

## Summary of suggested LCIA-based midpoint indicators and calculation methods

Indicator name and Info Sheet link	Key impact	Spatial scope	Area of protection	Midpoint LCIA calculation method*	Units	Uncertainty in results (relative)	Consensus on choice of method	Relevance – NZ supply chain	Relevance – global supply chain
						Low = +ve	High = +ve	High = +ve	High = +ve
<a href="#">Global warming potential</a> (100 year) (GWP100)	Climate change	Global	Human and ecosystem health	For EN 15804 EPDs IPCC (2013)	kg CO <sub>2</sub> eq. (100 year)	Low	High	High	High
<a href="#">Stratospheric ozone depletion potential</a> (ODP)	Depletion of the ozone layer	Global	Human and ecosystem health	CML	kg CFC-11 eq.	Low	High	Low <sup>1</sup>	Low
<a href="#">Acidification</a> (land and water) potential (AP)	Acid rain	Local	Ecosystem health	CML	kg SO <sub>2</sub> eq.	Moderate	Moderate	Low	High
<a href="#">Eutrophication potential</a> (EP)	Algal blooms	Local	Ecosystem health	CML	kg PO <sub>4</sub> <sup>3-</sup> eq.	Moderate	Moderate	High	High
<a href="#">Photochemical ozone creation potential</a> (POCP)	Summer smog	Local	Human and ecosystem health	CML (high NO <sub>x</sub> )	kg C <sub>2</sub> H <sub>4</sub> eq.	Moderate	Moderate	Low	High
Abiotic depletion potential – elements (ADPE)	Mineral resource depletion	Global	Natural resources	CML	kg Sb eq.	Moderate	Moderate	Moderate	Moderate
Abiotic depletion potential – fossil fuels (ADPF)	Fossil resource depletion	Global	Natural resources	CML	MJ	Low	High	Moderate	High
Particulate matter formation potential (PMFP)	Respiratory problems	Local	Human health	RiskPoll	kg PM <sub>2.5</sub> eq.	Low	High	High	High
<a href="#">Water scarcity footprint</a> (WSF)	Water shortages	Local	Natural resources	AWARE or Water Stress Indicator	TBC	TBC	TBC	TBC	TBC
Toxicity potential – human health (cancer) (HTPC)	Health problems	Local	Human health	USEtox 2.0	CTUh	High	High	Moderate	High
Toxicity potential – human health (non-cancer) (HTPNC)	Health problems	Local	Human health	USEtox 2.0	CTUh	High	High	Moderate	High
Toxicity potential –ecosystems (ETP)	Ecosystem damage	Local	Ecosystem health	USEtox 2.0	CTUeco	High	High	High	High
<a href="#">Land transformation potential</a> (LTP)	Land competition and ecosystem damage	All	Natural resources and ecosystem health	Frischknecht and Jungbluth (2007) or LANCA	m <sup>2</sup>	Moderate	Moderate	High	High
Ionising radiation potential (IRP)	Health problems	Local	Human health	ReCiPe 1.08 Midpoint	kg U-235 eq.	Moderate	Moderate	Low	Moderate

\* The methods given provide a placeholder until an information sheet is provided to confirm the method

## References

CML-IA is a database that contains characterisation factors for life cycle impact assessment (LCIA). <https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors>  
 The database contains the characterisation factors for all baseline characterisation methods mentioned in the [Handbook on LCA](#), Guinée, J.B., Gorrée, M., Heijungs, R., Huppes, G., Kleijn R., van Oers, L., Wegener Sleeswijk, A., Suh, S., Udo de Haes, H.A., de Bruijn, H., van Duin, R. & Huijbregts, M.A.J. (2002). Life Cycle Assessment: An operational guide to the ISO standards, Volume 1, 2 and 3. Centre of Environmental Science Leiden University, Leiden, The Netherlands

