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Comparison of 2021 and 2017 Soil Remediation Standards for the Inhalation Exposure Pathway

Contaminant	CAS No.	2017 Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2017 Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)
Acenaphthene	83-32-9	NA	NA ¹	300,000	NA ¹
Acenaphthylene	208-96-8	NA	NR	300,000	NR
Acetone (2-Propanone)	67-64-1	NA	NA ¹	NA	NA ¹
Acetophenone	98-86-2	2	NA ¹	5	NA ¹
Acrolein	107-02-8	0.5	NR	1	NR
Acrylonitrile	107-13-1	0.9	NR	3	NR
Aldrin	309-00-2	5	NA ¹	14	NA ¹
Aluminum (total)	7429-90-5	NA	NA ²	NA	NA ²
Anthracene	120-12-7	380,000	NA ¹	30,000	NA ¹
Antimony (total)	7440-36-0	360,000	NA ¹	23,000	NA ¹
Arsenic (total)	7440-38-2	980	1,100	76	5,200
Atrazine	1912-24-9	NA	NA ¹	NA	NA ¹
Barium (total)	7440-39-3	910,000	870,000	59,000	NA ²
Benzaldehyde	100-52-7	NA	NA ¹	NA	NA ¹
Benzene	71-43-2	2	2.2	5	11
Benzidine	92-87-5	0.004	NR	0.01	NR
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	71,000	78,000 ⁴	5,500	370,000 ⁴
Benzo(a)pyrene	50-32-8	3,600	3,500 ⁴	230	16,000 ⁴
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	71,000	78,000 ⁴	5,500	370,000 ⁴
Benzo(ghi)perylene	191-24-2	380,000	NR	30,000	NR
Benzo(k)fluoranthene	207-08-9	710,000	780,000 ⁴	55,000	NA ^{2,3}
Beryllium	7440-41-7	1,800	2,000	140	9,300
1,1'-Biphenyl	92-52-4	NA	NA ¹	140,000	NA ¹
Bis(2-chloroethoxy)methane	111-91-1	NR	NA ¹	NR	NA ¹

Contaminant	CAS No.	2017 Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2017 Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)
Bis(2-chloroethyl)ether	111-44-4	0.6	NA ¹	2	NA ¹
Bis(2-ethylhexyl)phthalate	117-81-7	NA	NA ¹	140,000	NA ¹
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1	NA ¹	3	NA ¹
Bromoform	75-25-2	98	NA ¹	280	NA ¹
Bromomethane (Methyl bromide)	74-83-9	25	18	59	82
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	NA ^{2,3}	NA	NA ^{2,3}
Butylbenzyl phthalate	85-68-7	NA	NA ¹	NA	NA ¹
Cadmium	7440-43-9	1,000	2,600	78	12,000
Caprolactam	105-60-2	NA	290	NA	1,300
Carbazole	86-74-8	740,000	NR	58,000	NR
Carbon disulfide	75-15-0	NA	NA ^{2,3}	NA	NA ^{2,3}
Carbon tetrachloride	56-23-5	2	1.4	4	6.9
Chlordane (alpha and gamma forms summed)	57-74-9	42,000	NA ^{2,3}	3,300	NA ^{2,3}
4-Chloroaniline	106-47-8	NR	NA ¹	NR	NA ¹
Chlorobenzene	108-90-7	NA	NA ^{2,3}	NA	NA ^{2,3}
Chloroethane (Ethyl chloride)	75-00-3	NA	NA ^{2,3}	NA	NA ^{2,3}
Chloroform	67-66-3	0.6	590	2	NA ^{2,3}
Chloromethane (Methyl chloride)	74-87-3	4	270	12	1,200
2-Chloronaphthalene	91-58-7	NR	NA ¹	NR	NA ¹
2-Chlorophenol (o-Chlorophenol)	95-57-8	910	NA ¹	2,200	NA ¹
Chrysene	218-01-9	NA	NA ^{2,3}	550,000	NA ^{2,3}
Cobalt (total)	7440-48-4	9,100	520	590	2,500
Copper (total)	7440-50-8	NA	NA ¹	280,000	NA ¹
Cyanide	57-12-5	NA	NA ²	260,000	NA ²
Cyclohexane	110-82-7	NR	NA ^{2,3}	NR	NA ^{2,3}
4,4'-DDD (p,p'-TDE)	72-54-8	61,000	NA ¹	4,800	NA ¹
4,4'-DDE (p,p'-DDX)	72-55-9	670	NA ¹	3,400	NA ¹
4,4'-DDT	50-29-3	44,000	NA ¹	3,400	NA ¹
Dibenz(a,h)anthracene	53-70-3	7,100	7,800 ⁴	550	37,000 ⁴
Dibromochloromethane (Chlorodibromomethane)	124-48-1	3	NA ¹	8	NA ¹

