phenomenon referred to as ocean acidification. Ocean acidification directly impacts marine calcifying organisms that use dissolved calcium and carbonate ions to build their shells and external skeletons. It is causing detrimental ecosystem changes that are, in turn, affecting ocean-dependent sustainable development activities, such as seafood farming. An equilibrium broadly exists between the atmosphere and shallow ocean with regards to CO_2 levels. “Air-sea gas exchange equilibrates surface water CO_2 to atmospheric levels with a timescale of approximately one year”. Marine carbon dioxide removal (mCDR) methods, such as Captura’s Direct Ocean Capture (DOC), can leverage this natural equilibrium to enable the removal of CO_2 from the atmosphere, while also helping to mitigate local ocean acidification. [..] As CO_2 is 150 times more concentrated volumetrically in the ocean than the atmosphere, Captura’s DOC has the potential to indirectly remove significant quantities of CO_2 from the atmosphere in an energy efficient

way. If deployed in semi-contained bays or inlets, it can also counteract ocean acidification on a local level, supporting the UNFCCC's broader sustainable development goals. [CC, 247]

74. We also see the Article 6.4 guidance providing clear differentiation between different types of carbon sequestration, and especially between truly permanent carbon removal and reversible carbon storage pathways. The 6.4SB can play an important role in helping clarify levels of permanence and setting appropriate monitoring and insurance requirements for technologies that provide reversible carbon storage. However, there are already competing measures being developed at national and multinational level, including the USA's Inflation Reduction Act and the EU's Carbon Removal Certification Framework. It is important that, as much as possible, all these frameworks are aligned, otherwise we could see CDR providers migrating to lower-standard jurisdictions. [44.01, 248]

75. With regards to the definition of Carbon Dioxide Removal, CDR must be considered a functional outcome, rather than an enumerated set of activities or processes: Any process, regardless of pathway, which results in a net reduction of CO_2 concentrations in the atmosphere must be considered carbon dioxide removal. Net carbon dioxide removals must be established by a comprehensive,cradle-to-grave life cycle analysis. We urge a definition of removals that is method-neutral, and criteria based to preserve latitude for emerging methods of removal. [XPZ, 249]

76. We strongly encourage the SB to follow the IPCC's lead in defining carbon removal as"anthropogenic activities removing carbon dioxide (CO_2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products." This definition is the consensus product of lengthy deliberation by thousands of scientists and other relevant experts and should be used by the SB as a foundation of the future Article 6.4 mechanism. We would like to reiterate that CDR encompasses a range of pathways, from land-based soil and forest carbon sinks; to biomass-based carbon removal and storage (BiCRS); to marine carbon dioxide removal (mCDR); to mineralization-based approaches; to direct air capture (DAC) – as well as emergent and potentially as yet undiscovered methods. Effectively all of these pathways and approaches are hybrids with varying degrees of nature and engineering, and we strongly encourage the SB to move away from labels such as "engineering-based activities" and adopt a definition of CDR that is method-neutral and criteria based. In a recently published Issue Brief, the Carbon Business Council draws upon IPCC recommendations and views from experts across the CDR sector to outline five key criteria for high-quality CDR: additionality, durability, net-negativity, verification, and equity and community engagement. (Note: Additionality can be challenging to assess with soil carbon sequestration and other regenerative agriculture practices that can nevertheless have meaningful climate value and offer important ecosystem co-benefits. Also, different CDR pathways offer varying levels of durability, all of which have the potential to contribute to meeting our climate goals.) We encourage the SB to adopt a similarly method-neutral, criteria-based approach to determine CDR projects' eligibility under the Article 6.4 mechanism. [NPBC, 253]

77. Definitions are extremely important. There is a need for differentiating between emissions reductions and removals in general. The removals definition should safeguard that such

differentiations will not become blurred. Two more important aspect for the definition of CDR are found in:

(a) The storage timeframe. Given that all reversal should be addressed in full, limiting the definition towards CDR methods that can safeguard storage permanence should be considered. Alternatively, the monitoring period should reflect options to safeguard addressing all reversals in full by coverage of a very long timeframe. The draft GHG Protocol Guidance for the Land sector and removals has specified the need for "ongoing monitoring" to safeguard that information about the carbon stock is never missing and thus allowing to address potential reversals;

(b) An active anthropogenic intervention. Given that A6.4ERs shall be designed to achieve mitigation of GHG emissions that is allowing for higher ambition, an "active anthropogenic" intervention should be required per the definition. [CWORKS, 302]

78. The definition of carbon removal should align to that by the IPCC which defines it as "anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products." Recognizing that CDR will need to be deployed at gigaton scale to achieve the 1.5°C or 2°C temperature rise targets, rather than delaying progress (by exclusion of emerging technologies) out of caution, the mechanism should focus on accelerating the testing and validation to reduce uncertainties that remain in technology-based CDR. [NC, 206]

2.1.1. General approach to definition

79. The Supervisory body may wish to define different types of removal activities. A high-level categorization could include the following two broad categories:

80. Temperature dependent feedback loops magnify the extend of methane increases, including biogenic methane production and methane release from melting arctic ice. Risk exists that these effects will outpace our efforts to reduce methane emissions, and that we will not see atmospheric methane decrease fast enough through point source emissions reductions alone. To allow for future generations to manage climate risk, it is important that 'carbon removals' or 'greenhouse gas removals' terminology be kept open:

(a) To all technologies which may be developed and proven with adequate MRV;

(b) To all greenhouse gases covered by the Kyoto agreement, including carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, perfluorocarbons, SF_6 and NF3;

(c) To greenhouse gases which may form a part of present and future agreements such as the Paris Agreement. Inversion Point's main concerns with the information note on removal activities are summarized as follows:

(i) The consideration of excluding non-CO_2 greenhouse gases from removal definitions on the basis of perceived likely contribution (Table 1, page 13, row 1, "Cons");

(ii) The exclusion of other Pros from non-CO_2 greenhouse gas addition removal definitions (Table 1, page 13, row 1, "Pros"), including: a. Air quality improvement co-benefits b. Increased impact on short-term warming effects relative to CO_2 c. Need for solutions capable of keeping pace with increased natural emissions (CH_4/N_2O);

(iii) Framing of CDR as either “engineering-based activities” or “land-based activities” (A);

(iv) Misrepresentation of the benefits of long-term storage and its foreseen role according to scientific assessments, e.g. via discount rates (B). [IPT, 284]

81. The definition of removals should be based on the following principles:

(a) Be technology neutral;

(b) Be neutral regarding whether removed GHGs are stored or destroyed;

(c) Avoid prescribing specific durations for storage (with the issue of temporary storage dealt with separately, and not in the definition);

(d) Apply to all relevant GHGs and not only CO_2. [OI, 285]

82. We suggest that the following definition of ‘GHG removal enhancement’ fulfills these criteria:

(a) Greenhouse gas removal enhancement: Anthropogenic activities that cause an increase in removals exceeding any increase in emissions caused by the activity. [OI, 285]

83. This definition addresses the issues related to temporal boundaries and removals versus avoided emissions in Information Note A6.4-SB005-AA-A09. For example, BECCS from biogenic waste would not meet the definition of ‘greenhouse gas removal enhancement’ as it does not cause an increase in removals but constitutes an emission reduction. The definition also addresses the issue raised in Information Note A6.4-SB005-AA-A09 on the need to include specification of ‘net’ removals, i.e., that activities which increase emissions more than they increase removals would not fulfill the definition of ‘Greenhouse gas removal enhancement’. We suggest inclusion of the word ‘enhancement’ to distinguish between activities that enhance removals and the activity of solely removing GHGs. The definition also addresses the issue of durability of storage, as activities that have non-durable storage and therefore reversal emissions will not fulfill the definition if any increase in emissions caused by the activity exceeds the removals caused by the activity. [OI, 285]

84. Once again, a more complete definition and framing of eligible removals activities that could help achieve the objectives of the Paris Agreement would focus on carbon removal as *the intentional movement of carbon from the fast carbon cycle to the slow carbon cycle, where the total fast carbon removed exceeds the total slow carbon emitted within a given project boundary*. Such removal activities could shift carbon to rebalance natural carbon reservoirs by transferring carbon from fast cycling reservoirs (i.e. the biosphere, the atmosphere, and the upper ocean) to slow cycling reservoirs (i.e. the deep ocean and marine sediments, geologic storage). [RT,288]

85. A robust and thorough definition must reflect the following principles:

(a) CO_2 is physically removed from the atmosphere;

(b) The removed CO_2 is stored out of the atmosphere in a manner intended to be permanent;

(c) Upstream and downstream greenhouse gas emissions, associated with the removal and storage process, are comprehensively estimated and included in the emission balance;

(d) The total quantity of atmospheric CO_2 removed and permanently stored is greater than the total quantity of CO_2 emitted to the atmosphere. [ZEP, 263]

86. The concept of "permanence" should also be accurately defined in the proposed guidance. While different activities can achieve carbon dioxide removal, they will involve different storage timeframes and risks of storage reversal. For example, storage in products and carbon farming activities will typically store CO_2 out of the atmosphere for decades to centuries; while storage of CO_2 in geological reservoirs offers the opportunity to safely store CO_2 for thousands of years. The European Commission proposal for a Regulation establishing a Union certification framework for carbon removals defines "permanent carbon storage" as "a carbon removal activity that, under normal circumstances and using appropriate management practices, stores atmospheric or biogenic carbon for several centuries, including bioenergy with carbon capture and storage and direct air carbon capture and storage". [ZEP, 263]

87. Any definition of GGR eligible for crediting under Article 6.4 must be the outcome of processes that lead to a net reduction of greenhouse gases in the atmosphere. We welcome a broad definition of 'removals' that accommodates future innovation, but urge that different removal pathways have different considerations in terms of real carbon impact (i.e., additionality, leakage and permanence) that should be understood and taken into account when designing crediting and monitoring frameworks. [GRI, 275]

88. Any overarching definition of carbon removals should be written purely from a scientific perspective and be technology neutral as such a definition will serve to set the context before attributes for specific technologies are reviewed. Whether within the removal's definition or as a separate but connected component, how each removals technology relates to leakage, permanence, social impacts, governance impacts, and changes to biodiversity at a minimum should be reflected to provide better understanding of the overall implications of using one removal technology over another, beyond the carbon removal impacts. [KITA, 262]

89. Atmospheric methane removal involves breaking methane down via processes that mimic natural methane oxidation in the atmosphere and methanotrophs in soil. To include methane removal approaches, the definition of "removals" would need to expand to include processes that "destroy" or "convert" greenhouse gasses, not just "remove… and store" them. Carbon removal requires sequestration, but since atmospheric methane removal breaks methane down, storing or sequestering is not a consideration. A broader, more inclusive definition of removals could be: "*removals" are processes or outcome of processes via anthropogenic activities to reduce atmospheric levels from greenhouse gasses (GHGs) already emitted, inclusive of any activities necessary in order to ensure that the "removed" greenhouse gas is kept from re-entering the atmosphere and reversing the 3 removal, for example via durable storage in geological, terrestrial, or ocean reservoirs, or in products*." [SCL, 292]

90. We urge the SB to move toward standards-based definitions for removals, including notions of permanence/durability, additionality, leakage, etc., - as well as co-benefits - and move away from choosing any specific pathway. Further, we urge the SB to refrain from grouping pathways into different classes as much as possible as with any taxonomy there will be pathways that could be in multiple groups, and the name of each of the classes can be misleading or could cause biases. [PT, 295]

91. Ocean alkalinity enhancement is believed to have durability of approximately 100,000 years. The mean seawater residence time of alkaline dissolved carbon (bicarbonate and carbonate ions (charged-balanced by cations other than H+) is about 100,000 yrs, based on the annual input of alkaline carbon from rivers (0.3 GtC/yr), the alkaline pool of dissolved alkaline carbon resident in the ocean (about 34,000 GtC), and assuming steady state (Middelburg et al. 2020) [PT, 295]

92. We suggest the term CDR must be limited to what Mother Nature does without help from engineering-based ACDR solutions. Instead, the use of term ACDR (Accelerated CDR) [CAT, 220]

93. Greater clarity is needed on the definition of natural and engineered solutions. At some level, all solutions are effectively engineered, and all solutions use natural mechanisms. A better definition of nature-based carbon removal might be those approaches that store carbon in living ecosystems, including ocean and soil carbon, food production, and so forth, thereby specifically including co-benefits of natural habitat and biodiversity restoration. [OLAB, 222]

94. Artificial carbon removal allows us to very expensively rebalance the Earth's carbon dioxide levels around a much lower proportion of natural habitat. We need to seriously question if this is the best solution to climate change that we can come up with. To be clear, many nature-based carbon removal technologies are on a substantial cost reduction curve and have a direct pathway to negative carbon removal costs, direct air capture is not and does not (there is no paradox here). [OLAB, 222]

95. In the nomenclature or definitions of 6.4 so far, removals tend to be ambient while reductions in emissions tend to cover near source removals. We suggest that 6.4 be used to support both in order to encourage the reduction of the presence of climate forcing agents overall and in order to avoid inefficient use of time drawing boundaries that may defeat that goal. [JMF, 270]

2.1.2. Using IPCC definitions vs going beyond IPCC definitions

96. IETA believes that the definition of removals should be clear and simple to avoid confusion and conflation with emission reduction or avoidance activities. It should clarify the relationship between anthropogenic actions and the atmosphere-Earth-ocean interactions in which removals form part of the Earth's natural carbon cycle and active climate system. The definition should also remain open for potential methods of removal still under development. Based on this understanding, IETA agrees with the following definition from the IPCC SR1.5, namely that carbon dioxide removals (CDR) refer to "anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological, geochemical or chemical CO2 sinks, but excludes natural CO2 uptake not directly caused by human activities." We suggest that the Article 6.4 mechanism focus on outcomes of removal activities, as credits generated

should be based on robust quantification of the net CO2 removed from the atmosphere rather than the specifics of the underlying process. Considering the limited experience with the removal of atmospheric GHGs other than CO2, IETA does not see a need to explicitly address those in the definition of removals for the purpose of the Article 6.4 mechanism. Broadening the definition of removals to other gases can risk conflating emission reductions and carbon removals (e.g., destruction of CH4 emissions from point sources). IETA considers it essential that the SB and market players continue to collaborate closely in developing a robust methodological framework for removals that ensures environmental integrity whilst minimising the administrative burden for project developers, host countries and other market participants alike. Large amounts of finance will be needed from the private sector for both land-based and engineered removal activities in the coming years. Clear rules and methodologies will need to be operationalised by market players, and undue burden on activity proponents must be avoided. Where rules present excessive administrative burden or lack of incentives, participants may be deterred from engaging in the Article 6.4 mechanism and instead utilise alternative crediting programs. By fostering a supportive and enabling environment, the Article 6.4 mechanism can play a key role in facilitating private sector investment towards carbon removal activities and low-carbon development. Guidance produced should, to the extent possible, be applicable to all types of removal activities without additional provisions or requirements which may favour/oppose specific activity types, creating further complexity for project developers and impeding investments. The science is clear – we need to rapidly scale up a diverse array of solutions to address climate change at the scale and urgency required. [IETA, 311]

97. The following definition of carbon removal by the IPCC should be used as the foundation for the A6.4 mechanism and its framework: “anthropogenic activities removing carbon dioxide (CO_2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products.” [OAIR, 210]

98. Regarding the role and potential elements of definitions for this guidance, including “Removals”, please refer to the IPCC CDR Fact Sheet.[IEAGHG, 267]

99. The following definition of carbon removal by the IPCC should be used as the foundation for the A6.4 mechanism and its framework: “anthropogenic activities removing carbon dioxide (CO_2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products.” [CBC, 211]

2.1.3. Definition of components (e.g., storage)

100. Carbon removal technologies are technologies at whose measuring point permanent storage applies, and the risk of re-release can be minimized up to a specific value. The installation or application of products is an essential point in determining the lifespan of the products. [TFI, 214]

101. Regarding A6.4-SB003-AA-A03’s definitions of “Removal activities,” we note that Option 2a is the most accurate description of carbon dioxide removals as a climate solution that provides truly durable, (i.e., 1,000 years or more), measurable and verifiable net removals. DACCS provides this type of permanent removal. We further note that the Supervisory Body’s July 8, 2022, A6.4-SB001-AA-A05 Concept note: Removal activities under the Article 6.4 Mechanism (version 1.0) (the “Concept Note”) describes DACCS as “[capturing CO_2 from ambient air through chemical processes with the subsequent storage of the CO_2 in geological formations.” (Section 3.1.7, paragraph 26). This description of the capture

process is too broad, and the description of the storage medium is too. limited. [DACC, 274]

102. Permanent carbon dioxide storage is inherent to DACCS. This makes DACCS the global standard-setter for permanent carbon dioxide removal and sets it apart from other forms of carbon dioxide removal (CDR). However, the Concept Note limits the medium of direct air carbon dioxide storage to “geological formations,” and this does not reflect the breadth of DACCS applications that include formation of permanent materials, e.g., minerals and products. As such, the description of storage should be revised to “storage of the CO_2 in geological formations or long-lived, durable minerals and materials, where the carbon can be conservatively assumed to remain stored within the material over the entire lifetime, including its end of life.”

103. The Concept Note too broadly describes the capture method of direct air carbon dioxide capture as a “chemical process,” which does not distinguish DACCS from other methods of removal. For example, virtually all forms of non-aquatic nature-based carbon dioxide removal require the chemical process of photosynthesis to remove carbon dioxide from ambient air. In addition, as described in the Concept Note, rock weathering is a form of removal based on a chemical process. In contrast, while direct air carbon dioxide capture can be achieved through a variety of chemical processes, it is more precisely described as “capturing CO_2 from ambient air through a technological or engineered method…” DACCS must be accurately defined, and distinguished from other removal activities, in order to achieve uniform implementation of national laws, rules and regulations, as well as voluntary contracts, regarding removal monitoring, reporting, crediting and accounting. [DACC, 274]

104. In Table 1 under Paragraph 33 of the information Note on removal Activities, version 4, we agree with the “Con” argument that “inert carbon products can store formerly atmospheric carbon for long periods of time and, in this case, should be underscored for biochar since biochar containing products can act as carbon sinks for long periods and biochar in a chemically inert material that can remain in the environment for time periods that can be considered permanent. [EBIC, 280]

105. In 34 (d) – the definition of Biochar as: “Stable, carbon-rich material produced by heating biomass in an oxygen-rich environment. Biochar may be added to soils to improve soil functions and to reduce greenhouse gas emissions from biomass and soils, and for carbon sequestration.” - is limited to agricultural uses. Biochar is carbon and carbon is used in various different applications. Many of those will yield to carbon removals of different durability, numerous to long-term and even permanent carbon removals.

106. Commenting on 37 (c) - *Storage in durable products:* - Biochar as a product, e.g. for agricultural use, can be durable for longer periods of time. The scientific disciplines of organic geochemistry and petrology are examining their persistence in the upper earth’s crust and a benchmark for “permanence” will be proposed. Industrially produced biochar, in most cases, are the most stable form of organic carbon and not prone to weathering. In products that are not subject to thermal oxidation (e.g., concrete), biochar will last for millennia. Thus, it is better suited as part of 37 (c) ii - Inert carbon products. [EBIC, 280]

107. The definition for removals in para 11 of the Information note A6.4-SB005-AA-A09, is too limited and seriously flawed. The term “*separating greenhouse gases”* implies that gases are physically separated. While this is true of CDR methods such as DAC where CO_2 gas is concentrated from the atmosphere, this does not describe CDR processes that react

CO_2 from the atmosphere by chemical, geochemical or biochemical means such as enhanced rock weathering (ERW), ocean alkalinity enhancement (OAE) or photosynthesis. The definition therefore seems method-prescriptive rather than inclusive. [GHR, 299]

108. We suggest that both in the interest of accurately describing GHG/CO_2 removal, and not unwisely excluding any some beneficial CDR activities, that the definition be modified accordingly. For example: "As an uncountable noun, removal refers to the process removing greenhouse gases (GHGs) from the atmosphere or from natural GHG emissions to the atmosphere (such as from soils, the ocean or geologic reservoirs), and durably sequestering from the atmosphere the removed GHGs for a climate-relevant period of time. [GHR, 299]

109. Paragraph 15a to 15c cite three attempts by the AR6, WGIII to define CDR. For the same reasons discussed above, these definitions, needlessly restrict CDR activities just to removal from the atmosphere. My suggested rewording is: "*Carbon dioxide removal (CDR) refers to human activities that 1) remove carbon dioxide (CO_2) from the atmosphere or 2) remove CO_2 from natural emissions to the atmosphere (such as from soils, certain regions of the ocean and geologic reservoirs) and 3) durably sequester from the atmosphere the removed CO_2 or products thereof for a climate relevant period of time. CDR includes enhancement of natural biological, geochemical or physical CO_2 sinks, the creation of artificial removal and sequestration methods, or some combination of the preceding. CDR excludes 1) natural CO_2 uptake not directly caused by human activities, and 2) removal of CO_2 directly from an anthropogenic CO_2 source emitting to the atmosphere.*" [GHR, 299]

110. Under the Article 6.4 mechanism, 'durable storage' and 'permanence' will need to be defined. [CG, 269]

2.1.4. Reductions vs removals

111. A clear distinction between emission removals on the one hand and emission reductions on the other hand is key. Definition of removals vs. reductions vs. delayed emissions should be based on the long-term outcomes of related activities, not on applied methods. Storage permanence should span a timeframe covering at least that targeted by the Paris Agreement´s long term temperature goals. [CCSI, 233]

112. Microsoft strongly recommends differentiating between removals and avoided emissions. In projects with both avoidance and removals occurring simultaneously, they should be tracked and labelled independently and not co-mingled for reporting purposes. [MS, 234]

2.1.5. Concerns about broad definition

113. Combination of solutions through measures such as horizontal stacking or replacement over time can offer flexibility and impact. For example, NORI's concept: blended tonne combines ex-post soil carbon removal with 10-year permanence with ex-ante long-storage duration removal to address both immediate and long-term climate challenges. Such flexibility would foster innovation and accelerate scaling of CDR. [NORI, 212]

114. The CDR industry is a nascent and lacks financial incentives which in turn is preventing investment in new technologies. Governments are reluctant to provide permits for R&D in

new CDR technologies. Agreeing on the right definition will help the industry in moving forward. [REW, 219]

115. A broad definition of removals has advantages, encouraging the development of as many removal pathways as possible and maximising the potential for innovation. However, different removal activities raise different risks, and each requires a different policy framework. For example, NbS removals that reduce the supply of economically productive land (such as afforestation of croplands) can have important leakage effects; given the current lack of robust methods for measuring leakage (Filewod and M cCarney, 2023) the climate impact of such removals is uncertain. Other NbS removals (such as restoration of degraded-but-unused lands or the development of green infrastructure) do not face this problem, and their impact can currently be quantified with higher certainty. Accommodating such differences is important to encourage high-quality projects (and build confidence and scale) within Article 6.4 activities. [GRI, 275]

2.1.6. Proposals to include specific technologies

116. Blueskieminerals is developing a process in which CO_2 in the atmosphere is reacted with mine tailings and additives the resulting carbonated tailings are stored for centuries. It can be deployed at megaton scale and expected to be commercially deployable by 2029 with cost range of $100-150/Ton CO_2. The mechanism should define the broad outline of valid solutions in terms of verifiability, permanence, additionality, rather than attempting to identify eligible activity types so as not to exclude emerging solutions such as this one. [BSM, 201]

117. Innovative carbon removal technologies such as River Alkalinity Enhancement must be incorporated into the framework. enhancing alkalinity in rivers promotes natural chemical reactions that sequester CO_2. [CR, 203]

118. Biochar that is produced at temperature above 600°C is exceptionally stable and can be considered a durable and permanent CDR that can sequester carbon for thousands of years. It also offers various co-benefits including sustainable agricultural practices, improved soil health, and enhanced resilience to climate change. [NC, 206]

119. Biochar Carbon Removal is an engineered removal method that stores carbon in a stable form for as long as 1,000 years, thus can be considered a permanent carbon removal method. Where ample agricultural and forestry residues exist, it can be deployed in large scale. The co-benefits include improved soil fertility and water retention, reduction of agricultural waste and use of synthetic fertilizers and thermal energy produced during the processing. [ECOERA,209]

120. Biochar based carbon dioxide removal (BCR) is a permanent carbon sink when processed at temperature above 650C. Co-benefit include energy generated during processing and byproducts that can be applied to soil, among others. The technology is ready to be deployed at scale. [Thn, 213]

121. “Electrolysis-assisted calcification” (electrochemistry) and “electrolysis-assisted shellfish calcification” (a combination of electrobiology and electrochemistry) are example of “Ocean-based biological removal” for “Ocean ecosystem reservoirs”. Both methods assist tropical coastal communities’ ocean resources to adapt to increasing greenhouse gas concentrations and increasing ocean acidity. At the same time, they are likely to produce some carbon dioxide removal (CDR) and/or seafood with zero to negative carbon footprint

while doubling the shellfish growth rate, thus providing food to counter the decreasing terrestrial production. [OF, 216]

122. Takachar has developed a technology that removes CO_2 from atmosphere by growth of crops and stores carbon by converting its byproducts (agricultural waste) into carbon-based bioproducts such as biochar-based fertilizers, chemicals and biofuels. As the process renders a substantial portion of the plant-based carbon into recalcitrant form, it remains stored for hundreds of years. Such technology can be deployed in remote areas by smallholder farmers to improve their livelihood. [TAK, 217]

123. Biochar Carbon Removal is a permanent engineered removal solution that provide multiple benefits of nature-based solutions, as well as other co-benefits such as improved crop yield. It is safe and has a high TRL score (8-9) and is ready to scale at present. The risk of reversal is low, and it provides durable storage for thousands of years. [CCE, 218].

