

Life Cycle Assessment of Substitutive Building Materials for Landfill Capping Systems in Vietnam

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Functional Unit for different landfill capping layers used in the study

Landfill Layers Functional Unit		
Landfill Sample Area	1 hectare / 10000 m ²	<i>Volume-based on Depth</i>
Depth of Mineral Sealing Layer	0.6m	6000 m ³

Comparing product stages; Method: ReCiPe 2016 Midpoint (H) V1.04 / World (2010) H / Characterization

Impact category	Unit	Quartz Sand - Concrete	Quartz Sand Rund - Concrete	Basalt Sand - Concrete	Granite Sand - Concrete	Marble Sand - Concrete
Global warming	kg CO2 eq	4.04E+2	3.71E+2	3.69E+2	3.46E+2	4.34E+2
Stratospheric ozone depletion	kg CFC11 eq	5.03E-5	4.7E-5	5.96E-5	5.61E-5	6.33E-5
Ionizing radiation	kBq Co-60 eq	2.7	2.5	2.53	2.37	2.9
Ozone formation, Human health	kg NOx eq	0.84	0.78	0.78	0.74	0.9
Fine particulate matter formation	kg PM2.5 eq	0.28	0.26	0.26	0.25	0.3
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.85	0.79	0.79	0.74	0.91

Terrestrial acidification	kg SO2 eq	0.73	0.67	0.68	0.64	0.78
Freshwater eutrophication	kg P eq	0.04	0.04	0.04	0.04	0.05
Marine eutrophication	kg N eq	3.76E-3	3.47E-3	3.49E-3	3.27E-3	4.07E-3
Terrestrial ecotoxicity	kg 1,4-DCB	5.06E+2	4.91E+2	5.17E+2	4.87E+2	5.36E+2
Freshwater ecotoxicity	kg 1,4-DCB	5.51	5.12	5.2	4.88	5.93
Marine ecotoxicity	kg 1,4-DCB	7.46	6.94	7.05	6.61	8.02
Human carcinogenic toxicity	kg 1,4-DCB	4.51	4.22	4.32	4.05	4.85
Human non-carcinogenic toxicity	kg 1,4-DCB	1.48E+2	1.38E+2	1.39E+2	1.3E+2	1.59E+2
Land use	m2a crop eq	45.83	42.24	80.03	75.41	79.68
Mineral resource scarcity	kg Cu eq	4.38	4.01	3.98	3.73	39.41
Fossil resource scarcity	kg oil eq	40.81	38.05	38.48	36.1	43.7
Water consumption	m3	3.12	3.2	3.64	3.45	3.22

Comparing product stages; Method: Cumulative Energy Demand V1.11 / Cumulative energy demand / Characterization

Impact category	Unit	Quartz Sand - Concrete	Quartz Sand Rund - Concrete	Basalt Sand - Concrete	Granite Sand - Concrete	Marble Sand - Concrete
Non renewable, fossil	MJ	1.88E+3	1.75E+3	1.77E+3	1.66E+3	2.01E+3
Non-renewable, nuclear	MJ	40.64	37.62	37.94	35.57	43.75
Non-renewable, biomass	MJ	0.38	0.35	0.35	0.33	0.41
Renewable, biomass	MJ	36.38	33.49	33.68	31.57	39.33
Renewable, wind, solar, geother	MJ	7.28	6.7	6.69	6.27	7.82
Renewable, water	MJ	84.04	78.16	79.11	74.21	90.02