Contaminant	CAS No.	2017 Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2017 Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)
1,2-Dibromo-3-chloropropane	96-12-8	0.08	0.026	0.2	0.12
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.1	0.085	0.3	0.41
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	NA ^{2,3}	NA	NA ^{2,3}
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA	NA ¹	NA	NA ¹
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	5	NA ^{2,3}	13	NA ^{2,3}
3,3'-Dichlorobenzidine	91-94-1	3	NA ¹	960	NA ¹
Dichlorodifluoromethane (Freon 12)	75-71-8	490	NA ¹	NA	NA ¹
1,1-Dichloroethane	75-34-3	8	NA ¹	24	NA ¹
1,2-Dichloroethane	107-06-2	0.9	71	3	320
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	61	52	150	240
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	230	NA ¹	560	NA ¹
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	300	NA ¹	720	NA ¹
2,4-Dichlorophenol	120-83-2	NA	NA ¹	NA	NA ¹
1,2-Dichloropropane	78-87-5	2	5.7	5	27
1,3-Dichloropropene (total)	542-75-6	2	4.8	7	23
Dieldrin	60-57-1	1	NA ¹	3	NA ¹
Diethylphthalate	84-66-2	NA	NA ¹	NA	NA ¹
2,4-Dimethylphenol	105-67-9	NA	NA ¹	NA	NA ¹
Di-n-butyl phthalate	84-74-2	NA	NA ¹	NA	NA ¹
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	730,000	NR	47,000	NR
2,4-Dinitrophenol	51-28-5	NA	NA ¹	820,000	NA ¹
2,4-Dinitrotoluene	121-14-2	6	NR	16	NR
2,6-Dinitrotoluene	606-20-2	2	NR	7	NR
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	NA	NA ¹	NA	NA ¹
Di-n-octyl phthalate	117-84-0	NA	NA ¹	NA	NA ¹
1,4-Dioxane	123-91-1	NR	45	NR	210
1,2-Diphenylhydrazine	122-66-7	5	NR	13	NR
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA	NA ¹	NA	NA ¹
Endosulfan Sulfate	1031-07-8	NA	NR	NA	NR