124. The Carbon/Hemp Blockchain, Inc. has developed and deployed innovative, agriculture-based carbon dioxide removal (CDR) and storage technologies on a global scale which that converts locally produced industrial hemp as a rotational crop biochar through controlled thermal decomposition, through which carbon is captured and stored in a stable form. When applied to soil, biochar not only sequesters carbon but also enhances soil microbial activity, reducing emissions of nitrous oxide (N2O) and methane (CH4). Biochar makes significant contribution to global emissions reduction and is scalable, while also generating multiple co-benefits for adopting communities. [IBI, 231]

125. Ocean-based carbon removal solutions utilizing the deep ocean or the ocean's bicarbonate reservoir that are not subject to risk of reversal are particularly interesting as they offer the near-term scalability of many traditional nature-based solutions with the durability and reversal benefits of many emerging technological solutions. These ocean-based approaches are designed to replicate and amplify the natural pathways by which the Earth durably stores carbon; if the objective of Article 6.4 of the Paris Agreement is to contribute to emissions mitigation and support sustainable development, solutions across a range of pathways must be supported and innovation must be encouraged [RT,288]

126. Biochar is a carbon-rich material produced by heating biomass in a low-oxygen environment, through pyrolysis that stabilises the carbon absorbed by biomass throughout its lifetime, preventing it from returning to the atmosphere. Due to the maturity of pyrolysis technology, biochar is a frontrunner in carbon dioxide removal (CDR) technology and can scale to climate relevance. As the process generates heat, it can serve as a 'Net Zero boiler' on industrial sites. In addition, application of biochar to soil has multiple agronomic values. [BBB, 264]

127. We request that the Supervisory Body align with the consensus of the scientific community, as reflected in the IPCC AR6 report, and incorporate the equally important need to grow biochar-based CDR capacity in unison with global efforts to reduce greenhouse gas emissions. Increasing CO_2 reductions along with rapidly increased CDR to meet global Net Zero goals will be crucial for Article 6.4 deliberations. We request the Supervisory Body integrates biochar-based carbon removal in the implementation of Article 6.4.[SGI, 276]

128. The Note on removal activities does not envision that unlimited CO_2 sequestration can be accomplished by pumping wood chips underground in a liquid slurry. There is no functional limitation to how much carbon the ground can store when the storage is beneath the active

and aerobic layers of the soil. Subterranean wood injection (SWI) is a hybrid technology storing biomass directly beneath intact geological formations at depths of 5-100 meters beneath the soil surface and will last millions of years based on geological and microbiological data. This "land-based system" IS an "engineering solution" that overcomes perceived.

129. Please include Subterranean Wood Injection in your Engineering-based removal activities and we suggest you leave a category for both injection-based and excavation-based wood burial in your Land-based removal activities as well. [LVI, 296]

130. Emphasises the potential of a third mechanism for carbon removal, or carbon management, occupying an intermediate space between offsets and removals. Offsets and emissions reductions are afflicted by a perceived abuse potential, in terms of double counting and false emissions mitigation claims. Removals are seen as safe mechanisms for application under Article 6.4, but require permanence of hundreds of years. The third Mechanism proposed requires rethinking of global supply chains as carbon pools – circular materials pools in which carbon can be suspended for relevant amounts of time or, alternatively, extracted and disposed of in permanent end-of-life sequestration. While this approach is gaining acceptance for mineralized materials such as concrete, it is not seriously considered, yet, for non-permanent applications, such as plastics, for a concern of reversals once even durable plastics applications expire after years to decades, at which point they may face incineration. [MOA, 300]

131. With sufficient monitoring with inventory management software, it can result in quasi-permanent carbon storage at a very large scale. Replacing 10% of global plastics with a material such as biochar or carbon black from renewable methane pyrolysis, or similar biogenic carbon materials, has the potential to draw-down and store up to 3.3 Gt of CO_2, annually. Chemical recycling processes will enable the permanent removal of these 3.3 Gt in a solid phase, after the carbon is split from the polymer fraction and safely sequestered underground. Alternatively, these materials can be stored as bio-oils or in a gas phase, if incineration is coupled with CCS. Horizontal stacking could incentivise recycling and permanent end-of-life removals. Creating a demand for atmospheric carbon in products has huge economic advantages. Through the benefit of a useful product life, carbon draw-down in many cases comes at no additional cost. If the material solutions are suitable for existing manufacturing processes, the demand for these solutions is already at the scale required, today. CDR capabilities will have to be scaled up quite rapidly from a few thousand tons p.a. to the required Gt scale. [MOA, 300]

132. On Pg. 11 of the Information Note A6.4-SB005-AA-A09, "Removal of CO_2 from oceans", paragraphs. 21 and 22, please include abiotic CO_2 removal from the ocean, for example, via the addition of CO_2-reactive alkalinity - OAE (Renforth and Henderson 2017) or via the physical/chemical extraction of CO_2 from seawater (de Lannoy et al. 2018). [GHR, 299].

133. Pg. 15 3.1. "Taxonomy of removal activities", para. 36 b) Please include ocean-chemistry-based CDR such as OAE. I can assure you that the massive retention of CO_2 by abiotic ocean chemistry (38,000 Gt C) is both proven and highly effective, and natural ERW and OAE currently removes about 1 Gt CO_2/yr from the atmosphere (IPCC 2021). By stating that such methods will not be available until 2030 and beyond, the SB is making an unfounded judgement that seemingly will make sure that is the outcome. Rather, the SB needs to provide a non-pre-judgmental, techneutral framework with which to encourage innovation and evaluation of CDR approaches as quickly as possible so as to determine

which if any methods can provide the timely, safe, cost-effective, high-capacity CDR required. [GHR, 299].

134. On Pg.16, para. 37 “The following are broad categories of storage methods:” Storage of dissolve inorganic carbon in the ocean, by far the largest carbon reservoir on the Earth’s surface, needs to be included here! Both ERW and OAE are well-describe methods of CDR (Campbell et al.2022, Renforth and Henderson 2017) that can lead to transfer of CO_2 from the atmosphere (or reduction of CO_2 transfer from soils or ocean to air) and storage in ocean seawater as dissolve alkaline bicarbonate and carbonate ions. Do not ignore this CDR and C sink – Mother Nature doesn’t. [GHR, 299].

135. Pg. 17, Table 2 Please add ocean-chemistry-based storage, by far the largest C reservoir on the Earth’s surface – 38,000 Gt C and on Pg. 19. Table 4. Ocean CDR is completely absent in this evaluation. Please see NASEM (2022)[20] and rectify accordingly and include it in the rest of the analysis in the document. [GHR, 299].

2.2. Monitoring and Reporting

2.2.1. B. Monitoring and Reporting 1 a.

136. *What timeframes and related procedures should be specified for these elements referred to in A6.4-SB003-A03?*

2.2.1.1. General

137. Advocating for a more flexible approach to permanence in carbon removal, we urge against setting an arbitrary time limit, such as 1,000 years, and instead emphasize the importance of considering timescales of at least several centuries [CFUT, 245]

138. To safeguard that reversals are addressed “in full”, the monitoring period for CDR activities should expand a very long timeframe. For activities involving geological sequestration, certain jurisdictions have set up frameworks, where the monitoring period can be understood as almost indefinite. Such decisions allow for an effective handling of reversal events, whilst lessening the burden for project developers as in some cases, the liability to monitor and cover reversals can be transferred to national entities, upon proof of permanence based on a performance assessment [CWORKS, 302].

139. Carbon dioxide removed from the atmosphere will need to be monitored in perpetuity, as emissions to the atmosphere from reversals are harmful at any time. The monitoring period may nevertheless in practice end when there are adequate assurances that the CO2 has been physically and permanently isolated from the atmosphere, but liability should remain to address any unforeseen risk of reversal. If the permanence of a removal activity is dependent on human intervention or management (e.g., the perpetual maintenance of a particular practice), the monitoring period should run at least as long as these activities—and the removals they provide—are required. If monitoring stops, the removed CO2 should be assumed to be re-emitted to the atmosphere and treated in the same way as a reversal. [BF, 252]

[20] https://nap.nationalacademies.org/catalog/26278/a-research-strategy-for-ocean-based-carbon-dioxide-removal-and-sequestration.

140. Removals are only removals when storage is durable; otherwise, activities merely delay emissions, but do not remove them. The monitoring period therefore must ensure long-term storage (as close as possible to permanent). Different views on what constitutes permanent storage and how monitoring periods should be defined, and setup accordingly are currently under discussion (see for example here, here, here and here). Verra's standard and its requirements for geological carbon storage (GCS) acknowledge that assessing across such timescales is not feasible. Thus, they do not specify a fixed monitoring period for applications, which include underground storage or utilization in products. Instead, monitoring should continue until certain conditions are met. These conditions might include containment at the storage site(s), the absence of a significant risk that the injected CO2 will have a significant adverse impact on the environment or human health, and the behavior of the CO2. These periods ensure that carbon is removed for the timeframe targeted by the Paris Agreement´s long term temperature goals; [CCSI, 233]

141. Timeframes should be tailored to the category and type of removal activity. Some countries may lack a consistent time series of emissions in relevant sectors, making it difficult to assess the impact of activities on NDC achievement. Some countries do not have land sector inventories [CA, 312].

142. If an offset is sold, resulting in emissions somewhere which are supposed to be 'offset' by a removal, then the logical answer, driven by a precautionary approach, is that the monitoring should last as long as the emissions enabled by the offset are in the atmosphere. That statement is likely to create a strong pushback among removal proponents as not being rational or reasonable. But reversals at any point in the future would 'undo' any supposed climate benefit. There is no point in the foreseeable future where the carbon budget will not be a concern, where reversals would have no wider impact. Therefore, it is perfectly reasonable to insist on monitoring for as long as the emissions the removal offset could be expected to be in the atmosphere (700-1000 years for CO2). The previous information note, in fact states that for removals to have any impact, they need to at least last the next 200-300 years (for which the activity should be monitored and ensured it maintains the carbon stock). Even that more defined period would be profoundly challenging, when considering the fluidity within our institutions (and the shorter-term nature of many companies). It would be reasonable following this concern to not allow removals into Art 6.4 at all. This principle should further inform decision making on the types of removals. Removals where reversal is likely, where monitoring is impossible, or where the unknowns around the technology create too many uncertainties, should not be allowed [CLARA, 316].

143. The monitoring, reporting and crediting timeframes for removal activities should build on previously agreed provisions in the Article 6.4 Rules, Modalities and Procedures(RMP), past experiences from the CDM, and knowledge gained from other independent crediting standards. Different monitoring periods, timeframes for addressing reversals, and reporting requirements may be applicable for different types of removal activities. As credits(A6.4ERs) from removal activities may be used to offset long-lived CO2 emissions, which may linger in the atmosphere for centuries, the monitoring period and timeframe for addressing reversals must be long enough to safeguard environmental integrity, yet realistic in order to not deter widespread uptake of removal activities under the Article 6.4mechanism [IETA, 311].

144. It may be prudent to estimate a probability distribution of the amount of carbon held in a sink, then assume a percentile of the distribution rather than the mean or median value.

In each case, application of MRV and subsequent choice of parameters will need to recognise:

(a) intrinsic variability: the difference in net removals in apparently similar cases. Variations might arise between sinks of similar type and circumstances, or in the same sink from year to year due to, for example, weather conditions, microclimatic conditions, or management practices. In some cases, this may lead to estimates that are systematically biased. In other cases, estimates may not be biased but there may still be substantial variance around the mean;

(b) measurement limitations, the limits in precision and accuracy with which actual net flows can be measured, even if the sink characteristics (e.g., soil chemistry, tree species, prevailing weather) are well understood;

(c) modelling limitations, the limits in precision and accuracy that can be achieved by projecting from existing and/or generalized data. [BF, 252]

2.2.1.2. Consistency with national requirements

145. Many elements related to monitoring, reporting and verification (MRV) for the geological storage of CO2 have been laid out in national and regional regulations. It is important that the monitoring and reporting timeframes in the proposed guidance are developed in a manner that is consistent with MRV requirements for geological storage set out in those regulations which can be considered good/best practice. This is aimed at ensuring that a mismatch between the timeframes required by national competent authorities and the ones set by international frameworks. A mismatch could be particularly challenging as, in most circumstances, the final 'mixture' of CO2 in storage reservoirs will comprise many sources of CO2, potentially under different crediting frameworks. Moreover, alignment with those frameworks that already in place will allow for faster implementation and a lesser burden on developers. The storage of CO2 in geological reservoirs is regulated by the CO2 Storage Directive (CCS Directive6) in European Union Member States, Iceland, Norway and Liechtenstein (European Economic Area, EEA), and by the 2010 CO2 Storage Regulations in the UK7 , which establish a legal framework for the safe geological storage of CO2. Both storage legal frameworks include provisions for site selection and characterisation which are designed to minimise the risk of leakage, conditions for permitting, as well as monitoring and reporting requirements to verify storage, including remediation obligations in case of reversals. Both frameworks require operators to carry out monitoring based on an approved monitoring plan which is updated every 5 years "to take account of changes to the assessed risk of leakage, changes to the assessed risks to the environment and human health, new scientific knowledge, and improvements in best available technology". Operators are also required to report to competent authorities at least once a year. The frameworks also specify a minimum period of 20 years before all legal obligations relating to monitoring and corrective measures can be transferred to competent authorities. Notably, a degree of flexibility is maintained in those frameworks – i.e., a shorter transfer period can be agreed if evidence suggest that the stored CO2 will be completely and permanently contained before the end of that period. This relatively short period (compared to the timeframe of millennia that geological storage can achieve) is made possible by a decreasing risk of reversal observed for geological storage, with sufficient scientific evidence for competent authorities to feel comfortable to take on the responsibilities. The development of MRV timeframes and procedures for the purposes of the Article 6.4 mechanism can benefit from building on the provisions laid out in the EU/EEA and UK CO2 storage legal frameworks. [ZEP, 263]

146. For activities involving geological sequestration, the Article 6.4 mechanism should seek alignment with national requirements for the permitting of injections. Relevant legislations are e.g., in place in the US (EPA UIC class VI wells) or Europe (CCS Directive) [CWORKS, 302].

2.2.1.3. For initial monitoring and submission of monitoring reports (paragraph 3.2.14);

147. The first monitoring report should be within 5 years. For activities such as biochar and in some cases of CCUS (CCUS such as production of concrete using CO2 could have sectoral scope of manufacturing industry and/or construction)- it could be within 2-3 years of project registration Subsequent monitoring - monitoring report ideally should be submitted at least once every 5 years [SP, 313]

148. “Initial monitoring” should commence at the beginning of the crediting period, with initial monitoring reports issued at a temporarily increased rate of frequency relative to “subsequent monitoring”. [DG, 271].

149. Should be designed in line with the logic of the European CCS directive for activities involving geological storage [CWORKS, 302].

150. The timeframes and procedures specified for monitoring and reporting elements should align with the Paris Agreement's reporting requirements. These timeframes should provide sufficient intervals for accurate data collection and reporting [PACHA, 306].

151. First monitoring report within 5 years for land-based activities and other project activities (DACCS and BECCS) and within 2-3 years of project registration for activities such as biochar (biochar project could have similar sectoral scope of AMS-III.BG or AMS-III.L - as it uses similar technologies as those methodologies) and in some cases of CCUS (CCUS such as production of concrete using CO2 could have sectoral scope of manufacturing industry and/or construction) [SP, 313].

152. All types of monitoring and reporting should be at least annual as this is similar to any company reporting their activities as part of regulation. This is from the perspective of needing to strike a balance between the costs, accuracy and early detection of issues such that corrective measures can be taken sooner, at lower cost, with better outcomes. Recognizing it is easier to report on some carbon projects annually than others, for the more difficult to monitor projects (ex. NBS) a simplified annual report could be utilized. The simplified annual report could reflect more of a general check-up on the project rather than a deep dive into what’s gone on with a project over the last few years as current monitoring reports do. The simplified annual report would be used in the years where a full monitoring report is not available. [Kita, 262]

153. We suggest that initial monitoring and submission of monitoring reports must occur within a defined time frame after the start of the first crediting period. This is important for two reasons. First, the Glasgow decision on Article 6.4 specifies that there should be maximum time periods. And second, any authorized Article 6.4 emission reductions must be used toward NDCs within the same NDC implementation period. Initial monitoring and submission of monitoring reports should occur prior to 3rd party verification and at a specified time interval from the project start to align with NDC implementation periods. Monitoring and monitoring reports should cover all crediting periods for which credits are issued. [IO, 285]

2.2.2. B. Monitoring and Reporting 1 (a).

154. *What timeframes and related procedures should be specified for these elements referred to in A6.4-SB003-A03?*

2.2.2.1. For subsequent monitoring and submission of monitoring reports (paragraph 3.2.14);

155. The frequency of subsequent monitoring and submission of monitoring reports should be consistent with the time frame of initial periods. [OI, 285]

156. Subsequent monitoring should then be delivered twice a year within the crediting period. Should the host country have in place monitoring obligations which require information that overlaps with that required by the mechanism's monitoring reports, such information may be used in mechanism reporting. [DG, 271]

157. Separate monitoring periods are typically contiguous in practice for a given project [DG, 271].

158. After initial monitoring and monitoring reports, C-Capsule requires a minimum of five years between monitoring reports. Within this timeframe, monitoring should not cease, and preference should be given to removals that have the capability to provide real time monitoring. C-Capsule and accredited Local Issuers reserve the right for ad hoc site visits and recommends the SB reserves the same right for registered removal facilities. Again, technologies with the capacity for real time monitoring should be treated preferentially to enable closer monitoring after potential reversal events. Where this is not possible, a maximum of six months between reports for the following two years should be allowed. After the subsequent two years post-event, monitoring can return to normal timeframes. This should be reviewed on a case-by-case basis, however, as there is a variety of potential reversal events, and some may require more frequent monitoring. C-Capsule agrees with the SB's decision to tailor policy to methodological specifications, both for timeframe relevant queries and all other requests for guidance. [CCAP, 246]

159. Consistent with ex-post tonne-year accounting, the "monitoring period" should span the time horizon of all sequential crediting periods for any specific project and is the time period over which the project is monitored. The monitoring period should end with the end of the final crediting period, after which no further credits will be generated. [SHC, 205].

160. Should be designed in line with the logic of the European CCS directive for activities involving geological storage [CWORKS, 302].

161. Monitoring report ideally should be submitted at least once every 5 years [SP, 313].

2.2.3. B. Monitoring and Reporting 1 (b).

162. *What timeframes and related procedures should be specified for these elements referred to in A6.4-SB003-A03?*

2.2.3.1. For monitoring and submission of monitoring reports following an observed event that could potentially lead to a reversal (paragraph 3.2.14);

163. Events observed that could lead to a reversal must be submitted to the SB within eight weeks of the event having taken place. [DG, 271]

164. Without monitoring it is not known whether a reversal event occurred. For this reason, it is important that there is a regular monitoring requirement, the following principles for the course of action when a potential reversal event is observed is proposed:

(a) When the mitigation activity proponents become aware of a potential reversal event, they should be required to inform the Supervisory Body within a specified and brief timeframe (e.g., within one month after the event occurred).

(b) A monitoring report quantifying the reversal should then be submitted thereafter but could be allowed more time for preparation (e.g., within six months of the reversal event).

(c) Where a mitigation activity proponent does not submit a monitoring report or a notification of a potential reversal event, all emission reductions or removals from the mitigation activity shall be deemed as reversed and the necessary actions should be undertaken to compensate for that reversal. [IO, 285]

165. Following an observed event that could potentially lead to a reversal; Operational failures would be widely publicized and evaluated at length. Compensation for reversals can be deducted from other mCDR services, separate MRV+ accounts. A 'basket' of mCDR technologies can keep separate MRV+ accounts, and likely would need to do so to avoid double counting or under counting. [MHS,200]

166. Consistent with ex-post tonne-year accounting, reversals do not need to be addressed and therefore no timeframe for addressing them is needed……… the maximum timeframe between monitoring should be the shorter of the crediting period and 10-years. This will ensure that there are not large fluctuations in carbon stocks which may not be measured if the maximum period between monitoring is greater than 10 years. There should be no minimum timeframe for monitoring, which may in the future unlock continuous monitoring as technology advances. Assuming the option of ex-post tonne-year accounting, the crediting period should have a minimum of one year and a maximum of 10 years, in between which it is at the discretion of the project proponent [SHC, 205].

167. The timeframe for addressing reversals should commence at the initiation of a project and possibly include a proportional time period post project closure. This latter period could be categorised as a post-project monitoring period. This period should vary depending on the project type, according to the scientifically assessed risk of non-permanence; the greater the risk, the longer the post-project monitoring period. For removals with high levels of permanence, such as those with geological storage, the post-project monitoring period should be low or nil. Where projects are subject to closure or monitoring requirements by domestic regulations, this should be considered and the postproject monitoring period under the mechanism should be aligned to avoid duplication of requirements [DG, 271].]

168. Should be designed in line with the logic of the European CCS directive for activities involving geological storage [CWORKS, 302].

169. When such an event is observed, the project proponent should immediately notify the Supervisory Body, within 2 months of the beginning of the event (some reversal events, e.g., fires, can last for multiple weeks). In this communication, the project proponent should communicate a timeline for the communication of a monitoring report focused on the impacts of the reversal event. That monitoring report should be submitted to the Supervisory Body not later than 6 months following the end of the reversal event [CMW, 308].

170. Events leading to potential reversal (e.g., forest fire in case of forestry project or atmospheric leakage of CO2 from reservoir in case of DACCS project) should be notified with 90 - 120 days (subject to further consultation), evaluation of such event could be submitted within 6 months of the notification [SP, 313].

171. Regarding reversal events, Kita recommends splitting them into two reports. One an early incident report issued asap. The other a later investigation and corrective actions report which could be done within a month of the reversal occurring. Doing so provides two benefits: 1) early risk management actions - like financial planning; and 2) provides time for a detailed analysis and action plan. This approach is similar to current reversals reporting seen within Verra and other large carbon standards. Existing ISO standards for incident reporting (e.g., ISO/IEC 27035:201) also provide a good blueprint for adapting & adopting such an approach as they are well tested. [Kita, 262]

2.2.4. B. Monitoring and Reporting 1 (c).

172. *What timeframes and related procedures should be specified for these elements referred to in A6.4-SB003-A03?*

  (a) *For monitoring and reporting, including any simplified reporting, conducted after the end of the last crediting period of activities involving removals (paragraphs 3.1.10 and 3.2.13).*

173. The Supervisory Body should establish a specific frequency in which the occurrence of any reversals must be monitored (e.g., biennially). In exploring any simplified approaches, such as using remote sensing data, it is important that sufficient granularity is ensured and that effects such as degradation without significant changes in tree canopy are detected. In addition, we recommend that the Supervisory Body establishes an independent mechanism, using remote sensing data, to independently assess whether major reversals occurred with registered mitigation activities. [IO, 285]

174. What happens after the Monitoring period will be different for land-based and technology-based removal credits. Within the context of trade in project-based mitigation outcomes, land-based removals are non-permanent by default. The SB should apply different conceptual frameworks to land-based and geological storage. Ideally, credit periods depend on the pay-back period of a project (a credit period is here understood to mean for how long a project can issue credits based on the certification of the project). When the FID is taken, the whole project life cycle is assessed in the NPV calculation. A technical project typically has an NPV assessment of 25 years, and the credit period for technical projects should be extended to 25 years. [SE, 244]

175. Simplified reporting for DACCS and BECCS could be once every 5 years post crediting period to ensure no reversal has occurred. This could end when there is sufficient data to support that CO2 plume is stable and reservoir is stable. For land-based activities such as forestry, it may continue till 100 years to conclusively report about no reversals [SP, 313]

176. Monitoring and reporting after the last crediting period (“post-project monitoring”) must be done on an annual basis for a time period determined by the risk of non-permanence or substituted with appropriate domestic regulatory monitoring arrangements. For example, projects with geological storage subject to robust regulatory requirements for monitoring of said storage should have either a de minimis or no post project monitoring period at all within the context of the 6.4 mechanism. [DG, 271]

177. For post crediting period monitoring, timeframes for reporting should be informed by the expected durability of the removal pathway and the quantified risks of reversal or Event of Carbon Default (EOCD). [CCAP, 246]

178. Should be designed in line with the logic of the European CCS directive for activities involving geological storage [CWORKS, 302].