Indicator name	Reference
GWP100	Forster P, Ramaswamy V, Artaxo P, Bernsten T, Betts R, Fahey DW, Haywood J, Lean J, Lowe DC, Myhre G, Nganga J, Prinn R, Raga G, Schulz M and Van Dorland R (2007). Changes in Atmospheric Constituents and in Radiative Forcing; Climate Change 2007: The Physical Science Basis –Contribution of Working Group I to the Fourth Assessment Report of the IPCC <a href="http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html">http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html</a> IPCC (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp. IPCC AR5 <a href="https://www.ipcc.ch/report/ar5/">https://www.ipcc.ch/report/ar5/</a>
ODP	World Meteorological Organization, Scientific (WMO) (1999). Assessment of Ozone Depletion, 1998, Global Ozone Research and Monitoring Project - Report No. 44, ISBN 92-807-1722-7, Geneva. World Meteorological Organization, 2010. Scientific Assessment of ozone Depletion: 2010. <a href="https://www.wmo.int/pages/prog/arep/gaw/ozone_2010/documents/Ozone-Assessment-2010-complete.pdf">https://www.wmo.int/pages/prog/arep/gaw/ozone_2010/documents/Ozone-Assessment-2010-complete.pdf</a>
AP and EP	Huijbregts, M. (1999). Life cycle Impact assessment of acidifying and eutrophying air pollutants. Calculation of equivalency factors with RAINS-LCA. Interfaculty Department of Environmental Science, Faculty of Environmental Science, University of Amsterdam. <a href="https://media.leidenuniv.nl/legacy/Life-cycle%20impact%20assessment.pdf">https://media.leidenuniv.nl/legacy/Life-cycle%20impact%20assessment.pdf</a>
POCP	Jenkin ME and Hayman GD (1999). Photochemical ozone creation potentials for oxygenated volatile organic compounds: sensitivity to variations in kinetic and mechanistic parameters. Atmospheric Environment 33(8), pgs1275-1293 <a href="https://www.researchgate.net/publication/225089665_Photochemical_ozone_creation_potentials_for_oxygenated_volatile_organic_compounds_Sensitivity_to_variations_in_kinetic_and_mechanistic_parameters">https://www.researchgate.net/publication/225089665_Photochemical_ozone_creation_potentials_for_oxygenated_volatile_organic_compounds_Sensitivity_to_variations_in_kinetic_and_mechanistic_parameters</a> and Derwent RG, Jenkin ME, Saunders SM & Pilling MJ (1998). Photochemical ozone creation potentials for organic compounds in Northwest Europe calculated with a master chemical mechanism; Atmospheric Environment, 32. Pgs 2429-2441 <a href="https://www.researchgate.net/publication/240399604_Photochemical_Ozone_Creation_Potentials_for_Organic_Compounds_in_Northwest_Europe_Calculated_with_a_Master_Chemical_Mechanism">https://www.researchgate.net/publication/240399604_Photochemical_Ozone_Creation_Potentials_for_Organic_Compounds_in_Northwest_Europe_Calculated_with_a_Master_Chemical_Mechanism</a>
ADPE and ADPF	Guinee <i>et al.</i> , 2002 <a href="http://www.cml.leiden.edu/research/industrialecology/researchprojects/finished/new-dutch-lca-guide.html">http://www.cml.leiden.edu/research/industrialecology/researchprojects/finished/new-dutch-lca-guide.html</a>
PMFP	Rabl A & Spadaro JV (2004). The RiskPoll software, version 1.051 (dated 19 Feb 2016) <a href="http://www.arirabl.org/software/spadarorabl04-metals.pdf">http://www.arirabl.org/software/spadarorabl04-metals.pdf</a> and <a href="http://www.arirabl.org/software/">http://www.arirabl.org/software/</a>
WSF	AWARE (part of WULCA) <a href="http://www.wulca-waterlca.org/">http://www.wulca-waterlca.org/</a> or Water Stress Indicator. Brown, A., Matlock, M. D., 2011. A Review of Water Scarcity Indices and Methodologies. White Paper # 106. Prepared for the Sustainability Consortium. <a href="https://www.sustainabilityconsortium.org/wp-content/themes/sustainability/assets/pdf/whitepapers/2011_Brown_Matlock_Water-Availability-Assessment-Indices-and-Methodologies-Lit-Review.pdf">https://www.sustainabilityconsortium.org/wp-content/themes/sustainability/assets/pdf/whitepapers/2011_Brown_Matlock_Water-Availability-Assessment-Indices-and-Methodologies-Lit-Review.pdf</a>
HTPC, HTPNC and ETP	Fantke, P.E., Huijbregts, M.A.J., Margni, M., Hauschild, M.Z., Jolliet, O., Mckone, T.E., Rosenbaum, R.K., Van De Meent, D. (2015). USEtox 2.0 User Manual (Version 2). <a href="http://www.usetox.org/">http://www.usetox.org/</a> . Rosenbaum, R. K., Bachmann, T. M., Swirsky Gold, L., Huijbregts, M., Jolliet, O., Juraske, R., . . . Hauschild, M. Z. (2008). USEtox—the UNEP-SETAC toxicity model: recommended characterisation factors for human toxicity and freshwater ecotoxicity in life cycle impact assessment. Int J Life Cycle Assess, 13(7), 532–546. <a href="https://www.researchgate.net/publication/49458514">https://www.researchgate.net/publication/49458514</a>
LTP	Frischknecht, R., & Jungbluth, N. (2007). Ecoinvent: overview and methodology. Dübendorf: Swiss Centre for Life Cycle Inventories. <a href="https://www.ecoinvent.org/files/200712_frischknecht_jungbluth_overview_methodology_ecoinvent2.pdf">https://www.ecoinvent.org/files/200712_frischknecht_jungbluth_overview_methodology_ecoinvent2.pdf</a> or Bos, U., Horn, R., Beck, T., Lindner, J., Fischer, M., Fraunhofer IBP (2016). LANCA: Characterization Factors for Life Cycle Impact Assessment, Version 2.0, Stuttgart ISBN 978-3-8396-0953-8
IRP	Frischknecht, R., Braunschweig, A., Hofstetter, P. & Suter, P. (2000). Modelling human health effects of radioactive releases in life cycle impact assessment. Environ Impact Assess Rev 20, 159-189. <a href="http://esu-services.ch/fileadmin/download/frischknecht-2000-HumanHealth.pdf">http://esu-services.ch/fileadmin/download/frischknecht-2000-HumanHealth.pdf</a> Huijbregts, M., 2016. ReCiPe2016: a harmonised life cycle impact assessment method at midpoint and endpoint level <a href="https://www.researchgate.net/profile/Francesca_Verones/publication/311630890_ReCiPe2016_a_harmonised_life_cycle_impact_assessment_method_at_midpoint_and_endpoint_level/links/58552d8d08aeff086bf90c0d/ReCiPe2016-a-harmonised-life-cycle-impact-assessment-method-at-midpoint-and-endpoint-level.pdf?origin=publication_detail">https://www.researchgate.net/profile/Francesca_Verones/publication/311630890_ReCiPe2016_a_harmonised_life_cycle_impact_assessment_method_at_midpoint_and_endpoint_level/links/58552d8d08aeff086bf90c0d/ReCiPe2016-a-harmonised-life-cycle-impact-assessment-method-at-midpoint-and-endpoint-level.pdf?origin=publication_detail</a>

## Justifications

<sup>1</sup> Required under EN 15804 but, almost all ozone depleting substances of relevance have been banned under the Montreal Protocol for many years and are completely phased out