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Endrin	72-20-8	NA	NA ¹	120,000	NA ¹
Ethylbenzene	100-41-4	NA	10	NA	48
Extractable Petroleum Hydrocarbons (No. 2 Fuel Oil and Diesel)	various	NR	NA ¹	NR	NA ¹
Extractable Petroleum Hydrocarbons (Other)	various	NR	NA ¹	NR	NA ¹
Fluoranthene	206-44-0	NA	NA ¹	300,000	NA ¹
Fluorene	86-73-7	NA	NA	300,000	NA ¹
alpha-HCH (alpha-BHC)	319-84-6	0.7	NA ¹	2	NA ¹
beta-HCH (beta-BHC)	319-85-7	8,000	NA ¹	620	NA ¹
Heptachlor	76-44-8	6	NA ¹	18	NA ¹
Heptachlor epoxide	1024-57-3	5	NA ¹	13	NA ¹
Hexachlorobenzene	118-74-1	1	NA ¹	4	NA ¹
Hexachloro-1,3-butadiene	87-68-3	12	NA ¹	35	NA ¹
Hexachlorocyclopentadiene	77-47-4	45	2.7	110	NA ^{2,3}
Hexachloroethane	67-72-1	NA	NA ^{2,3}	10,200	NA ^{2,3}
n-Hexane	110-54-3	NR	NA ^{2,3}	NR	NA ^{2,3}
2-Hexanone	591-78-6	NR	1,000	NR	NA ^{2,3}
Indeno(1,2,3-cd)pyrene	193-39-5	71,000	78,000 ⁴	5,500	370,000 ⁴
Isophorone	78-59-1	NA	NA ^{2,3}	NA	NA ^{2,3}
Isopropylbenzene	98-82-8	NR	NA ^{2,3}	NR	NA ^{2,3}
Lead (total)	7439-92-1	44,000	NA ¹	12,000	NA ¹
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	3	NA ¹	10	NA ¹
Manganese (total)	7439-96-5	91,000	87,000	5,900	400,000
Mercury (total)	7439-97-6	27	520,000 ⁴	65	NA ^{2,3}
Methoxychlor	72-43-5	NA	NA ¹	NA	NA ¹
Methyl acetate	79-20-9	NA	NA ¹	NA	NA ¹
Methylene chloride (Dichloromethane)	75-09-2	1,600	1,400	NA	NA ^{2,3}
2-Methylnaphthalene	91-57-6	NA	NA ¹	300,000	NA ¹
4-Methyl-2-pentanone (MIBK)	108-10-1	NR	NA ^{2,3}	NR	NA ^{2,3}
2-Methylphenol (o-cresol)	95-48-7	NA	NA ¹	NA	NA ¹

Contaminant	CAS No.	2017 Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2017 Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)
4-Methylphenol (p-cresol)	106-44-5	NA	NA ¹	NA	NA ¹
Methyl tert-butyl ether (MTBE)	1634-04-4	110	140	320	650
Naphthalene	91-20-3	6	5.7	17	27
Nickel (total)	7440-02-0	360,000	20,000	23,000	93,000
2-Nitroaniline	88-74-4	39	NR	23,000	NR
4-Nitroaniline	100-01-6	NR	NA ^{2,3}	NR	NA ^{2,3}
Nitrobenzene	98-95-3	5	7.5	14	36
N-Nitrosodimethylamine	62-75-9	0.02	NR	0.05	NR
N-Nitrosodi-n-propylamine	621-64-7	0.2	NA ¹	0.5	NA ¹
N-Nitrosodiphenylamine	86-30-6	NA	NA ¹	130,000	NA ¹
2,2'-oxybis(1-chloropropane)	108-60-1	23	NA ¹	67	NA ¹
Pentachlorophenol	87-86-5	590	NA ¹	1,700	NA ¹
Phenanthrene	85-01-8	NA	NR	300,000	NR
Phenol	108-95-2	NA	39,000	NA	NA ^{2,3}
Polychlorinated biphenyls (PCBs)	1336-36-3	20	NA ¹	57	NA ¹
Pyrene	129-00-0	NA	NA ¹	300,000	NA ¹
Selenium (total)	7782-49-2	NA	NA ¹	NA	NA ¹
Silver (total)	7440-22-4	NA	NA ¹	NA	NA ¹
Styrene	100-42-5	90	NA ^{2,3}	260	NA ^{2,3}
Tertiary butyl alcohol (TBA)	75-65-0	4,800	NA ¹	11,000	NA ¹
1,2,4,5-Tetrachlorobenzene	95-94-3	NR	NA ¹	NR	NA ¹
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NR	NA ¹	NR	NA ¹
1,1,2,2-Tetrachloroethane	79-34-5	1	NA ¹	3	NA ¹
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	43	47	NA	NA ^{2,3}
2,3,4,6-Tetrachlorophenol	58-90-2	NR	NA ¹	NR	NA ¹
Toluene	108-88-3	NA	NA ^{2,3}	NA	NA ^{2,3}
Toxaphene	8001-35-2	70	NA ¹	200	NA ¹
1,2,4-Trichlorobenzene	120-82-1	NA	94	NA	NA ^{2,3}
1,1,1-Trichloroethane	71-55-6	22,000	NA ^{2,3}	NA	NA ^{2,3}
1,1,2-Trichloroethane	79-00-5	2	NA ¹	6	NA ¹