179. The time between the end of the last crediting period and the moment in which the project no longer needs to report for reversals. In short, the amount of time that the carbon must remain sequestered [SYRA, 305].

180. Simplified reporting once every 5 years post crediting period for DACCS and BECCS (to ensure no reversal has occurred, ending when there is sufficient data to support that CO2 plume is stable and reservoir is stable), and continue until 100 years for land-based activities such as forestry (to conclusively report about no reversals) [SP, 313].

2.2.5. B. Monitoring and Reporting: 2.

181. Discuss any further considerations to be given to the core elements for monitoring and reporting in A6.4-SB003-A03; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.

182. A6.4SB should harmonize the stringency and requirements for all CDR activities, as competition between A6.4ER is to be expected, once the mechanism is fully operational. Thus, requirements for specific activities should not present a competitive disadvantage. By safeguarding a robust and science based framework, a race to the bottom in terms of quality should be addressed. Considerations of clear differentiations between reductions and removals, noting the different (but complementary) roles the two mitigation approaches have to fulfil is recommended [CWORKS, 302].

183. The core elements for monitoring and reporting should consider the scope of relevance to all 6.4 mechanism activities, removals activities, and specific removal activity categories or types. Harmonization of monitoring and reporting requirements will facilitate comparability and consistency across different removal activities. To the extent possible, these elements should harmonize with major existing voluntary and compliance carbon market rules such as Verra, Climate Action Reserve, or California ARB. We would also like to emphasize that MRV mechanisms should evolve over time and include Digital MRV solutions where feasible. DMRV (Digital MRV) is a software solution or service capable of data collection, processing, analysis, or synthesis for any MRV application, including project development, validation, verification, and registration. DMRV platforms may use remote sensing techniques, machine learning or artificial intelligence algorithms, mobile device applications, smart sensors, and other digital technologies [PACHA, 306].

184. Further elements for consideration: (i) alignment with existent good/best practice regulatory frameworks that can be considered good/best practice, also taking into account that a degree of flexibility must be preserved (see response to question 1 above); (ii) setting out robust MRV requirements for geological storage and other storage methods must be equally robust and confer an equivalent level of confidence that carbon dioxide continues to be stored out of the atmosphere. [ZEP, 263].

185. Measurement, reporting, and verification (MRV) in open systems is challenging but not impossible. Because research in the area of MRV for ocean alkalinity enhancement is

nascent, Planetary has publicly published a protocol for MRV and has gathered comments from scientists and oceanographers from around the world. [PT, 295].

186. Over the past 20 years, it is observed that many integrity deficits in current quantification methodologies arise because essential principles for carbon crediting have not been followed. We therefore believe that it is important the Supervisory Body includes robust general principles for the quantification of emission reductions and removals in its guidance. We recommend that methodologies for all types of mitigation activities, including removals and emission reductions, shall adhere to the following core principles and requirements for quantifying and monitoring emission reductions and removals. General requirements:

(a) **Systematic consideration of uncertainty**: Proposed new methodologies shall be accompanied by a comprehensive and systematic assessment of the overall uncertainty associated with the quantification of emission reductions or removals. In assessing overall uncertainty, all causes of uncertainty shall be considered, including assumptions (e.g., baseline scenario), estimation equations or models, parameters (e.g., representativeness of default values), and measurement approaches (e.g., the accuracy of measurement methods). The overall uncertainty shall be assessed as the combined uncertainty from individual causes.

(b) **Conservativeness**: Methodologies shall ensure that it is very likely (i.e., a probability of at least 90%) that the quantified emission reductions or removals from an individual mitigation activity are not overestimated, taking into account the overall uncertainty in quantifying the emission reduction and removals (i.e., the degree of conservativeness in quantifying emission reductions or removals shall be based on the magnitude of uncertainty in the estimation of emission reductions and removals). Methodology proponents shall justify how overall conservativeness is ensured in the light of the systematic evaluation of uncertainty.

(c) **Attributability of the quantified emission reductions or removals to the mitigation activity**: Quantification methodologies shall ensure that the quantified emission reductions or removals unambiguously result from the implementation of the mitigation activity and not from changes in exogenous factors that are not related to the mitigation activity. [IO, 285]

2.3. C. Accounting for removals:

2.3.1. General

187. It is essential that the baseline has the same measuring point as the project activity and that it is the same carbon pool that ultimately leads to negative emissions through the project [TFI, 214].

188. IETA takes the view that the specific nature of carbon removals, and the entwined need for country Parties to carefully manage enhanced sinks and reservoirs within their territories in order to avoid carbon reversals, calls for far greater involvement and the establishment of responsibilities for host countries relative to emission reduction activities (e.g., establishing strong policy and/or regulatory safeguards that protect enhanced sinks and reservoirs of carbon over the long-term). IETA also notes that these safeguards are likely to be specific to different types of sinks and reservoirs, and that in some cases they can draw upon precedents from the CDM (e.g., forests, geological storage), while in other

cases there is no established precedent indicating a need for significant further deliberations including by SBSTA (e.g., ocean storage). The safeguards described above are also strongly correlated with the accounting that shall be applied to carbon removals. Maintaining the environmental integrity of the Paris Agreement, and the effective measurement of progress towards its central goal, calls for any carbon reversals from enhanced sinks and reservoirs to be effectively identified, measured and reported in the national GHG inventories of the host country Parties. As such, it is incumbent on Parties to ensure that supported removals under the Article 6.4 mechanism are an integral part of the wider accounting framework for the Paris Agreement. A robust accounting framework means that the transfers of Article 6.4 removal credits between Parties, any related corresponding adjustments, and the stock take of progress against NDCs, should all seamlessly fit together [IETA, 311].

189. Accounting will need to include the following elements:

(a) Lifecycle emissions and their scope. Accounting rules will need to address the scope of lifecycle emissions associated with each project activity to be accounted. For BECCS, for example, success in delivering net removals will depend upon full project activity lifecycle emissions, including emissions from growing, harvesting and transporting biomass, and emissions connected with the fuel and energy used for transportation, compression, injection and storage of CO2. For DACCS, lifecycle emissions will include emissions in the fabrication of facilities and in energy used to power the process itself, in addition to emissions associated with the transport of emissions, compression, injection and storage;

(b) Paris aligned baselines as per the RMP

(c) Accounting for BECCS under current IPCC Guidelines is complicated by the fact that reporting and accounting implicate more than one sector in Parties' GHG emission inventories (e.g., LULUCF and energy, LULUCF and industrial processes, agriculture and energy). Further, different biomass feedstocks have different carbon intensities when combusted, which would need to be estimated, reported and accounted for. Rules for accounting where multiple parties are involved. BECCS and DACCS can involve multiple Parties and actors along the value chain and accounting guidance will be needed to address these challenges. Rules to account for saturation. Where the uptake of CO2 from an activity reaches equilibrium and CO2 is no longer being taken up. Rules to factor out climate impacts and non-anthropogenic removals. All removals must be anthropogenic. Hence project activities cannot be credited for removals resulting directly or indirectly from greater concentrations of CO2 in the atmosphere. Rules to address uncertainties. There are significant measurement uncertainties in connection with biogenically stored carbon that would need to be made visible for transparency, managed, and addressed, if biogenic removals were to be permitted. These include uncertainties in baseline establishment, measurement and monitoring. BECCS accounting rules require particular attention and development. As explained in Mace, et al. (2020) and Pulles, et al. (2022), the IPCC 2006 Guidelines recognize negative emissions from BECCS based on the zero-emissions factor applied to biomass combustion. The CRF tables used by developed countries for inventory reporting treat CO2 emissions from biomass combustion as a memo item, with these emissions not counted toward energy sector emission totals. However, this zero emissions factor applied to biomass results from assumptions that have been heavily critiqued: that emissions from biomass will be reported in the LULUCF sector at harvest, that biomass is produced in a sustainable manner, and that where biomass is harvested at an unsustainable rate, net CO2 emissions will be reflected and reported for as a loss of biomass stocks in the LULUCF sector. These assumptions may not be valid, for example, if the combusted biomass (whose emissions are captured and stored) originates in a country that reports land sector emissions using default emission factors (i.e., tier 1) that produce a less accurate estimate than use of country-specific emission factors, such that emissions at harvest are not fully reported [CA, 312].

190. Standardisation and modularisation to maximise the ability to compare on an equal basis within and between types of removals technologies (and thus projects) is recommended. Some important characteristics to consider are scientific reproducibility, transparent operating, and public reporting in a standard machine-readable format. [Kita, 262]

191. Further element for consideration: Complete carbon accounting: the quantification of carbon removals must be robust, transparent, and complete. In this sense, a cautious and comprehensive verification of principle 3 (see above, in the definition for "removals") is critical to make sure that all associated emissions are included in the lifecycle analysis (including energy/electricity input and activity taking place after the end of the life of the products).This also implies that while some technologies have the potential to lead to carbon removals, a case-by-case approach is needed to ensure that projects deliver real 'net' carbon removals. Importantly, this requires ER certificates to be issued on a net removal basis. [ZEP, 263]

192. To understand the full climate impact of any changes, activity and leakage emissions tracking should include all indirect greenhouse gasses and climate pollutants (hydrogen and black carbon, for example), in addition to direct greenhouse gas emissions. Any increase in the emissions of a climate pollutant due to a removal process should be accounted for in all relevant per-gas inventories. Different climate pollutants act on different timescales. GWP100 as a climate metric does not capture these dynamics and can mask that a process causes near-term warming over the next crucial few decades while calling it "net-zero". This would, for example, be the case for a process that emits 10 MT CO_2e of methane and removes 10 MT CO_2e of carbon dioxide, due to methane's stronger influence in the decade after emission. In all reporting, the activity and leakage emissions should be reported per pollutant, in units of mass, and the time-horizon of any CO_2e calculations should always be explicitly listed. Some methods of greenhouse gas removal may have net-negative impacts on multiple greenhouse gasses. This should be accounted for in order to value multiple climate benefits of such approaches [SCL, 292].

193. There are already three independent bodies that have developed MRV methodologies for quantifying biochar based GGR – Verra, EBC and Puro. These provide robust guidance for calculating the permanence of the biochar stored carbon by considering its properties and end use, as well as guidance on defining the scope of a project's LCA. Overall, the MRV methodologies outlined by each of the standards are similar across carbon storage calculations, LCA guidance, and validating the final biochar sink. They primarily differ in quantifying the biochar carbon stability and permanence. This discrepancy highlights the need for more work to be done by multilateral bodies such as the UNFCCC to align influence regulation on biochar carbon. [BBB, 264]

194. Current approaches to quantifying biochar's permanence underestimate the carbon stability of high-quality biochar, as they consider the carbon content of biochar as labile or recalcitrant, simplifying the longevity of stable carbon pools. These approaches interpret

the same data that extrapolates the observable degradation rate of the biochar in a lab context to 100 years. It is noted in the existing methodologies themselves that these are extremely conservative approaches, Schmidt et al. has also acknowledged this in the non-indexed biochar journal. This is reflected in the low 100-year stability factors assigned by the EBC and Verra biochar carbon removal methodologies. [BBB, 264]

195. It is our opinion that solutions relying on storage reservoirs with a high or constant risk of reversal – traditional nature-based solutions such as reforestation or sustainable agriculture that are subject to disruption or fire risk, geologic storage in areas with high leakage potential, etc. – should have more stringent requirements around ongoing monitoring following the monitoring period compared to solutions utilizing storage reservoirs with low or no risk of reversal (the deep ocean, the ocean's bicarbonate pool, chemical solutions such as enhanced weathering, etc.). Since the underlying mitigation benefit is constantly at risk with high-reversal or lower-permanence reservoirs, continued visibility into the stability and permanence of a given removal activity will be needed. By creating "tiered" ongoing monitoring requirements based on the expected stability of the carbon storage, the Supervisory Body can ensure that projects focus on (and invest in) the area's most likely to impede long-term storage and climate benefit; as an example, ongoing monitoring requirements for a reforestation project may help to proactively reduce wildfire risk factors in the area where the project is conducted. On the flip side, lowering ongoing monitoring requirements for a low reversal risk approach such as Ocean Alkalinity Enhancement can allow the project to focus on (and invest in) reducing quantification uncertainties in the calculation of removals, rather than in potentially unnecessary long term reversal monitoring. [RT, 288]

2.3.2. C. Accounting for removals: 1.

196. *Discuss any further considerations to be given to the core elements for accounting for removals in A6.4-SB003-A03; where possible, identifying their applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.*

197. We welcome considerations of clear differentiations between reductions and removals, noting the different (but complementary) roles the two mitigation approaches have to Confidential 4 / 6 Climeworks AG fulfil. Therefore, separate accounting of reductions and removals is encouraged. This logic has been implemented in the draft guidance for the land sector and removals issued by the GHG-Protocol [CWORKS, 302].

198. Natural ecosystems are typically modelled on the timescale of 100 years as there is higher uncertainty the further into the future you project, which is not to say that carbon stored in natural systems will only be stored for 100 years. Relative risks and merits should be considered based on project type while also taking into account uncertainties. There are many unknown unknowns when it comes to TBS solutions and today's reporting is not as stringent as we see in the NBS space. Thus, there is a need to create a set of disclosures and transparency around the specific issues arising from TBS, including assumptions behind life cycle analysis that can contribute to over-crediting risk [SYRA, 305].

199. In A6.4-SB003-A03 it is stated that "removals to be credited shall be those in excess of the baseline while deducting any activity emissions and leakage emissions." The amount of removals in excess of the baseline is directly linked to the requirement of raising ambition over time. The operationalization of a Baseline Contraction Factor (e.g., the Paris Goal Coefficient introduced in the International Initiative for Development of Article 6

Methodology Tools (II-AMT)) is one option to ensure this requirement is met. For removals, the amount of removals already considered in the baseline would need to be defined, which could draw on the host Party´s national policies explicitly addressing and financing removals. [CCSI, 233]

200. All risks of non-permanence need to be minimised to the extent feasible. This can best be incentivised by obligations on holders of the certified removals. If the risk of non-permanence cannot be sufficiently reduced, these activities should not be included in this mechanism. The activities which can be certified as removals in this mechanism should meet robust and scientifically stringent criteria to ensure that all removals certified have equivalent climate impact. [BF, 252].

201. The core elements for accounting for removals should be comprehensive and applicable to all 6.4 mechanism activities. They should also consider the specific requirements for removal activities, all relevant sinks, sources and reservoirs, as well as all six Kyoto gasses and their respective categories or types. Utilizing accounting techniques, such as dynamic baselines to assess net GHG reduction ex post will improve the integrity of transacted credits [PACHA, 306].

202. Activities involving removals that result in emissions reductions should align with the requirements for the development and assessment of major voluntary and compliance market methodologies. Clear guidance should be provided to ensure consistency and coherence between removals and emissions reduction activities, such as separation for reporting in terms of quantification of any reversal risk and potential buffer deductions [PACHA, 306].

203. Alignment and harmonization with existing international approaches to emissions accounting, Measurement Reporting & Verification, sustainability criteria, and standards will be important [ICCAIA, 303].

204. There is a need to further refine procedures and methodologies related to identification and mitigation of risks linked to reversals and leakages across carbon removal activities. The use of cradle to grave life-cycle assessments to account for activity boundaries and associated removal activity related emissions should support these assessments, with technology-based removal solutions already demonstrating low levels of risk for reversal or re-release of CO2 and thus exhibiting high potential for quality of future credits generated by these technologies [ICCAIA, 303].

2.3.3. C. Accounting for removals: 2.

205. *For activities involving removals that also result in emissions reductions, what are the relevant considerations, elements, and interactions between this guidance and the requirements for the development and assessment of mechanism methodologies, including.*

206. “Hybrid” activities should be contributing towards reductions and removal accounts based on a verified differentiation of the outcomes based on their relative shares/contributions. Further guidance could be requested from the IPCC, based on its vast experience via the provision of guidance for the establishment of national inventories [CWORKS, 302].

207. “Removals/negative emissions” and “avoided emissions” should be accounted for separately. To avoid double counting, further clarity is required from A6.4SB on the definition of removal credits and how they are distinct from avoidance credits. This would

recognise the uses of captured CO2 both for storage and its use as a feedstock with corresponding distinct environmental attributes [ICCAIA, 303].

208. Removals and avoided emissions must be accounted for and reported separately. Many CDR solutions may legitimately claim both removals and avoided emissions; it is critical that these are not conflated. Again, a comprehensive, cradle-to-grave life cycle analysis will elucidate many of the hazards related to removals vs avoided emissions discussed in the note. Durability must not be considered a ‘deterministic’ value inherent to any solution pathway. In fact, ALL CDR solutions carry some risk of reversal, which varies over time, and the probability of reversal is dependent not only by the solution type but the quality of execution and specific circumstances surrounding specific projects. Durability claims must be established and verified on a project by project basis. [XPZ, 249].

209. For engineered removals such as CCS (DACCS, BECCS, CCUS), there could be projects that involve multiple sources of CO2 and removals, in this case, could be based on the source of CO2 (or percentage):

(a) - CCS in Waste of Energy plants, a fraction of waste would be biogenic in nature, in such scenarios guidance at methodology levels would be required to differentiate between reductions (CO2 capture from fossil sources) and removals at the equation level in the methodology (or some other monitoring parameters). Similar guidance would also be required if a project is geologically storing CO2 from multiple sources (e.g., CO2 from natural gas processing and CO2 from direct air capture). In case of BECCS (e.g., biomass to energy plants or bioethanol plants), only fraction of biomass that is demonstrated by to be sustainable biomass should be eligible as removals;

(b) - Integrated project activities (e.g., agriculture land management) that combines multiple practices: methodologies should ideally provide requirements (where possible) to quantify benefits from each measure, e.g., GHG benefit of reduced fertilizer use and GHG benefit in terms of SOC increase due to reduced tillage);

(c) - A6.4 registry should consider having an optional label for A6.4ERs that are classified as removals, as removals might be required to comply with net zero pledges. Alternatively, removals can be called as A6.4 CDR/A6.4 RR [SP, 313].

2.4. D. Crediting period

210. *Discuss any further considerations to be given to the core elements for accounting for removals in A6.4-SB003-A03; where possible, identifying their applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types*

211. Industrial CDR approaches like DACS require high upfront investments that need to be amortized over longer timeframes (10-30 years). Whilst the choice of a short crediting period can safeguard the principles of encouraged ambition, methodologies allowing for longer crediting periods should be considered for activities such as DACS. The upper boundary of 15 years should be considered for industrial CDR activities [CWORKS, 302].

212. Considering the timber construction …. The crediting should happen at once after construction ... Incremental crediting is not practical ... It must be considered that, over time, the owners can change. For each new project, the most current methodology must be used [TFI, 214]

213. The crediting period should enable long-term planning and investments and at the same time avoid risks to lock-in emission intensive practices with the promise of addressing such practices´ emissions with Article 6.4 based removal activities. The monitoring period should exceed the crediting period by far to avoid non-permanent activities participating in article 6.4 cooperation. [CCSI, 233]

214. For CDR activities that offer truly permanent removal, for example by mineralising CO2 or converting it into another inert state, this period should last forever, once permanent carbon removal has been demonstrated and verified. For CDR activities that offer temporary or reversible sequestration, the crediting period would need to be renewed periodically in line with monitoring data confirming the CO2 was still sequestered. [44.01, 248]

215. Crediting period should be 15 years renewable. The requirements for monitoring and reversals under the mechanism should be consistent with the regulatory regimes for CO2 storage in [the respective jurisdictions i.e., Parties at the forefront of delivering carbon capture and storage technologies, such as the US, UK and EU, jurisdictions] [DG, 271]

216. The crediting period is closely related to the discussion of fossil fuel emissions lock-in. Any contribution to LT-LEDS should be reflected in the respective crediting period. The lock-in discussion relates to the Article 6.4 requirement for activities to contribute to LT-LEDS. In the long term, fossil fuel-based production (which comes with residual emissions) is expected to be minimized. Removal activities will have to be evaluated with regard to their contribution to LT-LEDS. This means that only activity types which are described in the respective country´s LT-LEDS as indispensable to offset residual emissions should be eligible for Article 6.4. [CCSI, 233]

217. The crediting period will need to run in perpetuity. Credits should be issued when there is a physical removal from the atmosphere and not before. For example, reforestation projects should generate credits as the forest grows once there is a consequent and observable net removal. The credit accompanying the removal will then need to be monitored and, where necessary, replaced. This monitoring will need to continue in perpetuity (see previous question), even for a fully mature forest. [BF, 252]

218. The length of the crediting period might be adjusted to different project types. When using historical baselines; the time between historical baselines and the start of the crediting period needs to be defined (the shorter the better, to ensure the baseline is still relevant) [SYRA, 305].

219. The core elements for crediting periods should be designed to ensure the integrity and accuracy of credit issuance. These elements should be applicable to all 6.4 mechanism activities, removals activities, and specific removal activity categories or types [PACHA, 306].

220. Crediting periods should be sufficiently short to ensure a ratchet in ambition over time, e.g., through a review of baseline levels and ongoing financial need at each crediting period renewal [CMW, 308].

221. Crediting period is proposed as 15 years, renewal twice, i.e., total of 45 years [SP, 313]. The Crediting period should be based upon the removal activity (land based / engineered) and also specific project activity (e.g., biochar or DACCS)

(a) - NBS (forestry, agriculture, mangroves): crediting period is appropriate although reassessment of baseline should be ideally more frequent (due to changing landscape of policies, incentives, etc at national and regional level), e.g., similar requirements in the VCM (5-10 years);

(b) - Removals such as biochar and long-term product storage (CCUS e.g., CO2 storage in Concrete/cement): come under the existing sectoral scope (or equivalent);

(c) - Biochar: crediting period similar to other as proposed by A6.4 (e.g., 5 years, renewable twice);

(d) - CCUS: same crediting period of 5 years, but renewed 3 times (total 20 years);

(e) - Ocean fertilization/alkanisation: crediting period determined after resolving all the major concerns (health, safety, environment impact and MRV) through scientific evidence and further evaluation of project types. 3 x 5 years may not be appropriate at this stage;

(f) - Geological carbon sequestration Projects for removals (DACCS, BECCS): renewed 7 or 8 times (40-45 years total) to allow checking regulatory surplus and updating of methodological requirements more often;

(g) - Renewal of crediting period: proving on-going financial need, project must demonstrate how it still require carbon financing [SP, 313].

222. Setting a maximum grace period before a project must transition to the latest methodology is recommended. Once the grace period expires, projects that didn't transition to the latest methodology would see credits from that point forward no longer valid. [Kita, 262]

223. It is critical that innovation is encouraged so that both new methodologies representing novel solutions can be readily integrated into the Article 6.4 mechanism, and so that existing projects regularly update their approaches and quantification guidance as solutions are tested and iterated upon. We would suggest two additional considerations in regard to the proposed language:

(a) New versions of methodologies should be required to highlight and explain any changes from previous versions of applicable methodologies. This will provide visibility for all stakeholders into what changed, implications for monitoring and measurement, and how the project is adapting to respond to real-world learnings.

(b) Removals previously "issued" under applicable methodologies within the Article 6.4 mechanism should not be changed retroactively when an updated methodology is released. A desire for backwards-facing adjustments to account for new information or uncertainty factors (whether positive or negative) is understandable, but potentially sets a dangerous precedent that could undermine the confidence in past Article 6.4 activities and "issuances". Eligible removals issued under an applicable methodology as part of Article 6.4 should represent the best available science we have at that time and should be issued and transacted on that basis. [RT, 288]

2.5. E. Addressing Reversals

2.5.1. General

224. Following the GHG protocol most standards guarantee a permanence in the credit for 100 years…. We advocate a more flexible approach to the permanence of carbon removal and oppose arbitrary time limits, e.g., 1,000 years, emphasizing instead the importance of considering periods of “at least several centuries.” This is in line with the recommendations of the European Union… [NC,206]

225. All activities that rely on the storage of carbon should be subject to specific rules on monitoring for reversals, as well as provisions to minimise the risk of reversals and address these reversals when they occur. This includes activities that primarily aim to reduce emissions, including, for example, cookstove projects which generate mitigation benefits by lowering deforestation [CMW, 308].

226. The approaches depend on the project type due to the different time frames, economics and carbon removals of the projects. …timber construction is a one-time project completed after 1 to 5 years…. The project creates a one-time storage and should be handled with a non-permanence risk buffer or emission reduction offset…… Furthermore, the regions, locations, and legal conditions have to be considered in the permanence analysis. For quick implementation, activity-specific is the right approach, especially insurance models must first be developed based on empirical values. …. Another approach/measure can apply to projects that show emission reductions and carbon removals, e.g., timber construction. The emission reductions can be used as "insurance," which is not monetized/credited. …. [TFI, 214]

227. The risks depend on the technology. Under the timber construction can occur the following risks: • non-completion of the project …: • Demolition of the building within the first 100 years without reuse of the materials … • Environmental disasters …[TFI, 214]

228. No reversals from underground storage have ever been reported globally. A benefit of DACCS, therefore, is that it minimizes the need for buffer pools or other forms of non-permanent risk buffers, and this should be recognized by the Supervisory Body. DAC Coalition members are currently negotiating contracts that do not offer insurance or buffer accounts because of the inherent low-risk of reversibility in DACCS. [DACC, 274]

229. Advocating for a more flexible approach to permanence in carbon removal, we urge against setting an arbitrary time limit, such as 1,000 years, and instead emphasize the importance of considering timescales of at least several centuries. Scientific evidence must be synthesized into a commonly accepted understanding of the durability of the carbon sequestering material in storage environments that do not cause significant reflux of CO2 into the atmosphere. [CFUT, 245]

230. In the event of a reversal, various aspects of the activity cycle will require careful consideration and adjustment, irrespective of the specific carbon dioxide removal (CDR) technology used. [CCAP, 246]

231. Intentional reversals, such as the deliberate mishandling of carbon, and unintentional reversals, like a forest fire, each bring unique challenges to risk management and should be treated accordingly in terms of buffer pool contributions and mitigation strategies. [CCAP, 246]

232. Potential reversals or leakages can be calculated as factors applied to carbon removal or mitigation claims. For each use case, data can be generated during trials regarding leakage models, which can be applied as factors to any carbon removal claims. The methodologies can be developed to create safer and higher quality carbon mitigation in the world's material supply chains. We hope some of these, with sound tracking approaches, should also be considered under Article 6.4 [MOA, 300].

233. To minimize the risk of non-permanence of removals over multiple NDC implementation periods, it is essential to have a robust framework for addressing reversals. The guidance should emphasize the full and timely [PACHA, 306].

234. ...the misconception that nature-based removals are at higher risk of reversals than removals from other sectors. In fact, removals from all sectors carry a certain risk of reversals (…) and should therefore be treated equally under Article 6.4 guidance on removals. This misconception is fuelled by two factors: (i) Reversal events in nature, like deforestation or wildfires, are dramatic and visible, while forest regrowth or compensatory policy measures are difficult to readily perceive. Reversals in other sectors are not as visible. (ii) At the same time, there is a widespread misunderstanding of the difference between carbon stocks and carbon flows in all sectors. This is exacerbated by a misunderstanding about accounting for forest carbon, which builds in a certain amount of natural forest dieoff. Please find more information under Annex 1. Technical Note: Understanding Risk of Reversals in Nature Based Removals Regardless of the sector or activity type where removals come from, climate policy mechanisms have been designed to address potential risks (e.g., buffer pools, insurance among others) …. The same approach should be followed to deal with reversals from any sector given that they all carry an inherent risk of reversals [CI, 307].

235. The 6.4 mechanism methodologies should require activity proponents to consider, measure, and address all risk categories of non-permanence, including internal risk (i.e., project risk such as management or financial risk), external risk (e.g., political risk) and natural risks (fires, pests, droughts, etc.). Quantification of those risks should be based on the latest available science. We recommend that the secretariat prepares a report summarising the current best-available science on risk quantification for carbon storage, taking into account the variability in risks for various storage types and various regions/locations. This could serve as a basis for defining specific risk quantification approaches in 6.4 methodologies. We strongly advise against relying on existing risk quantification methodologies from the VCM, as many projects report very low risks of reversals by exploiting flexibilities in VCM methodologies. In fact, reporting of very low reversal risks is incompatible with additionality requirements in some cases, such as for conservation projects, as projects would be arguing at the same time that they are protecting a threatened area, and that the area they are protecting faces a low risk of releasing the carbon it is storing [CMW, 308].

236. When considering how to address reversals it is important to factor in both likely increasing risks to biogenic carbon storage from escalating climate change impacts and the long lifetime that CO2 has in the atmosphere. Land-based removals cannot guarantee long-term sequestration on the necessary timescales and should not be used to compensate fossil fuel emissions. Mitigation activities that have a high reversal risk should be excluded from eligibility under Article 6.4. Examples include afforestation / reforestation, and soil carbon sequestration.

237. The risks of both unintentional and intentional reversals need to be addressed. Reversal risks include seepage from transportation, compression, injection or storage sites (e.g., BECCS, DACCS). As stated above, non-permanence risks render land-based removals problematic for inclusion in Article 6.4, as a result of the potential for reversals related to natural disturbances (e.g., fires, pests, storms), climate impacts themselves, feedback loops and land use decisions. Uncertainties in measurement and monitoring only amplify these elements [CA, 312].

238. In terms of updating the quantification of emission reductions and removals, it is important that all parameters that were fixed for a crediting period are reevaluated based on the latest available information. Further, the latest approved version of the relevant methodology and any tools should be used. [IO, 285]

2.5.2. E. 1.Addressing Reversals:

239. *In order to minimize the risk of non-permanence of removals over multiple NDC implementation periods, and, where reversals occur, ensure that these are addressed in full.*

240. *Discuss the applicability and implementation aspects of these approaches, including as stand-alone measures or in combination, and any interactions with other elements of this guidance:*

2.5.2.1. E 1.a. Non-permanence risk buffer (pooled or activity-specific);

241. The use of buffers should not be a requirement for projects with geological storage because of the negligible risk of reversal. Buffer requirements would likely be disproportionate to the real risk of reversal. In addition, given the multibillion-dollar investment required in BECCS projects, any pooling of risks between projects could make them unfinanceable. [DG, 271]

242. Ideally, cases of reversals of CDR should be addressed whenever they occur. The monitoring period determines whether reversals are detected and can, thus, be addressed. The monitoring period therefore is key to enable addressing reversals. The Verra requirements, which CCS+ is aligning with, includes a system for managing such reversals. Buffer credits are deposited in the GCS pooled buffer account based on the non-permanence risk report assessed by the validation/verification body. In the event of a reversal, the project proponent follows the buffer account reconciliation requirements set out in the VCS Program document Registration and Issuance Process. This ensures that any storage issue is reflected in the country's inventory, transferring responsibility to the states. [CCSI, 233]

243. Buffer contributions should be reflecting the overall risk profile of activities. For activities involving geological sequestration, previous work under the CDM should be taken into account. From the Durban CCS decisions, we applaud that buffer credits are refundable per design, as it incentivizes safe operations and rewards project proponents accordingly. Given this refundability of buffer credits for CCS activities under the CDM, options for pooling with other activity types might be limited [CWORKS, 302].

244. Risk buffers fall short of providing adequate system-wide insurance of all the risks posed in their current design. Project-specific risk assessments vary considerably, e.g.,

standardisation and robust assessments of all natural, internal and external risks are required [BEZERO, 304].

245. Project-specific risk assessments typically support the identification and mitigation of key risks. However, recent data indicates that even such best-practice measures may have resulted in under-resourced buffer pools. For example, natural risks, such as fires, have led to the California Air Resources Board's buffer pool to indicate that 95% of the credits deposited to insure against fire risk have already been depleted [BEZERO, 304].

246. Disclosure and information risk. We find significant gaps in disclosure of these reports in the VCM: 74% (25 out 34) of NBS projects with a BeZero Carbon Rating present at least one non-permanence risk report (NPRR) although only 3 projects present NPRR for all the vintages (9%) [BEZERO, 304].

247. It is our recommendation that the UNFCCC supports a high level of transparency regarding how percentages applied for natural, internal and external risks are reached. BeZero Carbon proposes that any cap placed on the maximum level of risk allowable should be disclosed/highlighted in the UNFCCC's risk assessment documentation. Similarly, where the approach required a minimum risk buffer allocation in cases where projects assess low risk, this or the lack of a minimum allocation should be specified. We also recommend that any project documentation detailing how risk buffer allocations are calculated be made publicly available. This allows a greater level of disclosure that brings greater indication that project risks are mitigated appropriately [BEZERO, 304].

248. Buffer pool allocations should be based on scientific assessment and empirical evidence of reversals for different forms of sinks. Buffer pool allocations should not be introduced into the regulatory framework surrounding permanent negative emissions and geological storages. For geological storage, if there are obligations under law to address reversal emissions, then there should be no need for further measures. After the Monitoring period, only host nation obligations and reporting and accounting should apply. The notion of intentional reversals is immaterial for geological storage. Significant intentional reversal would result in loss of license to operate under credible jurisdictions and methodologies, which is a strong enough incentive not to make a distinction. [SE,244].

249. Buffer pools are typically only used for NBS projects, which have a more material risk of reversal than TBS. However, with the development of CDR projects with geological storage and their exposure to losses risks, there is room to further investigate a percentage risk buffer based on the ground formation or the project location with a timeline threshold (i.e., less than 200 years. etc.). It is important to note that, if the reversal is extreme, and exceeds the carbon project's contributions to the buffer pool or the project is terminated, the liability of the project should vary. In this instance, buffer pools need to be complemented with other measures (for example, purchasing carbon credits from other projects) [SYRA, 305].

250. Tying up removal certificates ex ante in a buffer pool is simply not a rational reflection of the risk of reversal and would only be an additional financial burden for the climate to carry. From a methodology approach, the focus should rather be on securing that credits for geological storage are only issued in jurisdictions with state-of-the-art legislation for licensing, monitoring and liabilities, such as the EU set-up with the ETS and CCS directives. [SE,244]

251. In order to ascertain the extent of contributions towards the buffer pool, it is imperative to understand the inherent non-permanence risk of the removal activities. For example, when examining biochar as a method of carbon removal, the risk of non-permanence lies in the potential degradation or "leakage" of carbon from the biochar over time. This can be modelled by an exponential decay, with a Mean Residence Time (MRT) indicating the effective half-life of the biochar. The difference between the initial carbon value and the value at the end of a 100-year period can be expressed as a Leakage Buffer value, effectively determining the potential contributions to the buffer pool. This value is influenced by the nature of the feedstock and the pyrolysis process conditions and can be determined through proximate analysis of representative samples. Each removal method would therefore require its own protocol for calculating non permanence risk and, subsequently, the appropriate buffer pool contributions. The buffer pool's composition should be reflective of the various types of removal activities and the corresponding non-permanence risks. [CCAP, 246]

252. Buffer pool approaches to removals are inadequate in cases where potential reversals include emissions of 100% of stored CO2-equivalent – in such cases, buffer pools must equal 100% of issued credits, unless the accounting methodology explicitly accounts for temporary storage, in which case no buffer pool is necessary because emissions are also credited. In contexts in which there are limited physical potential for reversals (e.g., some carbon sequestration in the built environment, most geological storage technologies), buffer pools should equal the expected value of future reversals (evaluated conservatively at some confidence interval of the distribution of possible future values, rather than the mean). [GRI/LSE, 275]

253. In our understanding, the risks of non-permanence, also known as reversal risks, stem from the possibility that carbon, once removed from the atmosphere, might be unintentionally or intentionally released back into it. These risks can be broadly divided into four categories:

(a) Natural, Unintentional: This includes risks arising from natural occurrences or disturbances such as forest fires, pest infestations, or extreme weather events that could potentially release stored carbon back into the atmosphere. These risks can be minimised by diversifying removal methods, promoting ecosystem resilience through adaptive management, and ensuring that removal projects are strategically located to minimise exposure to these disturbances;

(b) Natural, Intentional: This involves human actions that intentionally interfere with natural carbon removal methods, such as deforestation or land-use changes. To address these risks, it is crucial to uphold strong regulatory frameworks and to promote sustainable land-use practices;

(c) Unnatural, Unintentional: These risks might occur when a technological failure or accident in an engineered carbon removal process leads to unintentional carbon release. Mitigation strategies could include maintaining rigorous safety protocols, regular equipment checks, and backup systems in engineered removal facilities;

(d) 4) Unnatural, Intentional: This includes risks arising from deliberate human actions, like the misuse of removed carbon, for instance, using carbon captured for long-term storage as a fuel source. To minimise these risks, clear guidelines on acceptable uses of captured carbon should be established and enforced, and the adherence to these guidelines should be regularly audited. [CCAP, 246]

254. In 2011, Decision 6/CMP.7 was adopted which formulates Rules, Modalities and Procedures (RMP) for CO2 storage. These RMPs should closely inform the current work related to addressing reversals and avoidance of leakage. The RMPs propose a refundable project specific buffer pool approach. [CCSI, 233]

255. There is merit in the creation of a non-permanence risk buffer. Whether pooled or specific to an activity, this buffer would serve as a safeguard against the risk of carbon reemission. As with all safeguards, its applicability should be tailored to the specific characteristics and risks of each removal activity. We propose the adoption of an insurance model, such as the one outlined in the C-Capsule guidelines (Product Code), where registrants can contract with insurance bodies (commercial or sovereign) to provide independent risk management services against the risk of Event of Carbon Default (EOCD). This would act as a guarantee for replacement of removals where reversals occur. Such an insurance account should be regularly monitored by the Article 6.4 SB, ensuring effective risk management and adding an extra layer of security against non-permanence. [CCAP, 246].

256. The applicability and implementation aspects of measures such as non-permanence risk buffer, insurance/guarantees for replacement of ERs, and other measures for addressing reversals should be assessed on a case-by-case basis [PACHA, 306].

257. Appropriately sized buffer pools tend to effectively address the risk of reversals, by withholding an amount of credits from being traded and setting them aside to form a “buffer pool” which is later used when a reversal occurs. In many cases, the amount withheld is not based on any actuarial assessment of the risk of reversal and it can vary. However, to be most efficient, the percentages of credits allocated to the buffer should match the actuarial risk of reversal for all activities covered by the buffer. The allocation should then take into account how reversals are detected, quantified, and reported [CI, 307].

258. Buffer pools do not constitute a robust way of guaranteeing the permanent storage of carbon in a sink. At best, they can strengthen the credibility of guaranteeing storage for a medium duration of time, if properly constituted and managed. It is not credible to expect buffer pools to be operated for more than a few decades, as there are many factors (political, economic, etc.) that could lead to the discontinuation of the buffer pool management. “Monitoring and compensation” approaches that rely on buffer pools and claim to guarantee the durability of storage for 100 years or more are simply not credible from an institutional point of view. In addition, buffer pools can only be used to compensate for reversals if these reversals are observed. They are therefore inherently limited by the monitoring period tied to the projects that are covered by the buffer pool. If the Supervisory Body chooses to rely on buffer pools to address reversals, these should be clearly communicated as a medium-term risk-mitigation strategy, and not as a long-term durability guarantee [CMW, 308].

259. It is noted that buffer pools have been implemented to address risks of reversals for removal activities in several independent crediting standards as well as during the CDM (for projects involving carbon geostorage). In addressing the questions raised in the structured consultation, IETA recommends that different design considerations for the use of buffer pools be drawn the different approaches employed by existing independent crediting standards. It is also recommended that the SB consider these various approaches and the implications of using them in the Article 6.4 mechanism, including any participation requirements for host Parties, their interaction with NDCs, application of corresponding adjustments and national GHG inventories and potential variations in design according to different types of sinks and reservoirs. To appropriately address risks

of reversals, any buffer pools should be designed in a highly robust manner based on a scientifically aligned risk assessment. These risk assessments should be developed before the registration of the project by activity proponents, updated over time, and carefully reviewed by third-party designated operational entities (DOEs) to ensure contributions to the buffer pool are adequate. The level at which the buffer contribution should be determined requires further consideration. It may be possible to set the buffer contribution at:

(a) The mechanism level (probably to be avoided give the wide variation in durability between sinks and reservoir types);

(b) The level of specific type of sink and reservoir; or

(c) The level of specific activities.

(d) It is noted that the application of various risk assessment tools can have environmental integrity implications for the resultant units. Therefore, we urge careful consideration in potentially relying on these approaches, especially where they involve non-technical risk elements (e.g., financial or political risk). Arbitrage between lower reversal risk activities (e.g., high durability stores) and activities with higher probability of reversals should be avoided. Buffer pools should also consider, rather than duplicate existing domestic regulations that require collateral for addressing reversals. For technology-based carbon sink enhancements, IETA welcomes the proposal to adopt the 'regulatory safeguards'-style approach for geological CO2 storage, which draws upon approaches previously agreed under the CDM. In addition, IETA has developed a set of principles to govern the development of tradable reductions and removals through the High-Level Criteria for Carbon Geostorage Activities. These include six key core methodological components, as well as ten high-level criteria and supporting safeguards to identify and manage any potential risks associated with carbon geostorage (including reversals). IETA recommends that the SB further deliberates on the potential of similar "regulatory safeguards" approaches to be applied to other types of sinks and reservoirs. Furthermore, in deliberating on means to address non-permanence and carbon reversals, we refer to our above observation regarding the responsibility of host country Parties to monitor, report and account for any emissions from enhanced sinks and reservoirs within their national territory, including any arising from Article 6.4 mechanism activities. Thus, IETA feels that there is an urgent need for a more wide-ranging discussion of how the risks and rewards associated with removal activities be effectively balanced across project developers, host countries and buyers, cognisant of the need to maintain environmental integrity of the Paris Agreement and to avoid moral hazards [IETA, 311].

260. Currently, standards have buffer pools in place for both nature-based, hybrid, and geological carbon removal projects. Kita encourages a crossover between buffers and insurance products, to cover reversal risk in totality. There is significant potential for a hugely complementary and collaborative approach between Carbon Standards and insurers to:

(a) enhance the financial resilience of existing buffer schemes;

(b) enable high-quality new buffer schemes;

(c) increase market liquidity;

(d) build trust.

261. Insurance for carbon credits, independent of the buffer, can provide:

(a) A creditworthy financial wrapper;

(b) A smoothing strategy to help manage downside risk of unexpected failure (where actual losses are higher than those modelled);

(c) Confidence that investors (i.e. carbon buyers) will receive expected returns; and

(d) Certainty of contractual expectation for underlying asset owners (i.e. carbon sellers).

262. Kita recently published a report on carbon buffers and insurance which is relevant to question 1. [Kita, 262]

263. ZEP encourages the Supervisory Body to consider existent national and regional regulations when defining the approaches to minimise non-permanence risks. Notably, the CO2 storage legal frameworks mentioned above require operators to have an approved corrective measures plan which must be implemented in case of leakages. Furthermore, operators are required to surrender emission allowances equivalent to leaked emissions. In this context, risk buffers and insurance/guarantees could result in extra obligations on EEA and UK storage operators, as well as have potentially significant implications on revenue streams. It would thus be sensible to consider existent legal frameworks so as to avoid conflicts with existent legislation while keeping the essence of the requirements. Furthermore, liability frameworks for other types of carbon removal activities must be as robust as the ones in place for geological storage. [ZEP, 263]

264. The use of non-permanence risk buffers is a common approach to address non-permanence among existing voluntary and regulatory carbon crediting programs. This is a viable approach for governments to adopt to devolve responsibility for reversal compensation to market actors. However, it should be noted that buffer reserves are simply an insurance mechanism. As with any insurance mechanism, buffer reserves can only be effective if it is clear who bears the primary liability for addressing reversals when they occur (i.e., who is being insured, which should be either the primary seller or the buyer of credits); for how long they bear this liability; and what the level of risk is for reversals over the time period being insured. [OI, 285]

2.5.2.2. E.1.b. Insurance / guarantees for replacement of ERs where reversals occur (commercial, sovereign, other);

265. in-kind reversal liability insurance is feasible… losses are measurable, …premiums ae affordable…- … any reversals are immediately made good … by compensating reversals with a new removal from the insurance pool. …. allows a removal to be credited indefinitely, … eliminating the need to regulate permanence. ... annual contracts suffice to cover reversal risk ... It is impossible to provide insurance for very long periods… short duration contracts are necessary for new learnings and environmental changes to be incorporated into risk modelling and pricing for insurance products**…**only modest changes to existing insurance regulations. …[CPOOL, 215].

266. Insurance products, alongside carbon credit ratings, are likely to dominate the future risk allocation in carbon markets. Where such alternative reversal mitigation options are applied (such as the replacement of credits from another project), we recommend that the projects detail which projects and vintages credits are sourced from. Transparency across project specific buffer pool accounting methods would also provide greater opportunity for end users to ascertain that any reversals that may occur are accounted for with credits of similar characteristics and effectively mitigate the risks presented [BEZERO, 304].

267. If other insurance mechanisms are utilised, transparency regarding the sources of insurance and how such mechanisms would be applied in the case of a reversal are necessary [BEZERO, 304].

268. Insurance schemes may offer an alternative to buffer pools. This could include shared responsibility whereby selling platforms have initial liability, but this is underpinned by government-backed carbon insurance schemes that sellers must procure. There is precedent for this in the UK government's FloodRE reinsurance scheme, which ensures flood insurance is available in high-risk areas that may be classed as uninsurable. [LSE/GRI, 275]

269. A pool or insurance could be an appropriate instrument for the Monitoring period for non-permanent removals. [SE,244]

270. This approach would be similar to the letter of credit process (when a bank guarantees the risk of default of a company or of another bank). This will need new actors on the market to be involved: insurers and banks. While insurers are already active in carbon markets, banks would need to get up to speed. However, the size of the market and the potential gains are likely to attract the banking sector. This approach would require heavy, and as a result pricy, monitoring processes to justify and use the insurance or the guarantees for the replacement of ERs when reversals occur [SYRA, 305].

271. The applicability and implementation aspects of measures such as non-permanence risk buffer, insurance/guarantees for replacement of ERs, and other measures for addressing reversals should be assessed on a case-by-case basis [PACHA, 306].

272. Financial instruments like insurance can also be used to address risks of reversals. Insurance mechanisms are designed to incorporate information about the statistical risks to an asset, using actuarial techniques. Therefore, these types of approaches may be preferable in some circumstances. Insurance is one way to guarantee that the liability for any reversal will be addressed in full, and the insurance industry has established ways of assessing risks and developing insurance tools to account for them. To discourage risky practices, insurance companies frequently set management requirements for insured projects. In theory, removals from all sectors could purchase insurance to cover the risk of reversals, though very few insurers currently provide this service. In many cases, a requirement to provide proof of insurance for any credit transaction under from activities outside NDCs might be appropriate. Parties may even require proof of insurance as a precondition for authorization of transacting credits, as a way to minimize their own liabilities [CI, 307].

273. While we welcome the SB's progressiveness in considering the role of insurance to address risks of reversals, IETA urges careful consideration before relying on these emerging approaches. As noted above, the implementation of buffer pools is a type of risk pooling instrument variously employed today by independent crediting standards.

Insurance by third parties could potentially provide a similar risk pooling service, which may be seen as an alternative or complementary approach to that of implementing pooled risk buffers. To date, insurance providers have offered policies to underwrite credit non-delivery risk on registered project activities, but to the best of our knowledge have not systematically offered policies that underwrite the risk of carbon reversals from carbon sinks and reservoirs of registered project activities (e.g., against the loss of stored carbon from forests or geological stores). Such approaches were previously considered for forestation activities (so-called “iCERs”), which did not achieve widespread support among Parties (e.g., at COP6-bis). They may be complex instruments that could be tied to other forms of insurance products relating to carbon reservoirs (e.g., forest fire risk; geological well risks) that require specialist knowledge to define and elaborate on. However, as such approaches mature and the number of providers who can showcase well-functioning insurance products expand, the SB might reassess their potential to contribute to the development and growth of high-integrity projects under the Article 6.4 mechanism [IETA, 311].

274. Insurance mechanisms via private parties (insurance agencies or re-insurance agencies) may not be mature enough to completely replace buffer mechanism. However, they can be complimentary to the buffer mechanism. They also have risk of bankruptcy or insolvency for 100 years period (assuming permanence is considered for at least 100 years). Insurance may take up some of the risk associated with the project based on the appetite of the insurer and other variables associated with projects and project proponents, e.g., insurer might take up risk associated with fire or extreme weather events (similar products occur in case of crops to protect them from natural risks) [SP, 313].