Contaminant	CAS No.	2017 Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2017 Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)	2021 Adopted Non-Residential Soil Remediation Standard for the Soil Inhalation Exposure Pathway (mg/kg)
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	3	3.0	10	14
Trichlorofluoromethane (Freon 11)	75-69-4	NA	NA ¹	NA	NA ¹
2,4,5-Trichlorophenol	95-95-4	NA	NA ¹	NA	NA ¹
2,4,6-Trichlorophenol	88-06-2	340	NA ¹	960	NA ¹
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NR	NA ^{2,3}	NR	NA ^{2,3}
1,2,4-Trimethylbenzene	95-63-6	NR	NA ^{2,3}	NR	NA ^{2,3}
Vanadium (total)	7440-62-2	NA	170,000	470,000	800,000
Vinyl chloride	75-01-4	0.7	1.4	2	6.4
Xylenes (total)	1330-20-7	NA	NA ^{2,3}	NA	NA ^{2,3}
Zinc (total)	7440-66-6	NA	NA ¹	110,000	NA ¹

NA = Not Available/Applicable

NR = Not Regulated

1 – Appropriate toxicological information not available

2 – Health-based criterion exceeds one million parts per million

3 – Exceeds soil saturation limit

4– Exceeds soil saturation limit; however, human health-based criterion based on particulate portion of the equation

Soil Remediation Standards -Soil Inhalation Exposure Pathway - Residential Exposure Scenario

2017 soil remediation standard existed but no 2021 soil remediation standard was proposed	14		
		11	2017 numeric soil remediation standard existed but 2021 adopted soil remediation standard is "NA"
		3	2017 soil remediation standard was "NA" and a 2021 numeric soil remediation standard adopted
2021 soil remediation standard was adopted but no 2017 soil remediation standard existed	17		
		2	2021 numeric soil remediation standard adopted
		15	2021 adopted soil remediation standard is "NA"
2017 soil remediation standard existed and a 2021 soil remediation standard adopted	121		
		44	2017 soil remediation standard was "NA "and 2021 adopted soil remediation standard is "NA"
		5	2017 soil remediation standard was "NA" and a 2021 numeric soil remediation standard adopted
		39	2017 numeric soil remediation standard existed but 2021 adopted soil remediation standard is "NA"
		13	2021 adopted numeric soil remediation standard is less than the 2017 soil remediation standard
		1	2021 adopted numeric soil remediation standard is equal to the 2017 soil remediation standard
		19	2021 adopted numeric soil remediation standard is greater than the2017 soil remediation standard

10 - Difference is less than an order of magnitude
3 - Difference is an order of magnitude or greater

Soil Remediation Standards -Soil Inhalation Exposure Pathway - Non-Residential Exposure Scenario

2017 soil remediation standard existed but no 2021 soil remediation standard was proposed	14	13	2017 numeric soil remediation standard existed but 2021 adopted soil remediation standard is
		1	2017 soil remediation standard was "NA" and a 2021 numeric soil remediation standard
2021 soil remediation standard was adopted but no 2017 soil remediation standard existed	17	1	2021 numeric soil remediation standard adopted
		16	2021 adopted soil remediation standard is "NA"
2017 soil remediation standard existed and a 2021 soil remediation standard adopted	121		
	35		2017 soil remediation standard was "NA "and 2021 adopted soil remediation standard is "NA"
	2		2017 soil remediation standard was "NA" and a 2021 numeric soil remediation standard adopted
	57		2017 numeric soil remediation standard existed but 2021 adopted soil remediation standard is "NA"
	1		2021 adopted numeric soil remediation standard is less than the 2017 soil remediation standard
			10 - Difference is less than an order of magnitude
			3 - Difference is an order of magnitude or greater
	0		2021 adopted numeric soil remediation standard is equal to the 2017 soil remediation standard
		26	2021 adopted numeric soil remediation standard is greater than the 2017 soil remediation standard