275. Other forms of insurance or guarantees (commercial, sovereign, or otherwise) might also be effective in addressing non-permanence risk. However, for these instruments to be effective, they would need to meet the same essential criteria as buffer reserves, i.e., clear assignment of primary liability for reversals to market actors, clearly defined risk obligations over discretely defined time horizons, and the avoidance of any moral hazard. Sovereign guarantees, in particular, could be valuable as a backstop to cover reversal liabilities where it is not possible to enforce obligations on private market actors (e.g., if an actor ceases to exist or goes out of business), but should not be the primary means to address reversals because of the moral hazard this would create. [OI, 285]

2.5.2.3. E.1.c. Other measures for addressing reversals in full.

276. A nature-based removal must therefore always be considered reversed at the end of the Monitoring period. The Monitoring period for land-based approaches should thus correspond to the timeframe the project is committed to keep the land as a removal. In effect, non-permanent removals are postponed emissions. Again, it follows that for land-based credits, the timeframe for addressing reversals is during the Monitoring period (as they should be considered released after that period). For permanent removals (BECCS/DACCS) as well as generically for CCS, the permanence is confirmed by the scientific consensus and the fact that the CO_2 is sent permanently to the geosphere. During the Monitoring period, reversals should be monitored and addressed according to the applicable jurisdiction as well as counted as an emission by the storage company. At the end of the Monitoring period, there should be a transfer of responsibility to the host nation. If there is a reversal after the transfer of responsibility, the host nation should count the reversal as an emission and take measures according to the applicable jurisdiction. [SE, 244]

277. Transfer of responsibility to the host nation of land-based projects would also be to give up the idea of monitoring and blur the line between the system and project view, since the state cannot at reasonable cost monitor all the land-based project areas. This is not the case with permanent removals, where the state can continue to monitor the individual storage complexes. Finally, it would in practice constitute a way to introduce a version of Ton-Years, but financed by the tax payer rather than credit buyers. [SE, 244].

278. The applicability and implementation aspects of measures such as non-permanence risk buffer, insurance/guarantees for replacement of ERs, and other measures for addressing reversals should be assessed on a case-by-case basis [PACHA, 306].

279. We emphasize the need to proactively minimize risks of reversal as a means of addressing the potential for reversals. We believe that the burden of systems to address reversals should be proportionate to the quantity of carbon at risk, and there may be a de minimis level that requires no international measures [CI, 307].

280. REDD+ and other land-sector activities have a long record of empirical studies and analyses that identify and quantify the risks (or “drivers”) of deforestation, degradation, and other activities that could generate a reversal event. Methods for most activities are mature and widely accepted, and some are included in IPCC guidance for national inventory reporting. New, more accurate and efficient technologies for detecting and monitoring changes in land-based carbon stocks and fluxes are emerging all the time. These emerging approaches should be supported and made available to host countries, as they may make the delivery of mitigation activities more cost-effective [CI, 307].

281. We favour assessments that are specific to activities, and we would discourage a sectoral or broad categorical assessment of risk. A host country should always be aware of the amount of credits that have been transferred and the risk profile associated with that quantity of credits. Insurance, diversification, and other risk management measures should be applied by host countries. C… Qualified experts in the activity should be employed to assess risk, with protections in place to avoid conflicts of interest. Once quantified, these risks should be assessed through actuarial techniques, and the management of risks should be addressed through the range of available risk management approaches [CI, 307].

282. Another approach for addressing reversals in full would be to implement temporary crediting (as was adopted for A/R projects under the Clean Development Mechanism). The effectiveness of temporary crediting approaches depends on the enforceability of credit replacement obligations on the part of buyers. This could be challenging the case of private actors or other non-state credit buyers, although potentially achievable through cooperative agreements among Parties engaged in the transfer of Article 6.4 emission reductions or removals. Note that temporary crediting approaches could also, in principle, be combined with buffer reserves or other insurance mechanisms to cover residual risks where replacement obligations are not enforceable. [OI, 285]

283. CCSA encourages the Supervisory Body to consider existent national and regional regulations when defining the approaches to minimise non-permanence risks. Notably, the CO2 storage legal frameworks mentioned above require operators to have an approved corrective measures plan which must be implemented in case of leakages. Furthermore, operators are required to surrender emission allowances equivalent to leaked emissions. In this context, risk buffers and insurance/guarantees could result in extra obligations on EEA and UK storage operators, as well as have potentially significant

implications on revenue streams. It would thus be sensible to consider existent legal frameworks so as to avoid conflicts with existent legislation while keeping the essence of the requirements. [CCSA, 287]

284. We do not see any of these proposed solutions to the problem of impermanence. Non-permanence buffers: tension between economic feasibility and ensuring the buffer is large enough; increasingly difficult to predict the reversibility risk, in particular of land-based carbon sequestration with a fast-changing climate; buffer pools often undercapitalized. [AAI, 289]

2.5.3. E. 2. Discuss the appropriate timeframe(s)

285. *Discuss the appropriate timeframes for applying the approaches, including any interactions with other elements of this guidance and the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types*.

286. For Non permanence risk tools assessment - it should be done at the time of validation/registration of the project to understand the overall risk associated with that particular project in the next 100 years. It should be updated at every verification and based on the risks analysed at the time of that verification, the amount of credits should be contributed to the buffer [SP, 313].

287. Insurance mechanism may be added as an extra/complimentary either at the start of project or for that specific monitoring period [SP, 313].

288. Flat deductions happen at the time of issuances, but the percentage must be specified either at the standard level or at that specific methodology [SP, 313].

289. Insurance for carbon credits can be applied at any point of a sale or investment including after contracting has concluded. However, where insurance is applied it's always better to bring the insurer in earlier rather than later [Kita, 262]

290. Once again, ZEP would encourage the Supervisory Body to consider existent national and regional regulations when defining these approaches. For example, under the EEA and UK regulatory frameworks mentioned, operators remain liable for leakages and must apply the necessary corrective measure (as set out in the corrective measures plans and by surrendering emission allowances equivalent to any leaked emissions) for the minimum period of 20 years. After this period, responsibilities relating to monitoring and corrective measures are transferred to national competent authorities. [ZEP, 263]

291. Activity types (meaning a specific technology or strategy such as reforestation) should be evaluated for risk assessments before projects can be proposed. The activity risk assessment should be conducted by a third-party expert with stakeholder / right holder consultation and comments. The Supervisory Body will then need to act on the report and decide to approve the activity or not. Then, individual projects should also be submitted to a risk assessment (which should be expected to respond to risks identified in the activity level assessment). This should once again include stakeholder consultation. [AAI, 289]

2.5.4. E. 3. What risks of non-permanence need to be minimized

292. What risks of non-permanence need to be minimized, and how can these risks have identified, assessed, and minimized and how can these risks identified, assessed, and minimized?

293. Removals with a relatively greater risk of reversal such as those not involving geological storage of CO2 should be subject to appropriate requirements for collateral, such as through a buffer. These risks should be identified and assessed through a non-permanence risk assessment prior to project implementation. Periodic reassessment of the risk of reversal may be necessary for these removals activities to ensure that appropriate mitigation is in place. For removals activities involving geological storage, the risk of non-permanence is negligible. A non-permanence risk assessment should still apply, but periodic reassessment of the risk of reversal would not be necessary in light of the negligible scientific risk. [DG, 271]

294. The monitoring of some removal activities must cover carbon capture, transport, and storage/utilization. Reversals can occur during all steps of the respective value chain (depending on the capture method). Monitoring methodologies should cover all steps of the value-chain, and enable different combinations of capture, transport, storage and utilization modules. Monitoring equipment and methods to quantify both captured and re-released CO2 are described in detail in the CCS+ Initiative´s methodologies, tools, and modules. The CCS+ initiative draws on Verra's Non-Permanence Risk Tool for assessing the risks associated with geological carbon storage of a storage site and for determining the appropriate buffer withholding to ensure the permanence of credited emissions reductions and removals. [CCSI, 233]

295. All risks of non-permanence need to be minimized, as they shall be "addressed in full" based on Decision 3/CMA.3. Therefore, they should be identified upfront to the extent possible, or immediately assessed and minimized (in full?) upon occurrence [CWORKS, 302].

296. Physical non-permanence: Stronger scientific consensus around dissolution rates at sea and on land is needed (for enhanced rock weathering and ocean alkalinity enhancement). This needs to be supported by robust MRV practices [BEZERO, 304].

297. Non-permanence risks in general can be minimised through contractual permanence measures: commitment periods for projects need to be in human relevant timeframes, combination of modelling and field testing in MRV (e.g. for enhanced rock weathering, digital modelling could be twinned with practices such as soil, water and gas sampling) [BEZERO, 304].

298. Non-permanence risks differ for different types of mitigation activities. The CCQI methodology, for example, identifies the following overview of relative reversal risks for different types of mitigation activities:

Mitigation activity	Non-permanence risk	Example activities
Destruction of non-CO_2 gases	No risk: No reservoir involved. The destruction cannot be physically reversed.	HFC-23 destruction from HCFC-22 production
Avoidance of formation of non-CO_2 gases, without effecting the amount of carbon stored in reservoirs	No risk: No reservoir involved. The process cannot be physically reversed.	Reducing CH_4 emissions from rice cultivation, ruminant livestock or organic waste diversion
Reducing demand for fossil fuels	No material risk within time horizon relevant for avoiding dangerous climate change (except for possible lock-in effects in the case of activities that lead to a long-term increase in energy or feedstock demand).[1]	Adoption of renewable energy; energy efficiency measures
Reducing demand for non-renewable biomass (thereby reducing forest degradation)	Material risks: natural disturbance risks and anthropogenic factors.	Efficient cook stove projects
Enhancing, preserving, or slowing depletion of terrestrial carbon reservoirs	Material risks: The size of the risk depends on spatial scale, how underlying drivers are addressed, and stability of the reservoir(s) affected by the mitigation activity.	Afforestation/reforestation; improved forest management; avoided deforestation/conversion; soil carbon enhancements; peatland preservation or "rewetting"; etc.
Storing carbon in geologic reservoirs	Material risks: The size of the risks mainly depends on reservoir stability.	Carbon capture and storage (CCS BECCS, DACCS, or other)
Preventing or extinguishing accidental uncontrolled burning of fossil fuels	Material risks: The size of the risks mainly depends on reservoir stability.	Extinguishing or preventing ignition of fires at waste coal piles

299. Determining and mitigating risks for individual mitigation activities requires an assessment of activity-specific circumstances, along with tailored mitigation solutions. Multiple independent carbon crediting programs have developed methodologies for conducting these assessments. [OI, 285]

300. Non-permanence risks of all kinds can be identified, assessed, and minimized via insurance products [Kita, 262]

301. Non permanence risk would differ based on the project activity. E.g., for forestry, drought could be a great risk, however for CO2 stored in concrete, drought, exposure to fire and other natural (biotic/abiotic factors) may not be that relevant [SP, 313].

302. The non-permanence tool (specific for NBS and other for geological sequestration) must identify relevant reversal risk at the tool level, however, these risks must be valuated at the project level, as risk and subsequent relevance maybe different for same project type but other different scenarios. E.g., a forestry project near the coastline may face risk of sea level rise during its project period, however, this may not be a risk for a forestry project near mountains [SP, 313].

303. The terms of the buffer pools must be clear, in the case the permanence is for 100, 200 or 300 years. And if the buffer pool can be claimed at different stages if no reversals had happened [SP, 313].

304. When evaluating an activity type, any major risk of non-permanence should be disqualifying. Carbon markets are not the only means of climate action, nor should they be a main one. Any activity type that does not qualify due to possible impermanence can still be pursued, but not via a market mechanism where an offset will be sold. This should be a major point of consideration for both activity type and project approval. [AAI, 289]

305. When evaluating an activity type, any major risk of non-permanence should be disqualifying. Carbon markets are not the only means of climate action, nor should they be a main one. Any activity type that does not qualify due to possible impermanence can still be pursued, but not via a market mechanism where an offset will be sold. This should be a major point of consideration for both activity type and project approval [CLARA, 216].

2.5.5. E.4. Level of risk assessment

306. *In respect of risk assessment, how should the following elements be considered in the implementation of the approaches in (a) and any other relevant elements in this guidance?*

2.5.5.1. E. 4. a. Level of non-permanence risk assessment, e.g., activity- or mechanism-level

307. Activity level [CWORKS, 302].

308. Level of non-permanence risk assessment would depend on the removal project type. The one with non-permanence risk tool, risk assessment should be a project level. As each project is unique on its own [SP, 313].

309. Regarding the use of insurance, risk assessments should be done at the activity level and at least annually. Completion of the risk assessment(s) is the responsibility of the insurer. [Kita, 262]

310. Activity types should be evaluated for risks and then there should be a second project specific assessment. Both assessments should be conducted by independent, third-party analysts with input from stakeholders, before decisions are made by the Supervisory Body [CLARA, 316].

311. The level of non-permanence risk assessment should be activity-specific, as different activities will have different reversal risk profiles and require different monitoring tools. The identification of risks should take place prior to certification/accreditation and be updated regularly. Activity proponents should be responsible for risk assessment, subject to the approval of competent authorities. [ZEP, 263]

312. Ultimately, however, what matters for insuring against (unintentional) reversal risk is whether reserves are sufficiently capitalized across the entire mechanism. Any buffer reserve should be regularly stress-tested to evaluate its potential to withstand systemic reversal risks. Where potential shortfalls are identified, activity-level risk assessments and buffer contributions should be adjusted accordingly. [OI, 285]

313. Activity types should be evaluated for risks and then there should be a second project specific assessment. Both assessments should be conducted by independent, third-party

analysts with input from stakeholders, before decisions are made by the Supervisory Body. [AAI, 289]

2.5.5.2. E.4. b. Timing for risk assessment(s)

314. i) Upfront; ii) in case of a reversal event; and iii) upon each renewal of the crediting period [CWORKS, 302].

315. At the time of validation/registration, repeated at every verification [SP, 313].

316. Activity type risk assessments should be conducted before projects of that type can be proposed, so the Supervisory body may make a decision on if that type of activity is eligible. Specific project risk assessment should be evaluated before any work begins and before the credits are sold [CLARA, 316].

317. At the activity level, risks should be assessed at the time an activity is registered and be re-evaluated periodically over time (e.g., at each credit issuance, or every five years). System- or mechanism-level stress tests should be conducted at a minimum every five years (e.g., in line with NDC cycles). [OI, 285]

318. Activity type risk assessments should be conducted before projects of that type can be proposed, so the Supervisory body may make a decision on if that type of activity is eligible. Specific project risk assessment should be evaluated before any work begins and before the credits are sold. [AAI, 289]

2.5.5.3. E.4.c. Entity(ies) responsible for risk assessment(s), e.g., activity proponent, 6.4SB, actuary

319. Non permanence risk assessments should focus on scientifically substantiated risks owing to the given technology of the project and its CO2 storage. They should be: conducted at mechanism level and assessed prior to initiation of the project in a scientifically robust manner. Geological storage has a range of supporting scientific literature assessing the risk of reversal of a variety of CO2 reservoirs. The Supervisory Body should consider how these may be taken into account in assessing non-permanence under this element.

320. The 6.4SB is encouraged to define activity specific risk assessments included within methodologies. Activity proponents should thereby become required to undergo the risk assessment in case they want to be issuing A6.4ER [CWORKS, 302].

321. Development of requirements, RMP 6.4, conducting risk assessment - activity proponent, DOE - evaluation of risk assessment at the time of validation/verification. For insurance - actuary - should be backed by reinsurer [SP, 313].

322. The risk assessment must be conducted by an independent third-party entity that is not answerable to the activity or project proponent. Furthermore, the risk assessment must be made public [CLARA, 316].

323. As indicated in the CCQI methodology, best practice would be for activity proponents to conduct activity-level risk assessments in line with methodological guidelines provided by the Article 6.4 SB. These assessments, however, should verified by independent validation and verification bodies. Mechanism-level stress tests could be conducted by the A6.4 SB in collaboration with qualified independent risk experts. [OI, 285]

324. The level of non-permanence risk assessment should be activity-specific, as different activities will have different reversal risk profiles and require different monitoring tools. The identification of risks should take place prior to certification/accreditation and be updated regularly. Activity proponents should be responsible for risk assessment, subject to the approval of competent authorities. [CCSA, 287]

325. The risk assessment must be conducted by an independent third-party entity that is not answerable to the activity or project proponent. Furthermore, the risk assessment must be made public. [AAI, 289]

2.5.6. Buffer pools

326. *How should the following elements be considered in the implementation of the approaches in (1) above and any other relevant elements in this guidance?*

2.5.6.1. 5.a. Methods for determining the level of buffer pool contributions

327. The CCS+ initiative draws on Verra's Non-Permanence Risk Tool for assessing the risks associated with geological carbon storage of a storage site and for determining the appropriate buffer withholding to ensure the permanence of credited emissions reductions and removals. [CCSI, 233]

328. Methods should science based and allowing for periodic updates [CWORKS, 302].

329. Some standards currently allow those projects which are insured to have lower buffer contributions. If insurance becomes more widely adopted, it could play a part in increasing market liquidity. [Kita, 262]

330. Buffer pool contribution by each project must be based on the individual risk assessment. Level of contribution can be achieved by the risk scoring methods - e.g, those adopted by VCS, ACR, GS, etc [SP, 313].

331. The buffer pool contributions should be based on the outcome from an activity-specific risk assessment. It is important that the buffer pool contribution takes into account future climate change and provides a very high level of assurance that reversals can be compensated for. We recommend that a minimum contribution applies to all activities with material reversal risk and that higher contributions are required from activities with higher reversal risks. Activities with high reversal risk should be excluded from eligibility. [OI, 285]

2.5.6.2. 5.b. Composition of buffer pool

332. *5.b. Composition of buffer pool, including in relation to ER vintages and contributing activity types or categories*

333. Buffer pools should be designed activity specific [CWORKS, 302].

334. Buffer pool contribution should be deducted from the net issuance possible. ERs being contributed to buffer pool, should not have serial number. NBS buffer pool could have contribution from forestry, agriculture and other land use projects (including mangroves, seagrass, etc). CCS buffer - to have contribution from BECCS, DACCS. Vintage contributed would be the same as that of issuance- equally divided [SP, 313].

335. The buffer pool should be as diverse as possible. However, this will be determined by the location and type of mitigation activities being registered under the Article 6.4 mechanism,

which is beyond the control of the Supervisory Body. We therefore believe that contributions to the buffer pool should be adjusted over time, based on regular stress tests of the buffer pool, which should consider the diversity of activities and mitigation activity locations contributing to the buffer. [OI, 285]

2.5.6.3. 5.c. Intentional and unintentional reversals

336. The atmosphere doesn't care if it is intentional or unintentional [CWORKS, 302].

337. 5c. Intentional reversals should be compensated for by the entity that initiated the reversal. [Kita, 262]

338. We recommend following an approach that assigns an enforceable, primary liability for intentional reversals to mitigation activity proponents. Unintentional reversals may be compensated through a robust buffer reserve (or other insurance) mechanism. Note that any discontinuation of monitoring prior to the end of an activity's commitment period should be treated as an intentional reversal. [OI, 285]

2.5.6.4. 5.d. Treatment of uncancelled buffer ERs

339. *5.d. Treatment of uncancelled buffer ERs, including after the end of the last crediting period of the contributing activity*

340. Uncancelled units in any buffer following the end of the last crediting period of a project should be made utilisable for transfer by the project proponent, subject to any post-project monitoring period applied commensurate with the level of the risk of reversal. [DG, 271].

341. Should be made refundable to award project proponents and incentivize safe operations [CWORKS, 302].

342. For geologically sequestered removal projects, the American Carbon Registry accounts for reversals after the end crediting period: 'Reversals post-Project Term are compensated as outlined in the legally binding Risk Mitigation Covenant, filed in the real property records of each county, parish, and other governmental subdivision that maintains real property records, which prohibits any intentional reversal unless there is advance compensation to ACR.' Just as a nuclear plant has a decommissioning fund, buffers could have a similar structure whereby an organization, such as a charity, takes on responsibility of said fund and the management of the remaining buffer pool credits. [Kita, 262]

343. One way to treat them is to cancel the buffer at the end of crediting period to compensate for any future reversals that may happen. However, with this approach, it is not sure if and how much reversal would happen after crediting. Another approach could be that buffer could be allocated back to the activity proponent over the years if they continue the monitoring of the project and the project does not have any reversals. The latter might be the preferred one as it would incentivise the proponent beyond the just the rules to continue monitoring [SP, 313].

344. Note that it is essential for integrity that required periods for monitoring and compensation of reversals ("commitment periods") extend beyond the end of the last crediting period for an activity. This is the approach followed under California's regulatory carbon offset program, for example, as well as other programs. Best practice would be to cancel all buffer credits at the end of the required commitment period, in order to compensate for any reversals that might occur beyond the commitment period. If the carbon credits in the

buffer pool were not cancelled but instead were used to compensate for reversals from other mitigation activities, the approach would effectively not compensate for any reversals beyond the commitment period time horizon for monitoring and compensating for reversals. [OI, 285]

2.5.6.5. 5.e. Specifications for ERs cancelled for compensation for reversals

345. Specifications for ERs that cancelled for compensate for reversals, including in relation to ER vintages and contributing activity types or categories

346. We welcome considerations of clear differentiations between reductions and removals, noting the different (but complementary) roles the two mitigation approaches have to fulfil. Therefore, separate accounting of reductions and removals is encouraged. Following this logic, Climeworks encourages not to mix buffer contributions from reductions and removal activities [CWORKS, 302].

347. The ERs cancelled should be in the chronologically order of vintages i.e, older vintages should be cancelled [SP, 313].

348. Kita agrees ERs cancelled for reversal compensation should be tagged as such in a registry. To help increase transparency, it would also be relevant for the registry to provide specific information as to what reversal the cancelled ERs apply to such as:

(a) Project;

(b) Reversal event and if it was intentional or unintentional;

(c) Size of the reversal event;

(d) Date of the reversal event. [Kita, 262]

349. In general, there is no need to match the vintages of buffer credits with reversed tonnes of mitigation. However, a diverse mix of credits (vintage, activity type, category, geography, etc.) contributed to the buffer reserve can help to ensure the robustness of the reserve (e.g., with respect to the potential reversal of the buffer credits themselves). [OI, 285]

2.5.6.6. 5.f. Replenishment in case buffer cancellations exceed contributions

350. 5.f. Replenishment in case buffer cancellations exceed contributions; slide language on re-raising baseline level of storge before new crediting

351. In case of a reversal, where the buffer contribution of the specific project exceeds the reversal occurred, the buffer can be replenished in two ways: Transferring any remaining ERs in the activity proponent account to the buffer; and proponent buying additional ERs from the market (preferably of the same activity or the category) to compensate for additional ERs cancelled to compensate for reversals [SP, 313].

352. Insurance could play a role if buffer cancellations exceed contributions by managing downside risk of unexpected failure (where actual losses are higher than those modelled) [Kita, 262]

353. It is typically not an issue if buffer cancellations for an activity's reversals exceed that activity's contributions – that is how insurance mechanisms are designed to work. This is

because, ideally, not every activity contributing to the buffer will experience significant reversals. A well-designed, pooled buffer reserve should be able to compensate for large activity-scale (not systemic) reversals when they occur. While in some cases it may be justifiable to adjust an activity's baseline after a large reversal. However, this can pose integrity risks if not approached conservatively. Best practice would be to disallow baseline adjustments after a reversal or only to allow the baseline to be adjusted to a lower level. [OI, 285]

2.5.7. Implications of a reversal

354. *6. In the event of a reversal, what interactions and implementation aspects should be considered in respect of other elements of the activity cycle?*

355. Buffer contributions should not apply to projects with >99% chance CO2 remaining after >125 years, such as those with geological storage. Where they do apply, buffer contributions should be determined by a scientifically substantiated level of risk of reversal. To aid buyer certainty, intentional reversals may need to be addressed or compensated in a different manner to unintentional reversals, potentially one which increases the scope for remediation [DG, 271]

356. For activities involving geological sequestration, the Article 6.4 mechanism should seek alignment with national requirements for the permitting of injections. Relevant legislations are, e.g., in place in the US (EPA UIC class VI wells) or Europe (CCS Directive) [CWORKS, 302].

357. In the event of reversal, ER credits must be cancelled, up to the amount of the net reversal, and the necessary adjustments must be made in national registries. [ZEP, 263]

358. Reversals should be evaluated each time, in order to determine if the risk assessment for the project or the activity type missed important information. A report which includes 'lessons learned' should be developed for each instance and be made available to the Supervisory Body and ultimately made public. Should a majority of the activity types for removals result in reversals at any given point, extra scrutiny should be applied in project risk assessments. If this is the case for five years in a row, the activity should lose its eligibility to generate credits. A new risk assessment could be conducted but only after a period of time (such as five years) to allow understanding, strategies and or the technology to further evolve [CLARA, 316].

359. Best practice would be to cease credit issuance until the reversal has been remedied and compensated for. [OI, 285]

360. Reversals should be evaluated each time in order to determine if the risk assessment for the project or the activity type missed important information. A report which includes 'lessons learned' should be developed for each instance and be made available to the Supervisory Body and ultimately made public. Should a majority of the activity types for removals result in reversals at any given point, extra scrutiny should be applied in project risk assessments. If this is the case for five years in a row, the activity should lose its eligibility to generate credits. A new risk assessment could be conducted but only after a period of time (such as five years) to allow understanding, strategies and or the technology to further evolve. [AAI, 289]

2.6. F Avoidance of Leakage:

361. *Discuss any further considerations to be given to the core elements for leakage avoidance in A6.4-SB003-A03; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.*

362. The guidance to avoid leakage or otherwise adjust for it in the level of net removals should apply to all removals activities. Any estimations of leakage should be based on scientifically substantiated modelling. [DG, 271]

363. As mentioned in Microsoft's submission to the March 16th call for input, Microsoft suggests stronger inclusion of leakage considerations related to nature-based credits. Sufficiently accounting for activity and market leakage within, and beyond, the jurisdictional boundary of the project scope is required to meet Microsoft's criteria for high-quality carbon removal. The most robust way to address leakage is for project developers to work with other producers to replace the supply displaced by the project (e.g., cattle, wood, etc.). [MS, 234]

364. Leakage is counter-factual and very uncertain and difficult to ascertain. Modern methodologies should as far as possibly avoid counterfactual assessments and instead base themselves on factual outcomes. Here leakage is interpreted as indirect emissions outside the project boundary. Methodologies should avoid counterfactual assessments and instead base themselves on factual outcomes. [SE, 244]

365. Since all Leakage will be appearing in nations' emissions reporting, it is suggested that a new approach to Leakage is applied. The approach is to:

    (a) Account for Land Use Change and Indirect Land Use Change Leakage beyond the baseline of the project;

    (b) Not to account for other leakage if it can be established that the territory(-ies) where the leakage is likely to occur has/have a reduction trajectory for the emissions, for instance in relation to possible leakage due to electrical usage. [SE, 244]

366. Strictly speaking, a binding reduction trajectory sets the net total amount of CO2 emissions allowed with or without the project, and it could in this case be argued that the notion of Leakage loses its meaning. [SE, 244].

367. Define activity shifting leakage discounts for all activities under the 6.4 mechanism. For jurisdictional approaches, market leakage should be considered. Market leakage refers to an increase in GHG emissions resulting from the change in supply and demand equilibrium outside the program's jurisdiction (for example a country). This type of leakage is extremely challenging to track and account for [SYRA, 305].

368. All types of leakage should be considered, measured, and addressed under the article 6.4 mechanism. This includes activity-shifting leakage and market leakage and should not be limited to domestic leakage [CMW, 308].

369. IETA highlights the importance of clearly defining leakage while noting how the term "carbon leakage" is used to indicate two distinct phenomena in carbon markets:

    (a) The relocation of emission-intensive trade exposed (EITE) activities from jurisdictions with a higher cost of carbon to jurisdictions with a lower one;

(b) An increase in emissions outside the boundary of an emission reduction or removal activity as a result of activity implementation (e.g., indirect land use change arising from the afforestation of agricultural land, which may lead to the clearance of other forested land outside of the activity boundary for agricultural purposes).

370. IETA considers that a thorough leakage risk assessment and/or other tools and methods can be employed ex ante to assess the impact of an activity in respect of potential sources and the scale of leakage risks(e.g., environmental and social safeguards, national and regional laws and regulations on land development and land covenants; lifecycle assessment). Secondly, methodological design is critical. For instance, methodologies for land-based removals must not allow for the opting in and out of specific land parcels over the course of a project activity, especially where jurisdictional approaches are allowed. Rather, project boundaries and participating entities should remain fixed throughout the crediting and monitoring periods. IETA also notes that the use of standardised adjustment factors has been discussed as a simplified method to account for leakage. While IETA recommends that leakage be assessed at the project level using project-specific information, in the case that adjustment factors are used, any standardised leakage measure should include periodic verification of historic leakage post implementation of projects to ensure a high level of environmental integrity of projects [ITEA, 3011].

371. In addition to use of jurisdictional level programmes, cross-boundary leakage risks need to be considered [CA, 312].

372. It is essential that the mechanism establishes an appropriate allocation of liabilities for all types of carbon removal activities [ZEP, 263]

373. Regarding SB005-A02 section 2E &F, reversals and leakage are briefly discussed above and are easily mitigated against because sequestration is within a solid, accessible material, above ground. It’s worth contemplating that sequestration in solid, elemental carbon is a potentially viable and more rapidly scalable alternative to geologic sequestration. Cost could ultimately become a non-issue because the solid carbon can be used as a feedstock for a high-value product (battery-grade-graphite) that simultaneously sequesters carbon. A financial mechanism that cannot be leveraged if you sequester the carbon deep underground [RC, 266]

374. We believe that this section needs considerably more elaboration. We recommend establishing the following principles:

(a) Methodologies for emission reductions or removals shall consider all potential sources of leakage associated with the type of mitigation activity and not limit the consideration to a particular boundary (i.e., not be limited to national boundaries).

(b) All material sources of leakage shall be included in the quantification of emission reductions or removals, except where the omission of leakage sources is conservative.

(c) The consideration of leakage sources shall include, where relevant: upstream or downstream emissions; emission increases due to direct or indirect shifting of activities, services or products; and ecological leakage (e.g., mitigation activities affecting emissions in nearby areas that are hydrologically connected).

(d) Methodologies shall establish requirements to minimize any material sources of leakage (e.g., through requirements that avoid leakage).

(e) Any material remaining leakage shall be estimated and deducted in the quantification of emission reductions or removals.

(f) The estimation of leakage emissions shall be robust and conservative in light of the uncertainties, taking into account the choice of assumptions, models, parameters, data sources, measurement methods, and other factors. [OI, 285]

2.7. G. Avoidance of other negative environmental, social impacts

375. *Discuss considerations to be given to core elements for avoidance of other negative environmental, social impacts; where possible, identifying the applicable scope, i.e., relevance to all 6.4 mechanism activities, to removals activities, or to specific removal activity categories or types.*

376. CDRs should be (a) scientifically (not just theoretically) proven to be effective; (b) Based on thorough research prior to any ocean ecosystem trials. …(c) have a biodiversity net gain (but …no negative impact on relevant ecosystems…); (d) Have robust key checks and balances in place to ensure that any potential change to the marine environment is detectable when ocean trials go ahead [SRT,202]

377. … it is not sufficient to "minimize and where possible avoid" adverse human rights impacts. They should not be accepted at all. … more specific guidance is needed …. refer to the global authoritative standard on business and human rights: UN Guiding Principles on Business and Human Rights (UNGP). .. the carbon-crediting activities should be required to have in place: 1) A policy commitment to meet their responsibility to respect human rights; 2) A human rights due diligence process to identify, prevent, mitigate and account for how they address their impacts on human rights; 3) Processes to enable the remediation of any adverse human rights impacts they cause or to which they contribute. … take note of the … wording by the Nordic Code developed under the Nordic Dialogue. …[FNW,208]

378. …….A method-neutral, criteria-based Article 6.4 mechanism should absolutely include strong guardrails for equity, ecosystem safety, and environmental justice, but should not preclude individual carbon removal pathways, or deployment in specific geographies…..[OAIR, 210]][CBC, 211].

379. For activities involving geological sequestration, the Article 6.4 mechanism should seek alignment with the CDM decision on CCS activities made in Durban 2011 [CWORKS, 302].

380. When applicable, mandate consultations with local stakeholders; establish safeguards, and adapt them to the project type. Some project types have an especially high risk of resulting in negative impacts; consider existing international frameworks, such as the Cancun Safeguards for REDD+; establish requirements that go beyond safeguards, such as monitoring and reporting of co-benefits and benefit-sharing plans [SYRA, 305].

381. Climate change has and will continue to impact communities differently. Microsoft believes carbon removal projects should exceed the "do no harm" principle and actively advance economic and social development as well as other non-carbon benefits. Microsoft prioritizes projects that provide more than just carbon removal, such as advancing sustainable livelihoods, environmental justice, climate resilience and biodiversity. At a minimum, in order to avoid negative social impacts, local communities must have free prior and informed consent related to any market activities or Article 6.4 Emission Reductions

(A6.4ERs) produced within their territories. Going beyond the minimum of doing no harm, local communities should economically benefit from the production of A6.4ERs through revenue sharing. A6.4ERs should ideally be produced in a manner that advances procedural justice (fairness in decision making) as well as distributive justice (equitable allocation of project risks, benefits and impacts). 5Stakeholder engagement must occur throughout the duration of the project lifetime. [MS, 234].

382. Responsible and equitable deployment of CDR can help to achieve our climate goals while also delivering co-benefits to ecosystems and communities. As noted in the Carbon Business Council's May 24, 2023, letter to the SB, we strongly dispute the notion that CDR is incompatible with sustainable development, and not to be deployed in developing countries. On the contrary, responsibly deployed CDR can serve as an engine for sustainable and equitable development worldwide, and we would be pleased to connect the SB with CDR companies and projects already hard at work in the Global South, including in least developed countries and small island developing states. A method-neutral, criteria-based Article 6.4 mechanism should include strong guardrails for equity, ecosystem safety, and environmental justice, but should not preclude individual carbon removal pathways or deployment in specific geographies. [NPBC, 253]

383. …it is important to identify and assess the potential environmental and social impacts associated with removal activities. This includes considering the direct and indirect effects on ecosystems, biodiversity, water resources, air quality, land use, and local communities. The scope of these considerations should encompass all 6.4 mechanism activities to maintain consistency and coherence in the implementation of avoidance measures. To effectively avoid negative environmental and social impacts, it is essential to establish clear guidelines and safeguards. These may include conducting environmental and social impact assessments, implementing mitigation measures, and promoting the participation of local communities and indigenous peoples in decision-making processes. Additionally, mechanisms for grievance redressal and monitoring of impacts should be incorporated to ensure accountability and transparency throughout the project lifecycle. Furthermore, specific attention should be given to identifying and addressing potential disproportionate impacts on vulnerable groups, including marginalized communities and indigenous peoples. Adequate measures should be implemented to safeguard their rights, traditional knowledge, and livelihoods, and to prevent any potential harm resulting from removal activities [PACHA, 306].

384. Considering the diverse range of removal activity categories or types, it is essential to tailor the avoidance measures accordingly. Different activities may present unique challenges and require specific considerations to mitigate their environmental and social impacts effectively. Therefore, it is important to analyze the characteristics and potential risks associated with each removal activity category or type and develop appropriate mitigation strategies accordingly. The avoidance of other negative environmental and social impacts should be a fundamental aspect of activities involving removals. By integrating robust environmental and social safeguards, conducting impact assessments, promoting stakeholder engagement, and addressing the specificities of different removal activity categories or types, the mechanism can ensure that removal activities contribute to sustainable development while minimizing any adverse consequences [PACHA, 306].

385. Experience can be drawn from the COP decisions on REDD+, specifically the Cancun Safeguards and from international REDD+ programs. The Cancun Safeguards are a precedent under the United Nations Framework Convention on Climate Change

(UNFCCC), therefore these should be used as a starting point and Article 6.4 mechanism safeguards must not fall below this standard [CI, 307].

386. The prior consideration and avoidance of negative environmental or social impacts of any types of projects under Article 6.4 is of utmost importance for the trust and integrity of the mechanism and its contribution to sustainable development. Social safeguard provisions should be ensured through both:

(a) Ex-ante consultations, and

(b) Ex-post mechanisms to report and address any grievances. [IETA, 311]

387. Whilst acknowledging that the enforcement of environmental and social protection laws is a national prerogative of the host Party, it is important to ensure that all activities under the Article 6.4 Mechanism are aligned with internationally agreed conventions and principles on environmental and social considerations, including the free, prior, and informed consent (FPIC) of Indigenous Peoples and local communities. If a country or region does not have specific guidelines or processes, an impact evaluation before project initiation may be a feasible option. Such evaluation should be verified by a third-party assessor and may lead to the modification or rejection of the project. As agreed by the SB at its latest meeting (SB005), all projects should undergo a mandatory sustainable development assessment. This applies to all projects under the Article 6.4 mechanism, including activities involving removals. For each project, depending on the scale, location and activity type, there may be specific additional concerns which has to be considered at the activity level. [IETA, 311].

388. Under the CDM, additional environmental and social safeguards were adopted in the modalities and procedures for both afforestation/reforestation and geostorage activities. In these respects, IETA urges the SB to review these previous requirements and consider, inter alia: whether they can be adopted for use under the 6.4 mechanism, whether any additions or omissions are necessary, and whether the same conditions could be applied to all types of removal activities.

(a) Whether they are suitable for use today under the 6.4 mechanism;

(b) Whether any other additions or omissions are necessary; and

(c) Whether the same conditions could be applied to all types of removal activities. The establishment of an independent and well-defined grievance and appeals mechanism as mandated by the RMP will further strengthen the environmental and social integrity of the mechanism. This should remain accessible, transparent, robust and with clearly defined scope to do no harm. Design considerations of such a grievance mechanism have been further elaborated in numerous previous submissions [IETA, 311].

389. The potential for negative environmental and social impacts needs to be addressed at the mechanism and project levels. There is a need for broad stakeholder consultations during the project development stage and a grievance process should be established before the Article 6.4 mechanism is up and running [CA, 312].

390. In order to ensure that all 6.4 mechanism activities are sustainable and have a positive impact on both the environment and society, it is crucial to develop and implement environmental and social safeguard approaches. By doing so, potential risks and negative

effects stemming from these activities can be minimized. Additionally, a majority of carbon removal projects require consultation with local stakeholders prior to approval and the establishment of grievance mechanisms to address any issues that may arise following the project's implementation. In order to avoid the negative environmental and social impacts of 6.4 mechanism activities stepwise approach need to be followed.

(a) Who need to conduct Environmental and Social Risk Assessment for 6.4 mechanism activities?

    (i) The environmental and social screening serves as a preliminary measure in the environmental and social due diligence process carried out by accredited organizations.

(b) When to conduct Environmental and Social Risk Assessment for 6.4 mechanism activities?

    (i) This screening takes place at the very beginning of proposal development, specifically during the Concept Note creation. As a result of the screening, it may be necessary to explore alternative options, such as varying methodologies, schedules, scopes, or locations.

(c) Which type of 6.4 mechanism activities require Environmental and Social Risk Assessment?

    (i) An environmental screening must be completed for all activities proposed for all 6.4 mechanism activities. [ETS, 261]

391. All activities under 6.4 mechanism must be conducted in accordance with respect for and protection of human rights, especially the rights of indigenous peoples, the rights of local communities and the rights of women. All activities must comply with international law and standards. Credits under this mechanism must not be allowed to be generated by activities that have negative environmental and social impacts, especially those that have caused a rights violation. To implement this, there must be meaningful public participation and consultation with rights holders before a project is approved and throughout the life of the project. This should include complying with indigenous peoples' right to free, prior and informed consent. As part of the project approval process, if a project is impacting indigenous peoples' territory, the tribal government must have given permission after a meaningful stakeholder consultation and risk assessment. Removal credits issued under the Paris Agreement should not be generated from activities that have negative environmental and social impacts. It is also essential that an independent grievance mechanism is in place prior to any article 6.4 mechanism activities taking place, to help provide a remedy if those risks that are not avoided and harm occurs. For this grievance process to be effective, the 6.4 independent grievance redress mechanism must be aligned with the UN Guiding Principles on Business and Human Rights effectiveness criteria, including that it be legitimate, accessible, equitable, transparent, predictable, rights-based, and a source of continuous learning [CLARA, 316].

392. BBB produces biochar tailored for high quality GGR and integration into dairy farms. The biochar is designed to be added to slurry, farmyard manure (FYM), or bedding which is then cleared and added to FYM. Routine application of biochar at a low dose (200 kg-

1000 kg ha-1 yr-1) within existing farming practices and the current regulatory landscape allows for the valorisation of high-value benefits including:

1. Rapidly build soil carbon;

2. Improve nutrient cycling in soil;

3. Promote root and mycorrhizal development;

4. Increase soil plant available water and macronutrients;

5. Enhance crop resilience to climate-related stress;

6. Boost crop productivity;

7. Reduce emissions and nutrient leaching from stored manure;

8. Elevate nutrient content of organic fertiliser;

9. Suppress bacteria in livestock bedding;

10. Works as a sorbent/desiccant in bedding.

393. The social impacts of using biochar as a GGR are clear. To name a few, biochar helps the world meet its Net Zero targets in a cost-effective manner; reduces harmful pollutants from the agricultural sector e.g., by reducing ammonia emissions from dairy farms; provides new jobs to citizens; and diversifies our energy landscape, transitioning industrial sites away from fossil fuels. [BBB 264]

394. Regarding SB005-A02 section 2G, because the end use case is within an industry (stationary storage batteries) that already includes feedstock graphite produced thru an environmentally unfriendly process, any transition toward a battery use case will be a social and environmental improvement. Battery production will be performed within areas already deemed as appropriate for industrial activities as designated by local planning and zoning authorities – helping ensure facilities don't locate near residential neighbourhoods. A carbon negative manufacturing process and a carbon negative product will both be promoted. Additionality is ensured because no carbon-negative graphite is currently being used within the stationary storage battery industry. Carbon-negative graphite within batteries should be considered as a co-benefit in that reducing humanity's reliance on fossil fuels means a transition to more renewable sources of energy, in combination with batteries, which can now be partially made out of carbon-negative materials. In the short term, bio-graphite derived from waste biomass will be considered as a potential feedstock. As a long-term solution, this could pose resource competition concerns. However, as soon as economically feasible, the intention is to move to a DAC + conversion processes that does not require waste biomass. Meaning resource competition concerns are limited to the scaling of facilities that make batteries. Battery manufacturing is an endeavour the world currently can't build fast enough. Developing a dual carbon battery architecture that ensures a high carbon concentration per volume translates to less land area being needed for sequestration (taking up the same land area being used for current stationary battery storage installations). Securing sufficient feedstock carbon means the potential to easily sequester GT's of CO2-e, annually, with less than 20% of this emerging and rapidly growing market. The envisioned battery architecture eliminates a reliance on less environmentally friendly metals and ensures a nationally secure, abundant feedstock (atmospheric CO2) for any country wishing to help develop this technology. I envision no

new negative side-effects from the development and scaling of our technology - on ecosystems, biodiversity, people, land, water, energy or food security. I envision no negative impact from waste products as a result of our process. I do envision both job and wealth creation for locals that embrace our approach - either in aiding the manufacture of our batteries or in deploying them. [RC, 266]

395. Depending on the circumstances, jurisdiction, or activity type, the extent to which activities should actively monitor and report on demonstrable social and environmental co-benefits – rather than merely avoiding harms – may also merit consideration. Engineered removals bring about important co-benefits – for example, they can be an important contributor to wider economies of scale for the CCUS industry, helping to de-risk CO2 networks and thus reducing wider societal costs, notably impacting those industries most reliant on CCS for decarbonising (e.g., cement). [CCSA, 287]

396. Coastal communities are experiencing a rapid decline in the health of the local ocean, riverways and waterways tied directly to the impacts of anthropogenic emissions. Heat, acidification and increased climate volatility are directly impacting livelihoods and economies reliant on working with natural resources, such as fishing and aquaculture. This decline threatens coastal communities and food security. It puts the natural processes that regulate our climate systems at extreme risk of collapse. Without positive interventions including ocean-based carbon removal, the capacity of the ocean to sequester and store atmospheric CO_2 will likely continue to diminish, accelerating the increase in atmospheric CO_2 and the resulting acidification of surface seawater. This “negative baseline” of rapidly declining ocean health provides critical context when considering ocean climate solutions, as there is no solely conservation-focused strategy that provides a realistic pathway towards earning fully maintaining or improving ocean health at a global scale. While conservation and preservation of at-risk areas will be a critical component of combating climate change and maintaining a healthy, productive and biodiverse ocean, taking positive action to restore degraded ecosystems, reverse acidification, and remove excess carbon are necessary to counter the irreversible changes faced by marine ecosystems and to protect against negative environmental and social impacts. Simply put, there is no path to effectively combating the climate crisis that does not include taking positive action to address ocean acidification and warming. [RT, 288]

397. All activities must comply with international law and standards. Credits under this mechanism must not be allowed to be generated by activities that have negative environmental and social impacts, especially those that have caused a rights violation. To implement this, there must be meaningful public participation and consultation with rights holders before a project is approved and throughout the life of the project. This should include complying with indigenous peoples’ right to free, prior and informed consent. As part of the project approval process, if a project is impacting indigenous peoples’ territory, the tribal government must have given permission after a meaningful stakeholder consultation and risk assessment. Removal credits issued under the Paris Agreement should not be generated from activities that have negative environmental and social impacts. While the independent grievance redress mechanism will not help avoid negative environmental and social risks, it can play a role in providing remedy if those risks are not avoided and harm occurs. As evidenced by the history of the CDM, market activities can negatively affect people and the environment. Therefore, it is essential that such a mechanism is in place prior to any article 6.4 mechanism activities taking place. [AAI, 289]

2.8. Other inputs

398. Of the 104 responses received to the prior information note, only 18 commented on tonne year accounting. It is immediately apparent to us that the “silent majority” consenting to tonne-year accounting through its omission of commentary has been ignored in favor of the “vocal minority “………A Better Yardstick for Carbon Markets (attached), a white-paper specifically addressing the shortfalls of our current tonne year accounting system, the solutions provided by tonne-year accounting, and answers to its common criticisms …… a time horizon of infinity is recommended (or the effective mathematical equivalent of one million years), in lieu of the 100-year or 200-300-year time horizon. Because of the adoption of a discount rate, there is no need to arbitrarily limit the time horizon considered.. [SHC, 205].

399. We note three additional areas where clarification is needed to maximize the effectiveness of implementation of the Article 6.4 mechanism: 1. Alignment or harmonization with existing global frameworks. We would encourage reference to or alignment with existing global frameworks for accounting systems or metrics, such as the GHG Protocol, with a view toward supporting harmonization of disclosures globally to the extent possible. 2. Clarity on corresponding adjustments. Clarity on corresponding adjustments is needed to provide the certainty needed for the market to develop and scale successfully. 3. Clarity on relative treatment of projects not certified under Art. 6.4. It will be essential to clarify that credits issued under Article 6.4 are not characterized de facto as more or less beneficial as credits from projects accredited by other bodies [JMP, 301].