**Order of Magnitude Contaminants - Soil ingestion - Dermal and Soil Inhalation Exposure Pathways'
Residential Exposure Scenario**

Contaminant	CAS #	2017 soil remediation standard (mg/kg)	2021 adopted soil remediation standard (mg/kg)
Benzaldehyde	100-52-7	6,100 (ingestion-dermal)	170 (ingestion-dermal)
Caprolactam	105-60-2	31,000 (ingestion-dermal)	290 (inhalation)
Cobalt (total)	7440-48-4	1,600 (ingestion-dermal)	23 (ingestion-dermal)*
Cobalt (total)	7440-48-4	9,100 (inhalation)	520 (inhalation)*
Ethylbenzene	100-41-4	7,800 (ingestion-dermal)	10 (inhalation)
Hexachlorocyclopentadiene	77-47-4	45 (inhalation)	2.7 (inhalation)
Nickel (total)	7440-02-0	360,000 (inhalation)	20,000 (inhalation)**

* ingestion-dermal is the driving exposure pathway for cobalt

**ingestion-dermal is the driving exposure pathway for nickel (1,600 mg/kg)

† Given that the former direct contact soil remediation standards were based on the lower of the ingestion-dermal or inhalation exposure pathway, both are provided in the order of magnitude evaluation

**Order of Magnitude Contaminants - Soil ingestion - Dermal and Soil Inhalation Exposure Pathways
Non-Residential Exposure Scenario**

Contaminant	CAS #	2017 soil remediation standard (mg/kg)	2021 adopted soil remediation standard (mg/kg)
Benzaldehyde	100-52-7	68,000 (ingestion-dermal)	910 (ingestion-dermal)
Butylbenzyl phthalate	85-68-7	14,000 (ingestion-dermal)	1,300 (ingestion-dermal)
Caprolactam	105-60-2	340,000 (ingestion-dermal)	1,300 (inhalation)
Cobalt (total)	7440-48-4	23,000 (ingestion-dermal)	390 (ingestion-dermal)*
Ethylbenzene	100-41-4	110,000 (ingestion-dermal)	48 (inhalation)
1,1-Dichloroethane	75-34-3	7,400 (ingestion-dermal)	640 (ingestion-dermal)**

* The 2017 driving soil remediation standard for cobalt was for the soil inhalation exposure pathway (590 mg/kg). The 2021 adopted soil remediation for cobalt for the soil inhalation exposure pathway is 2,500 mg/kg. The 2021 adopted soil remediation standard for cobalt for the soil ingestion-dermal exposure pathway is 390 mg/kg. While the 390 mg/kg soil remediation standard for cobalt is the driving standard, it is not more than an order of magnitude lower than the 2017 soil inhalation exposure pathway remediation standard for cobalt. As such, the order of magnitude trigger is not applicable.

** The 2017 driving soil remediation standard for 1,1-dichloroethane was for the soil inhalation exposure pathway (24 mg/kg). The 2021 adopted soil remediation for 1,1-dichloroethane for the soil inhalation exposure pathway is "not applicable". As such, the 2021 adopted soil remediation standard for 1,1-dichloroethane (640 mg/kg) for the soil ingestion-dermal exposure pathway becomes the default soil remediation standard. While there is more than an order of magnitude difference between the prior ingestion-dermal soil criterion and adopted ingestion-dermal soil remediation standard, the order of magnitude provision is not applicable.

† Given that the former direct contact soil remediation standards were based on the lower of the ingestion-dermal or inhalation exposure pathway, both are provided in the order of magnitude evaluation