400. We acknowledge that the supervisory body has taken into account the stakeholder feedback on tonne-year accounting. We would still like to reaffirm that the tonne-year crediting method should no longer be considered by the Supervisory Body due to several fundamental flaws. This method creates a false equivalence between temporary and permanent carbon storage, which goes against the concept of a carbon budget and cumulative emissions. By counting short-term carbon storage as equivalent to permanent reduction or removal, tonne-year accounting undermines the goal of the Paris Agreement. Tonne-year accounting methods, whether physical or economic, fail to consider the science of temperature stabilization and the need to compensate for any CO2 reversal to achieve temperature targets. These deficiencies have been recognized for a long time, and it is important to prioritize permanent mitigation over short-term storage to effectively address climate change and adhere to a global carbon budget. [CFUT, 245]

401. Commercial-scale DAC projects can serve as long-term electricity offtakers and encourage the development of new renewable energy assets ... We encourage the SB to establish monitoring, reporting, and verification (MRV) frameworks that ensure DAC projects are truly carbon negative to encourage these types of partnerships. …[CAP,207]

402. A nature-based removal must therefore always be considered reversed at the end of the Monitoring period. The Monitoring period for land-based approaches should thus correspond to the timeframe the project is committed to keep the land as a removal. In effect, non-permanent removals are postponed emissions. Again, it follows that for land-based credits, the timeframe for addressing reversals is during the Monitoring period (as they should be considered released after that period). For permanent removals (BECCS/DACCS) as well as generically for CCS, the permanence is confirmed by the scientific consensus and the fact that the CO_2 is sent permanently to the geosphere. During the Monitoring period, reversals should be monitored and addressed according to the applicable jurisdiction as well as counted as an emission by the storage company. At

the end of the Monitoring period, there should be a transfer of responsibility to the host nation. If there is a reversal after the transfer of responsibility, the host nation should count the reversal as an emission and take measures according to the applicable jurisdiction. [SE, 244]

403. We urge the Supervisory Body to consider that engineering-based carbon dioxide removal (CDR) methods, including BCR, have the potential to contribute significantly to addressing both environmental and societal impacts, notably through the production and utilization of biochar. [CFUT, 245]

404. Regarding SB005-A02 section 2E &F, reversals and leakage are briefly discussed above and are easily mitigated against because sequestration is within a solid, accessible material, above ground. It’s worth contemplating that sequestration in solid, elemental carbon is a potentially viable and more rapidly scalable alternative to geologic sequestration. Cost could ultimately become a non-issue because the solid carbon can be used as a feedstock for a high-value product (battery-grade-graphite) that simultaneously sequesters carbon. A financial mechanism that cannot be leveraged if you sequester the carbon deep underground [RC, 266]

405. The CMA should clarify that for Art 6 projects that are in line with NDCs, nations should welcome VCM purchases by corporations and their positive impact on the achievement of their NDCs, keeping reduction trajectories and reduction projects separate from removal trajectories and removal projects. In other words, in those cases, where co-funding has taken place, both the host nation and the co-funding corporations can legitimately and with maintained integrity co-claim a mitigation outcome towards their respective climate objectives which are kept track of in two separate accounting systems. Of course, no two nations or no two corporations must ever account the same outcome. This is how emission reductions already are treated by nations, irrespective of whether they are based on compliance measures, voluntary measures or supported by government aid schemes. Of course, for cross-border corporate compliance purchases, a Corresponding Adjustment between nations must always take place to avoid double counting between nations. [SE, 244]

406. Where the risk of reversal is high (e.g., soil organic carbon), the ton-year currency should provide a solution where payment is performed yearly, as long as no reversal has occurred.[REW, 219]

407. We suggest the term CDR must be limited to what Mother Nature does without help from engineering based ACDR solutions. Instead, the use of term ACDR (Accelerated CDR) [CAT, 220]

408. There are two ambiguities related to the process of removals that have to do with the rate at which the removals occur and the amount of time over which those removals are stored…an equation is provided to define removal…….At a fundamental level, tonne-year is simply a unit of measurement that quantifies a concept involving mathematical integration of mass over time. Because it is a unit of measurement, it is very likely that very different methodologies would produce very different outcomes but in the same units of measurement. It would be preferable if methods that are currently called tonne-year accounting are referred more specifically [MPI, 227]

409. Instead of releasing the plant carbon back into the air through open-air burning or anaerobic decomposition, process rendering a large portion of the plant-based carbon into

a recalcitrant form that stays inert (e.g. in the soil) for at least hundreds to thousands of years is described, over 10000 small farmers are covered [TAK, 217]

410. Instead of focusing on MRV we need to focus on diversifying food production and habitat restoration, with the objective of achieving carbon removal that is too cheap to meter [OLAB 222]

411. CO2 Removal must be performed simultaneously with atmosphere energy removal. CO2 Removal and CO2 Emission Reduction without energy removal cannot reduce Atmosphere CO2 concentration due to the laws of physics [ELI, 221]

412. We encourage the Supervisory Body to consider including CO2 captured from the ocean in its definition of removal activities, i.e., "Anthropogenic activities removing carbon dioxide (CO2) from the atmosphere or ocean and durably storing it in geological, terrestrial, or ocean reservoirs, or in products". The ocean plays an important role in regulating Earth's climate by absorbing 30% of anthropogenic CO2 from the atmosphere and thereby slowing the rate of atmospheric warming. [CC, 247]

413. The note's framing of CDR as either "engineering-based activities" vs "land-based activities" is arbitrary. In fact, many high qualities carbon dioxide removal proposals are hybrids of engineering and nature based solutions. The statement that "Engineering-based removals are technologically unproven", as a blanket statement, is false. Furthermore, many "land-based activities" can result in durable carbon removal with proper risk management and project oversight. We encourage the Supervisory Body to move away from labels such as "nature-based" and "engineering-based," which can be counterproductive to taking action: Any discussion that frames CDR policy as a choice between one or the other fails to recognize the urgency and rate at which Gigatonne-scale CDR deployment is required. In fact, we will likely require massive deployment of projects across all solution pathways (provided they meet guidelines for quality and safety) in order to meet our climate obligations. [XPZ, 249]

414. Removals traded under Article 6.4 should not be allowed to impact NDC ambitions for emissions reductions. Thus, removals – land-based or technical – should only be applied towards dedicated removal trajectories which aim to neutralize the hard-to-abate emissions of the total volume of unabated emissions. A pre-requisite to acquire removals should be first to estimate the amount of hard-toabate emissions a nation or a company has and in what sectors. Land-based removals should only be applied towards hard-to-abate emissions in the AFOLU sector. For other sectors, permanent technical removals, such as BECCS and DACCS, should be applied as a condition to claim net-zero. [SE, 244]

415. Projects for removing carbon dioxide from the atmosphere must take account of other goals. These include:

(a) creating co-benefits for greenhouse gas emissions mitigation beyond those taken account of in calculating the net removal;

(b) enhancing adaptation and resilience to climate change, for example increasing resilience against flooding;

(c) protecting and enhancing biodiversity;

(d) promoting other environmental goals, including safeguarding water quality, and avoiding excess burden on the nitrogen cycle; and

(e) improving the wellbeing of local communities, including by providing leisure, employment and educational opportunities, as part of a just transition.

416. As a condition for removals being certified, projects should be required to meet the specified standards and to follow the required procedures relevant to these goals. [BF, 252]

417. There is a need to further refine procedures and methodologies related to identification and mitigation of risks linked to reversals and leakages across carbon removal activities. The use of cradle to grave life-cycle assessments to account for activity boundaries and associated removal activity related emissions should support these assessments, with technology-based removal solutions already demonstrating low levels of risk for reversal or rerelease of CO2 and thus exhibiting high potential for quality of future credits generated by these technologies. [IATA, 255]

418. “Removals/negative emissions” and “avoided emissions” should be accounted for separately. To avoid double counting, further clarity is required from A6.4SB on the definition of removal credits and how they are distinct from avoidance credits. This would recognize the uses of captured CO2 both for storage and its use as a feedstock with corresponding distinct environmental attributes. [IATA, 255]

419. The info note’s conclusions are inconsistent with current IPCC accounting guidance and acknowledgement of the need for gigatonne scale CDR in coming decades. The info note’s framing of CDR as either “engineering-based activities” or “land-based activities” is arbitrary and not science-based. [RTTO, 256]

420. We encourage the Supervisory Body to adopt the definition of CDR provided by the IPCC: "anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products." [USBC, 257]

421. we want to emphasize to the SB is the importance of codifying Monitoring, Reporting, and Verification (MRV) into Article 6.4. MRV aims to develop the standards to quantify the impact of the different solutions that exist to mitigate climate change and remove atmospheric CO2. [CLLA, 259]

422. Carbon removals go beyond ‘nature vs engineered’ to span a very wide spectrum of approaches that involve the application of both natural resources and human ingenuity. Though it is hugely tempting to put carbon removals into two neat, tidy categories – ‘nature-based’ and ‘engineered’ – this no longer represents anything close to the full range of carbon removal approaches. Already we have biochar, bioenergy with carbon capture and storage and enhanced rock weathering, all of which combine nature-based benefits with enhanced CO2 storage through engineering processes. And this is a fast-moving industry, with many new technologies and approaches in development. [RRDC, 260]

423. In order to ensure that all 6.4 mechanism activities are sustainable and have a positive impact on both the environment and society, it is crucial to develop and implement environmental and social safeguard approaches. By doing so, potential risks and negative effects stemming from these activities can be minimized. Additionally, a majority of carbon removal projects require consultation with local stakeholders prior to approval and the establishment of grievance mechanisms to address any issues that may arise following

the project's implementation. In order to avoid the negative environmental and social impacts of 6.4 mechanism activities stepwise approach need to be followed. [ETS, 261]

424. Who need to conduct Environmental and Social Risk Assessment for 6.4 mechanism activities? The environmental and social screening serves as a preliminary measure in the environmental and social due diligence process carried out by accredited organizations. When to conduct Environmental and Social Risk Assessment for 6.4 mechanism activities? This screening takes place at the very beginning of proposal development, specifically during the Concept Note creation. As a result of the screening, it may be necessary to explore alternative options, such as varying methodologies, schedules, scopes, or locations. Which type of 6.4 mechanism activities require Environmental and Social Risk Assessment? [ETS, 261]

425. An environmental screening as above must be completed for all activities proposed for all 6.4 mechanism activities. [ETS, 261]

426. Kita believes this guidance, particularly the definition of certain key terms, can be quite influential in how removals are utilized through mid-century. In terms of providing carbon insurance to unlock additional financial flows for carbon projects, Kita is technology agnostic. We believe all removal technologies will be necessary to achieve a 1.5C world. However, Kita also recognizes that stance only addresses carbon and finance. It does not address necessary social, governance and biodiversity improvements. While all removal technologies are important, some perpetuate more co-benefits than others (ex. Forestry projects that work directly with IPs and LCs). This is where how removals are defined by the Supervisory Body will matter; whether it be a catch all definition or one that breaks technologies out into subcategories (ex. NBS, hybrid, engineered). [KITA, 262]

427. Kita would like to put forward that any overarching definition of carbon removals should be one written purely from a scientific perspective and technology agnostic. Such a definition will serve as the basis for context setting before one reviews attribute for specific technologies. Whether within the removal's definition or as a separate but connected component, how each removals technology relates to leakage, permanence, social impacts, governance impacts, and changes to biodiversity at a minimum. This may help decision makers better understand the overall implications of using one removal technology over another beyond simply the carbon impacts. [KITA, 262]

428. Mechanisms such as the Article 6.4 can support the development of carbon removals at scale, notably, by creating early demand and providing the needed predictability for prospective carbon removal developers and buyers. This guidance is essential to provide clarity and credibility in carbon markets through the development of a well-designed, enabling, and transparent regulatory system, namely monitoring, reporting, verification and governance mechanisms – and can stand in as a gold standard guidance for carbon markets. It should also be noted that this guidance is being developed alongside other initiatives (e.g., European Union's certification scheme for carbon removal activities) and that consistency in carbon removal accounting is essential to build trust in carbon markets, establish a global level-playing field and unlock further opportunities for developers. [ZEP, 263]

429. It is important to clearly define "removals", avoiding misconceptions and confusion with carbon dioxide reductions. A robust and thorough definition must reflect the following principles:

(a) CO2 is physically removed from the atmosphere;

(b) The removed CO2 is stored out of the atmosphere in a manner intended to be permanent;

(c) Upstream and downstream greenhouse gas emissions, associated with the removal and storage process, are comprehensively estimated and included in the emission balance;

(d) The total quantity of atmospheric CO2 removed and permanently stored is greater than the total quantity of CO2 emitted to the atmosphere. [ZEP, 263] [CCSA, 287]

430. The concept of "permanence" should also be accurately defined in the proposed guidance. While different activities can achieve carbon dioxide removal, they will involve different storage timeframes and risks of storage reversal. For example, storage in products and carbon farming activities will typically store CO2 out of the atmosphere for decades to centuries; while storage of CO2 in geological reservoirs offers the opportunity to safely store CO2 for thousands of years. The European Commission proposal for a Regulation establishing a Union certification framework for carbon removals defines "permanent carbon storage" as "a carbon removal activity that, under normal circumstances and using appropriate management practices, stores atmospheric or biogenic carbon for several centuries, including bioenergy with carbon capture and storage and direct air carbon capture and storage". [ZEP, 263]

431. At the moment, the most urgent, simplest, and most cost-effective intervention to implement is to plant trees, shrubs and other vegetation in semi desert areas or prairies, in addition, obviously, to all peri-urban areas (both small and large cities) [DEMO, 265]

432. We object in the strongest terms to the notion that engineered CDR solutions are inconsistent with sustainable development goals for the Global South. We object to the notion that engineered CDR methods are unproven or unsafe. [OC, 268]

433. Elemental solid carbon (graphite, graphene, diamond, etc.) is widely regarded in the literature as both non-biodegradable and non-photodegradable for thousands of years. These materials are chemically inert in nature. Making sequestration within them an attractive pathway assuming MRV is regularly performed, and an end-of-life protocol is tightly followed to ensure safe recyclability. [RC, 266]

434. Regarding SB005-A02 section 2B, since the use-case is a stationary storage battery, 3rd party MRV – based on industry best practice or as the Article 6.4 SB deems appropriate – will have physical access to the sequestration material because it will reside "above ground". Effectively stacked like blocks at a client site. The material (envisioned as a composite made of roughly 80% graphitic-density-carbon) can also be sent in small batches to various labs for testing to ensure permanence claims. Because sequestration occurs within the material itself, the only risk of reversal is if (1) the material is not as permanent as implied (which can be determined via lab testing and on-site verification) and if (2) the storage blocks are structurally damaged such that they need recycled / replaced (a process that can be controlled internally). [RC, 266]

435. We quote the IPCC and IEA for the roles of removals. We suggest the CDM examples are followed in the roles and functions of these entities: Activity proponent(s), Article 6.4 mechanism Supervisory Body (6.4SB), 6.4 mechanism registry administrator, Host Party, stakeholders. [IEAGHG, 267]

436. A process to store “megaton quantities of atmospheric CO2 in mining waste” is described [BSM,201]

3. References

3.1. Stakeholder inputs

Table 3. Parties that responded to the call for public input

Submission date	Party	Acronym	Reference number	Document URL
22/05/2023	Russian Federation	RU	53	https://shorturl.at/houY5
09/05/2023	United Kingdom	UK	54	https://shorturl.at/cquDS
02/05/2023	Papua New Guinea on behalf of Coalition for Rainforest Nations	PN	55	https://shorturl.at/pACH3
17/04/2023	Norway	NW	56	https://shorturl.at/hjVY0
07/04/2023	Republic of Korea	ROK	57	https://shorturl.at/nMZ24
23/03/2023	Colombia on behalf of Chile, Colombia, Guatemala, Panama, Paraguay, and Peru	CO	58	https://shorturl.at/jwW03
15/03/2023	European Union on behalf of European Union	EU	59	https://shorturl.at/gEY25

Table 4. Stakeholders that responded to the call for public input

Submission date	Stakeholder	Acronym	Reference number	Document URL
04/10/22	Hayes Limnology Lab: Ocean alkalinity enhancement using electrolysis	HLB	1	https://bit.ly/40Cu7kx
06/10/22	Planetary Technologies: Ocean alkalinity methods	PT	2	https://bit.ly/3XadYQB
04/10/22	Hayes Limnology Lab: Ocean alkalinity enhancement using electrolysis	HLB	1	https://bit.ly/40Cu7kx
06/10/22	Planetary Technologies: Ocean alkalinity methods	PT	2	https://bit.ly/3XadYQB

Submission date	Stakeholder	Acronym	Reference number	Document URL
10/10/22	GCC: Inputs on Annex 5 to the SB002 annotated agenda	GCC	4	https://bit.ly/40HbE6A
11/10/22	Winrock: ACR & ART input-6.4 removals public comment	ACR	8	https://bit.ly/3K9v0vp
11/10/22	Wetlands International: Inputs on removal activities	WI	9	https://bit.ly/3YC8lMe
11/10/22	Verdane: Response to UNFCCC Article 6.4 call	VA	10	https://bit.ly/3x4BoMw
11/10/22	TREEO: Review Article 6.4 mechanism	TREEO	11	https://bit.ly/40xawCi
11/10/22	TNC: Removals and REDD-plus	TNC	12	https://bit.ly/3I9SmzB
11/10/22	Timber Finance Initiative: Engineered timber as carbon storage	TFI	13	https://bit.ly/3DNo7vp
11/10/22	The HBAR Foundation: Response of THF to UNFCC Calls for Input on A6.4M	HBAR	14	https://bit.ly/3x7rvxO
11/10/22	Stockholm-Exergi: Contribution by Stockholm Exergi in response to UNFCCC’s Call for input 2022	SE	15	https://bit.ly/3Ia9zsk
11/10/22	Running Tide: Article 6.4 input for ocean-based carbon removal	RT	17	https://bit.ly/40yUYy5
11/10/22	Perspectives: Input on removal activities under A6.4 Mechanisms	PERSP	18	https://bit.ly/3DSjYXr
11/10/22	Orsted: Peatlands and BECCS	OD	19	https://bit.ly/3I5SFeC
11/10/22	Instituto Acao Verde: Deforestation Double Counting	IAV	22	https://bit.ly/3x6y6IF
11/10/22	ICLRC: Response to call for input 2022-Activities involving removals	ICLRC	24	https://bit.ly/3YEn49r
11/10/22	GCCSI: Submission to the A6.4 Supervisory Body Call for Inputs 2022 - SB002-A05	GCCSI	25	https://bit.ly/3x5deRV
11/10/22	Evident C-capsule: Inputs on removal activities	ECP	27	https://bit.ly/3Ih4aa6

Submission date	Stakeholder	Acronym	Reference number	Document URL
11/10/22	Drax: Response to the A6 consultation	DG	29	https://bit.ly/3ljxZH0
11/10/22	DAC Coalition: Recommendations from Direct Air Capture Coalition	DC	30	https://bit.ly/3RKAs9E
11/10/22	Climeworks: Response to the documents regarding removals under Article 6.4	CW	31	https://bit.ly/40CC4Gp
11/10/22	Clean Air Task Force: CATF Article 6.4 Comments	CAT	32	https://bit.ly/3JVyAsH
11/10/22	Cercarbono: Additionality and double counting	CCO	33	https://bit.ly/3DRdqrO
11/10/22	Center for Clean Air Policy: CCAP Submision Annex 5 to the SB002	CCAP	34	https://bit.ly/40JszFp
11/10/22	Carbon Recycling: Contributions to the Information Note document	CR	36	https://bit.ly/3IgnITE
11/10/22	Carbon Finance Labs: UNFCCC Article 6.4 Contribution	CFL	38	https://bit.ly/3HI8yq5
11/10/22	Carbon Engineering: Role of DACCS removal activities	CE	39	https://bit.ly/3YCZzNZ
11/10/22	Carbon Business Council: Inputs on removal activities	CBC	40	https://bit.ly/3x5DD27
11/10/22	CARBFIX: Subsurface mineralization of CO2	CF	41	https://bit.ly/3In9Mjj
11/10/22	BeZeroCarbon: Consultation response	BZC	43	https://bit.ly/3lh7QZs
11/10/22	Bellona: Response to CDR call for input	BF	46	https://bit.ly/3Xl8hPz
11/10/22	Arcusa S: Call for input 2022 - activities involving removals under the Article 6.4 Mechanism	SA	47	https://bit.ly/3XjZ4XQ
11/10/22	ALLCOT: Inputs on Land-Based Removals	ALLCOT	48	https://bit.ly/3xbZcxS
13/10/22	Center for International Environmental Law: CIEL Submission on Article 6.4 Removals (late submission)	CIEL	50	https://bit.ly/3ljtzjA

Submission date	Stakeholder	Acronym	Reference number	Document URL
14/10/22	IETA: Removals input for 6.4SB (late submission)	IETA	51	https://bit.ly/40GSsG8
27/10/22	MDB Working Group comments on the annotated agenda of the third meeting of the Supervisory Body	MDB WG	53	https://bit.ly/3NorLBk
15/03/23	Office of the United Nations High Commissioner for Human Rights (OHCHR) on behalf of The Office of the UN High Commissioner for Human Rights	OHCHR	60	https://shorturl.at/axJPT
10/04/23	Action Group on Erosion Technology and Concentration (ETC group) on behalf of Action Group on Erosion Technology and Concentration (ETC Group)	ETC	61	https://shorturl.at/bezFJ
21/03/23	Oeko-Institut e.V. Institute for Applied Ecology on behalf of Stockholm Environment Institute, University of Edinburgh and Oeko-Institut	OI	62	https://shorturl.at/ciuB7
17/03/23	Bellona Foundation (BF) on behalf of Bellona Foundation	BF	63	https://shorturl.at/girL5
16/03/23	Center for International Environmental Law (CIEL)	CIEL	64	https://shorturl.at/xCVZ5
16/03/23	Heinrich Böll Foundation (HBF)	HBL	65	https://shorturl.at/hFU09
15/03/23	Global Carbon Capture and Storage Institute on behalf of The Global CCS Institute	GCCSI	66	https://shorturl.at/fozV2
15/03/23	LIFE Education Sustainability Equality (LESE) on behalf of Women and Gender	LESE	67	https://shorturl.at/aezSW
15/03/23	Carbon Capture and Storage Association (CCSA)	CCSA	68	https://shorturl.at/RWY57

Submission date	Stakeholder	Acronym	Reference number	Document URL
15/03/23	ActionAid International on behalf of CLARA submission, submitted by ActionAid International	CLARA	69	https://shorturl.at/wFL15
15/03/23	International Emissions Trading Association (IETA)	IETA	70	https://shorturl.at/colX5
15/03/23	WWF	WWF	71	https://shorturl.at/sFRUZ
15/03/23	Institute for Agriculture and Trade Policy (IATP)	IAP	72	https://shorturl.at/aqy27
15/03/23	Friends of the Earth International on behalf of Friends of the Earth International	FoE Int	73	https://rb.gy/fwzn4
15/03/23	Institute for Governance and Sustainable Development (IGSD)	IGSD	74	https://rb.gy/rliin
15/03/23	The University of Texas at Austin	UT	77	https://rb.gy/18qiq
14/03/23	Indigenous Education Network of Turtle Island (IENTI/IEN) on behalf of Indigenous Environmental Network (IEN)	CMW	78	https://rb.gy/03i3m
14/03/23	Carbon Market Watch (CMW) on behalf of Carbon Market Watch (CMW)	CMW	78	https://rb.gy/p2aah
14/03/23	Plymouth Marine Laboratory (PML)	PML	79	https://rb.gy/2kwcr
14/03/23	Environmental Defense Fund (EDF) on behalf of Environmental Defense Fund, Conservation International, The Nature Conservancy, Wetlands International, Rare, Ocean Conservancy, Ocean & Climate Platform, National Wildlife Federation	EDF	80	https://bit.ly/3MU9hHd
20/04/23	Stockholm Exergi	SE	81	https://bit.ly/3NdOa43
31/03/23	Drax Group	DG	82	https://bit.ly/43HiyJJ
27/03/23	Friends of the Earth Germany/ BUND	FoE/BUND	83	https://bit.ly/45QmfyE
22/03/23	Friends of the Earth England, Wales and Northern Ireland	FoE UK	84	https://bit.ly/43Ei3js

Submission date	Stakeholder	Acronym	Reference number	Document URL
17/03/23	Carbon Finance Lab	CFL	85	https://bit.ly/43los3x
17/03/23	AirCapture and Denominator	AD	86	https://bit.ly/3NaOjp6
17/03/23	IEAGHG	IEAGHG	88	https://bit.ly/3OVS1Er
22/05/23	Jack Roberts	JR	89	https://shorturl.at/mqvLU
22/05/23	Jason Demeny	JD	90	https://shorturl.at/cgrJU
22/05/23	Thoralf Gutierrez (Sirona Tech)	TG	91	https://shorturl.at/gv036
22/05/23	Richard Edwards (Clo Carbon Cymru)	Clo	92	https://shorturl.at/moLUZ
22/05/23	Paul Halloran (University of Exeter)	UoEx	93	https://shorturl.at/kwKPT
22/05/23	CarbonRun	CR	94	https://shorturl.at/cST15
22/05/23	Inplanet GmbH	IP	95	https://shorturl.at/xKW89
22/05/23	Prof. Ning Zeng (University of Maryland)	UMD	96	https://shorturl.at/aoMQS
22/05/23	Tim Isaksson	TI	97	https://shorturl.at/cdfTY
22/05/23	Planetary Technologies	PT	98	https://shorturl.at/fyFM3
22/05/23	Paolo Piffaretti (Carbonx)	CX	99	https://shorturl.at/dHRV5
22/05/23	David Andersson (ECOERA AB)	ECOERA	100	https://shorturl.at/xyzDO
22/05/23	Adam (Zopeful Climate)	ZC	101	https://shorturl.at/svZ05
23/05/23	Hanna Ojanen (Carbonculture)	CC	102	https://shorturl.at/efBKL
22/5/2023	Tony S. Hamer (GHG PATS)	PATS	103	https://shorturl.at/ehzN3
23/05/23	Carbon-Based Consulting LLC	CB	104	https://shorturl.at/guLX1
23/05/23	Carbon Removal India Alliance (CRIA)	CRIA	105	https://shorturl.at/ntxFS
23/5/2023	BlueSkies Minerals Inc.	BS	106	https://shorturl.at/cyER8
24/05/23	Carbon Business Council	CBC	107	https://shorturl.at/FRW15
24/05/23	Kaja Voss (Inherit Carbon Solutions AS)	ICS	108	https://shorturl.at/jnL47
24/05/23	Lead authors of the State of Carbon Dioxide Removal Report	SCDRR	109	https://shorturl.at/aDEH1
24/05/23	Cella	CLLA	110	https://shorturl.at/fwIV5
24/05/23	Stockholm Exergi	SE	111	https://shorturl.at/aezDH
24/05/23	Plymouth Marine Laboratory	PML	112	https://shorturl.at/ilV46

Submission date	Stakeholder	Acronym	Reference number	Document URL
24/05/23	Injy Johnstone	IJ	113	https://shorturl.at/tvyU6
24/05/23	OpenAir	OA	114	https://shorturl.at/dgACL
24/05/23	OXO Earth	OXO	115	https://shorturl.at/aqrS5
26/05/23	Keep Our Sea Chemical Free	KOSCF	116	https://shorturl.at/KW458
27/05/23	Marginal Carbon AB	MC	117	https://shorturl.at/hjGR7
24/05/23	Charm Industrial	CI	118	https://shorturl.at/iBFN0
24/05/23	Carbon Finance Labs	CFL	119	https://shorturl.at/egqFK
24/05/23	Dr. Robert Chris	RC	120	https://shorturl.at/gILT7
25/05/23	Stockholm Environment Institute; University of Edinburgh; Oeko-Institut	SEI+	121	https://shorturl.at/aqwU6
27/05/23	Linden Trust for Conservation	LTC	122	https://shorturl.at/eOQV0
28/05/23	Linden Trust for Conservation	LTC	122	https://shorturl.at/eOQV0
25/05/23	1PointFive	1.5	123	https://shorturl.at/guxA4
24/05/23	Seafields	SF	124	https://shorturl.at/tuS04
24/05/23	Microsoft Inc.	MS	125	https://shorturl.at/bsGOV
24/05/23	Climeworks AG	CW	126	https://shorturl.at/nBKSY
27/05/23	Equatic	EQ	127	https://shorturl.at/bINWY
28/05/23	IEAGHG	IEAGHG2	128	https://shorturl.at/vwP49
25/05/23	Business Council for Sustainable Energy	BCSE	129	https://shorturl.at/bitEP
25/05/23	Running Tide	RT	130	https://shorturl.at/lrRY8
25/05/23	Negative Emissions Platform and other co-signatories	NEP	131	https://shorturl.at/HNRWZ
25/05/23	Phil Kithil	PK	132	https://shorturl.at/bzFN2
25/05/23	CCU Alliance	CCU	133	https://shorturl.at/iwKPW
25/05/23	Timber Finance	Tfi	134	https://shorturl.at/lwIJP
25/05/23	Air Capture	AC	135	https://shorturl.at/wFGU6
25/05/23	Mati Carbon Removals	MCR	136	https://shorturl.at/enoGI
20/05/23	Center for Negative Carbon Emissions	CNCE	137	https://shorturl.at/efoKU
25/05/23	CarbonPlan	CP	138	https://shorturl.at/cuHMU
14/05/23	Captura	CC	139	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Captura.pdf

Submission date	Stakeholder	Acronym	Reference number	Document URL
25/05/23	UNDO	UNDO	140	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_UNDO.pdf
25/05/23	Neustark AG	N-AG	141	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_NeustarkAG.pdf
25/05/23	44.01	44.01	142	https://unfccc.int/sites/default/files/resource/SB005_call_for-input_4401.pdf
25/05/23	IETA	IETA	143	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_International%20Emissions%20Trading%20Association%20%28IETA%29.pdf
25/05/23	Carbon Direct.Inc	CD	144	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Carbon%20Direct%20Inc.pdf
25/05/23	The Doers Club	CRDC	145	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Doers%20Club.pdf
25/05/23	Drax Group	DG	146	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Drax%20Group.pdf
25/05/23	Carbfix	CX	147	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Carbfix.pdf
25/05/23	Puro.earth	PE	148	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Puro%20Earth.pdf
25/05/23	CO2RE Hub	CO2RE	149	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_CO2RE%20Hub%20.pdf
25/05/23	Swiss Lenten Fund	SLF	150	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_SwissLenten_Fund.pdf
25/05/23	Coalition for Negative Emissions	CNE	151	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Coalition%20for%20Negative%20Emissions.pdf

Submission date	Stakeholder	Acronym	Reference number	Document URL
25/05/23	Climate Analytics GmbH	CA	152	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Climate%20Analytics%20gGmbH.pdf
25/05/23	Climate Action Platform Africa	CAPA	153	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Climate%20Action%20Platform%20Africa.pdf
25/05/23	The Bioenergy Association of Finland	BEAF	154	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Bioenergy%20Association%20of%20Finland.pdf
25/05/23	Zero Emissions Platform	ZEP	155	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Zero%20Emissions%20Platform.pdf
25/05/23	Leefmilieu	LU	156	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Leefmilieu.pdf
25/05/23	Carbon Gap	CG	157	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_CarbonGap.pdf
25/05/23	Orsted	ORST	158	https://unfccc.int/sites/default/files/resource/SB005-call_for_input_%C3%98rsted.pdf
25/05/23	The Bellona Foundation	BF	159	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_The%20Bellona%20Foundation.pdf
25/05/23	Fern	FERN	160	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Fern.pdf
25/05/23	Carbon Capture and Storage Association	CCSA	161	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Carbon%20Capture%20and%20Storage%20Association.pdf
25/05/23	Dogwood Alliance	DA	162	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_DogWood%20Alliance%20.pdf
25/05/23	CCS+ Initiative	CCSI	163	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_CCS%2B%20Initiative.pdf

Submission date	Stakeholder	Acronym	Reference number	Document URL
25/05/23	Stripe Climate & Shopify	SCS	164	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Stripe%20Climate%20%26%20Shopify.pdf
25/05/23	Carboniferous	CF	165	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Carboniferous.pdf
25/05/23	National Wildlife Federation	NWF	166	https://unfccc.int/sites/default/files/resource/SB005_call_for-input_National%20Wildlife%20Federation.pdf
24/05/23	KLIMPO	KLIMPO	167	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_KLIMPO.pdf
25/05/23	Direct Air Capture Coalition	DACC	168	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Direct%20Air%20Capture%20Coalition.pdf
25/05/23	Octavia Carbon	OC	169	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Octavia%20Carbon.pdf
25/05/23	Aspiration	AN	170	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Aspiration.pdf
25/05/23	Global CCS Institute	GCCSI	171	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Global %20CCS%20Institute.pdf
24/05/23	Carbon Capture Inc.	CCI	172	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_CarbonCapture%20Inc.pdf
25/05/23	Biofuelwatch	BW	173	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Biofuelwatch.pdf
25/05/23	Carbon Capture Coalition	CCC	174	https://unfccc.int/sites/default/files/resource/SB005_call_for-input_Carbon%20Capture%20Coalition.pdf
25/05/23	Environmental Defense Fund	EDF	175	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Environmental%20Defense%20Fund.pdf
24/05/23	Paebbl	PBL	176	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Paebbl.pdf

Submission date	Stakeholder	Acronym	Reference number	Document URL
25/05/23	EFI Foundation	EFIF	177	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_EFI%20Foundation.pdf
25/05/23	Recarb	RB	178	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_EFI%20Foundation.pdf
25/05/23	World Resources Institute	WRI	179	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_World%20Resources%20Institute.pdf
25/05/23	Clean Air Task Force (CATF)	CATF	180	https://unfccc.int/sites/default/files/resource/SB005_call_for_inputCleanAirTaskForceCATF.pdf
24/05/23	Edison Electric Institute (EEI)	EEI	181	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Edison%20Electric%20Institute%20%28EEI%29.pdf
25/05/23	Ocean Visions	OV	182	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Ocean%20Visions.pdf
25/05/23	John M. Fitzgerald	JF	183	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_JohnMFitzgerald.pdf
26/05/23	Prof. William R Moomaw (Tufts University)	WRM	184	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Prof%20William%20R%20Moomaw%20Tufts%20University.pdf
26/05/23	PD Forum	PD-F	185	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_PD%20Forum.pdf
25/05/23	CIBOLA Partners	CP	186	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_CIBOLA%20PARTNERS%20v2.pdf
25/05/23	Heirloom	HM	187	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Heirloom.pdf
25/05/23	Perspectives Climate Research GmbH	PERSP	188	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Perspectives%20Climate%20Research.pdf

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25/05/23	Carbon Engineering	CE	189	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Carbon%20Engineering.pdf
26/05/23	Boston Consulting Group	BCG	190	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Boston%20Consulting%20Group.pdf
25/05/23	Mary S. Boot, Partnership for Policy Integrity and Chad Hansen, John Muir Project	PPI	191	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_MaryBooth_ChadHansen.pdf
25/05/23	Nasdaq Stockholm	NSQ	192	https://unfccc.int/sites/default/files/resource/SB005_call_for_input_Nasdaq%20Inc..pdf
09/06/23	Michael Hayes	MHS	200	https://unfccc.int/sites/default/files/resource/MichaelHayes.pdf
12/06/23	Blueskiesminerals.inc	BSM	201	https://unfccc.int/sites/default/files/resource/BlueSkiesMinerals.pdf
14/06/23	Seal Research Trust	SRT	202	https://unfccc.int/sites/default/files/resource/SealResearchTrust.pdf
15/06/23	CarbonRun	CR	203	https://unfccc.int/sites/default/files/resource/CarbonRun.pdf
15/06/23	Roberto Rochadelli (fupef)	RBI	204	https://unfccc.int/sites/default/files/resource/RobertoRochadelli.pdf
15/06/23	Sky Harvest Carbon (Will Clayton)	SHC	205	https://unfccc.int/sites/default/files/resource/Sky_Harvest_Carbon.pdf
15/06/23	NovoCarbo	NC	206	https://unfccc.int/sites/default/files/resource/Novocarbo.pdf
15/06/23	Capture6	CAP	207	https://unfccc.int/sites/default/files/resource/Capture6.pdf
16/06/23	Finnwatch	FNW	208	https://unfccc.int/sites/default/files/resource/Finnwatch.pdf
16/06/23	ECOERA	ECOERA	209	https://unfccc.int/sites/default/files/resource/ECOERA.pdf
16/06/23	OpenAir	OAIR	210	https://unfccc.int/sites/default/files/resource/OpenAir.pdf

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16/06/23	Carbon Business Council	CBC	211	https://unfccc.int/sites/default/files/resource/CarbonBusinessCouncil.pdf
16/06/23	Rick Berg (Nori.inc)	NORI	212	https://unfccc.int/sites/default/files/resource/NoriInc.pdf
16/06/23	Thomas Hoffmann (Decarbo Engineering GmbH)	THN	213	https://unfccc.int/sites/default/files/resource/DecarboEngineering.pdf
16/06/23	Timber Finance	TFI	214	https://unfccc.int/sites/default/files/resource/TimberFinance.pdf
16/06/23	CarbonPool	CPOOL	215	https://unfccc.int/sites/default/files/resource/CarbonPool.pdf!
17/06/23	OceanForesters	OF	216	https://unfccc.int/sites/default/files/resource/OceanForesters.pdf
17/06/23	Takachar	TAK	217	https://unfccc.int/sites/default/files/resource/Takachar.pdf
18/06/23	Carbo Culture	CCE	218	https://unfccc.int/sites/default/files/resource/CarboCulture.pdf
18/06/23	Rewind.earth	REW	219	https://unfccc.int/sites/default/files/resource/Rewindearth.pdf
18/06/23	Clean Air Tech Limited	CAT	220	https://unfccc.int/sites/default/files/resource/CleanAirTech.pdf
18/06/23	Elitelco	ELI	221	https://unfccc.int/sites/default/files/resource/Elitelco.pdf
18/06/23	Otherlab	OLAB	222	https://unfccc.int/sites/default/files/resource/Otherlab.pdf
18/06/23	Carbon Click, S.A. de C.V	CCL	223	https://unfccc.int/sites/default/files/resource/CarbonClick.pdf
19/06/23	Arca	ARC	224	https://unfccc.int/sites/default/files/resource/Arca.pdf
19/06/23	AirMiners	AMN	225	https://unfccc.int/sites/default/files/resource/AirMiners.pdf
19/06/23	Seaweed Generation	SWG	226	https://unfccc.int/sites/default/files/resource/SeaweedGeneration.pdf
19/06/23	Max Planck Institute for Biogeochemistry	MPI	227	https://unfccc.int/sites/default/files/resource/MaxPlanckInstitute.pdf

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19/06/23	Carbon Mineralization Flagship Center	CNF	228	https://unfccc.int/sites/default/files/resource/CarbonMineralizationCenter.pdf
19/06/23	Green East Master Ltd	GEM	229	https://unfccc.int/sites/default/files/resource/GreenEastMaster%2C.pdf
19/06/23	The Charles Darwin Rescue Plan	CDR	230	https://unfccc.int/sites/default/files/resource/CharlesDarwinRescuePlan.pdf
19/06/23	International Biochar Initiative	IBI	231	https://unfccc.int/sites/default/files/resource/InternationalBiocharInitiative.pdf
19/06/23	CarbonHemp Blo.Inc	CHB	232	https://unfccc.int/sites/default/files/resource/CarbonHempBlockchain.pdf
19/06/23	CCS+ Initiative	CCSI	233	https://unfccc.int/sites/default/files/resource/CCS%2BInitiative.pdf
19/06/23	Microsoft	MS	234	https://unfccc.int/sites/default/files/resource/Microsoft.pdf
19/06/23	ecoLocked GmbH	ELG	235	https://unfccc.int/sites/default/files/resource/EcoLocked.pdf
19/06/23	University of Hamburg	UoH	236	https://unfccc.int/sites/default/files/resource/UniversityHamburg.pdf
19/06/23	German Biochar Association	GBA	237	https://unfccc.int/sites/default/files/resource/GermanBiocharAssociation.pdf
19/06/23	Omega Terraform	OT	238	https://unfccc.int/sites/default/files/resource/OmegaTerraform.pdf
19/06/23	Carbon Lockdown Project	CLP	239	https://unfccc.int/sites/default/files/resource/CarbonLockdownProject.pdf
19/06/23	Carbofex Oy	CFO	240	https://shorturl.at/ghkV5
19/06/23	Everest Carbon Inc	ECI	241	https://shorturl.at/eBES3
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19/06/23	CROPS Carbon International LTD	CROPS	243	https://shorturl.at/qGMRV
19/06/23	Stockholm Exergi	SE	244	https://shorturl.at/aeCMY
19/06/23	Carbonfuture	CFUT	245	https://shorturl.at/uMOQT
19/06/23	C-Capsule	CCAP	246	https://shorturl.at/luJK3
19/06/23	Captura	CC	247	https://shorturl.at/cKS28
19/06/23	44.01	44.01	248	https://shorturl.at/qBQW3

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19/06/23	XPRIZE	XPZ	249	https://shorturl.at/dpPS1
19/06/23	Skyrenu Technologies	STECH	250	https://shorturl.at/dALNU
19/06/23	Carbuna AG	CAG	251	
19/06/23	The Bellona Foundation	BF	252	https://shorturl.at/dmrCF
19/06/23	Noya PBC	NPBC	253	https://shorturl.at/dvHV8
19/06/23	Equatic	EQ	254	https://shorturl.at/xV078
19/06/23	IATA and Airbus	IATA	255	https://shorturl.at/avwNP
19/06/23	Rivotto	RTTO	256	https://shorturl.at/avxV7
19/06/23	U.S. Biochar Coalition	USBC	257	https://shorturl.at/adlGL
19/06/23	FEWCOOP SA	FEWCOOP	258	https://shorturl.at/eqHK4
19/06/23	Cella Mineral Storage, Inc	CLLA	259	https://shorturl.at/hnBUV
19/06/23	Rethinking Removals Doers Club	RRDC	260	https://shorturl.at/uIVY9
19/06/23	Eyob Tenkir Shikur	ETS	261	https://shorturl.at/iCOY2
19/06/23	Kita	KITA	262	https://shorturl.at/pqxK7
19/06/23	The Zero Emissions Platform	ZEP	263	https://unfccc.int/sites/default/files/resource/Kita.pdf
19/06/23	Black Bull Biochar (BBB)	BBB	264	https://unfccc.int/sites/default/files/resource/ZeroEmissionsPlatform.pdf
19/06/23	DEMOcritUS	DEMO	265	https://unfccc.int/sites/default/files/resource/BlackBullBiochar.pdf
19/06/23	RedCarbon	RC	266	https://unfccc.int/sites/default/files/resource/RedCarbon.pdf
19/06/23	IEAGHG	IEAGHG	267	https://unfccc.int/sites/default/files/resource/IEAGHG.pdf
19/06/23	Octavia Carbon	OC	268	https://unfccc.int/sites/default/files/resource/OctaviaCarbon.pdf
19/06/23	Carbon Gap	CG	269	https://unfccc.int/sites/default/files/resource/CarbonGap.pdf
19/06/23	John M. Fitzgerald	JMF	270	https://unfccc.int/sites/default/files/resource/JohnM_Fitzgerald.pdf
19/06/23	Drax Group Plc	DG	271	https://unfccc.int/sites/default/files/resource/DraxCorporateLimited.pdf

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19/06/23	ARCTECH USA	AU	272	https://unfccc.int/sites/default/files/resource/ARCTECH.pdf
19/06/23	Mati Carbon Removals	MCR	273	https://unfccc.int/sites/default/files/resource/MatiCarbonRemovals.pdf
19/06/23	Direct Air Capture Coalition	DACC	274	https://unfccc.int/sites/default/files/resource/DirectAirCaptureCoalition.pdf
19/06/23	Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science	GRI/LSE	275	https://unfccc.int/sites/default/files/resource/GranthamResearchInstituteonClimateChangeandtheEnvironment.pdf
19/06/23	Sitos Group, Inc	SGI	276	https://unfccc.int/sites/default/files/resource/SitosGroup.pdf
19/06/23	Crown Monkey	CM	277	https://unfccc.int/sites/default/files/resource/CrownMonkey.pdf
19/06/23	Jim Ransom	JR	278	https://unfccc.int/sites/default/files/resource/Jim_Ransom_TeamIOB.pdf
19/06/23	Terrra	TERRA	279	https://unfccc.int/sites/default/files/resource/Terrra.pdf
19/06/23	The European Biochar Industry Consortium	EBIC	280	https://unfccc.int/sites/default/files/resource/EuropeanBiocharIndustryConsortium.pdf
19/06/23	Inventive Resources, Inc	IRI	281	https://unfccc.int/sites/default/files/resource/InventiveResources.pdf
19/06/23	STX	STX	282	https://unfccc.int/sites/default/files/resource/STX.pdf
20/06/23	HBAR Foundation	HBAR	283	https://unfccc.int/sites/default/files/resource/HBAR_Foundation.pdf
20/06/23	Inversion Point Technologies Ltd	IPT	284	https://unfccc.int/sites/default/files/resource/InversionPointTechnologies.pdf
20/06/23	Oeko-Institut, Greenhouse Gas Management Institute, Stockholm Environment Institute, University of Edinburgh Business School, Infras, Carbon Limits, and Calyx Global	OI	285	https://unfccc.int/sites/default/files/resource/Oeko-Institut_GGMI_SEI.pdf

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20/06/23	remove	ROVE	286	https://unfccc.int/sites/default/files/resource/remove.pdf
20/06/23	Carbon Capture and Storage Association	CCSA	287	https://unfccc.int/sites/default/files/resource/CarbonCapture_StorageAssociation.pdf
20/06/23	Running Tide	RT	288	https://unfccc.int/sites/default/files/resource/RunningTide.pdf
20/06/23	ActionAid International	AAI	289	https://unfccc.int/sites/default/files/resource/ClimateLandAmbitionandRightsAlliance.pdf
20/06/23	Carbon Recycling	CRCY	290	https://unfccc.int/sites/default/files/resource/Carbon_Recycling.pdf
20/06/23	Planboo	PBOO	291	https://unfccc.int/sites/default/files/resource/Planboo.pdf
20/06/23	Spark Climate Solutions	SCL	292	https://unfccc.int/sites/default/files/resource/SparkClimateSolutions.pdf
20/06/23	From the Ground Up	FGU	293	https://unfccc.int/sites/default/files/resource/FromTheGroundUp.pdf
20/06/23	TecnoFiltro SCS	TFSCS	294	https://unfccc.int/sites/default/files/resource/TecnoFiltro%20SCS.pdf
20/06/23	Planetary Technologies	PT	295	https://unfccc.int/sites/default/files/resource/Planetary_Technologies_Kelland.pdf
20/06/23	Levitree, Inc	LVI	296	https://unfccc.int/sites/default/files/resource/Levitree.pdf
20/06/23	Partanna	PNNA	297	https://unfccc.int/sites/default/files/resource/Partanna.pdf
20/06/23	Earth's Blue Aura	EBA	298	https://unfccc.int/sites/default/files/resource/EBA.pdf
20/06/23	Greg H. Rau	GHR	299	https://unfccc.int/sites/default/files/resource/Planetary_Technologies_Rau.pdf
20/06/23	Daniel Schwaag	DS	300	https://unfccc.int/sites/default/files/resource/Made_of_Air.pdf
20/06/23	JPMorgan Chase & Co	JPM	301	https://unfccc.int/sites/default/files/resource/JPMorgan_Chase.pdf
20/06/23	Climeworks	CWORKS	302	https://shorturl.at/fxRV7

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20/06/23	International Coordinating Council of Aerospace Industries Associations	ICCAIA	303	https://shorturl.at/cAQ37
21/06/23	Ted Christie-Miller (BeZERO)	BEZERO	304	https://shorturl.at/ilG12
21/06/23	Sylvera	SYRA	305	https://unfccc.int/sites/default/files/resource/Sylvera.pdf
22/06/23	Pachama	PACHA	306	https://unfccc.int/sites/default/files/resource/Pachama.pdf
22/06/23	Conservation International	CI	307	https://unfccc.int/sites/default/files/resource/ConservationInternational.pdf
23/06/23	Carbon Market Watch	CMW	308	https://shorturl.at/quG36
24/06/23	Austrian Biomass Corbonisation Society	ABCS	309	https://shorturl.at/xPWY2
25/06/23	PYREG GmbH	PYREG	310	https://shorturl.at/uILV6
26/06/23	IETA	IETA	311	https://shorturl.at/kuwCY
23/06/23	Climate Analytics	CA	312	https://shorturl.at/klLTU
27/06/23	south pole	SP	313	https://shorturl.at/yEF69
29/06/23	Global CCS Institute	GCCSI	314	https://shorturl.at/dZ479
19/06/23	Carbon Capture Machine	CCM	315	https://shorturl.at/cfrT1

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Document information

Version	*Date*	*Description*
01.0	5 July 2023	Published as a late annex to the annotated agenda of SB 006.

Decision Class: Operational, Regulatory
Document Type: Information note
Business Function: Methodology
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Related documents:

4 July 2023	A6.4-SB006-AA-A14- Information note: Draft elements for the recommendation on activities involving removals (version 01.0)
3 June 2023	A6.4-SB005-A02 – Information note: Guidance and questions for further work on removals (version 02.0)

17 May 2023	A6.4-SB005-AA-A09 – Information note: Removal activities under the Article 6.4 mechanism (version 04.0)
17 May 2023	A6.4-SB005-AA-A10 – Information note: Summary of the views submitted by Parties and observers on activities involving removals (version 01.0)
10 March 2023	A6.4-SB004-A02 - Information note: Guidance and questions for further work on removals (v.01.0)
28 February 2023	A6.4-SB004-AA-A04 - *Information note*: Removal activities under the Article 6.4 mechanism (version 3.0)
07 November 2022	A6.4-SB003-A03 - *Recommendation:* Activities involving removals under the Article 6.4 mechanism (version 1.0)
25 October 2022	A6.4-SB003-AA-A03 - *Draft recommendation*: Removal activities under the Article 6.4 mechanism (version 2.0) A6.4-SB003-AA-A04 - *Information note*: Removal activities under the Article 6.4 mechanism (version 2.0)
15 September 2022	A6.4-SB002-AA-A05 - *Draft recommendation*: Requirements for the development and assessment of mechanism methodologies pertaining to activities involving removals (version 1.0) A6.4-SB002-AA-A06 - *Information note*: Removal activities under the Article 6.4 mechanism (version 1.0)
08 July 2022	A6.4-SB001-AA-A05 - *Concept note*: Removal activities under the Article 6.4 Mechanism (version 1.0)