



# Order of Magnitude Evaluation Guidance

## Version 2.0 (May 2021)

### 1. Introduction

Order of magnitude provisions are established by the Brownfield and Contaminated Site Remediation Act (Brownfield Act), N.J.S.A. 58:10B-12j and 13e, and are implemented through several provisions of the Technical Requirements for Site Remediation (Technical Requirements, N.J.A.C. 7:26E).

### 2. Applicability

#### Surface Water Remediation Standards

There are no surface water remediation standards impacted by an order of magnitude or more decrease in a surface water remediation standard. Therefore, an Order of Magnitude evaluation does not need to be conducted.

#### Ground Water Remediation Standards

Ground water quality standards were first deemed ground water remediation standards by reference in the Technical Requirements effective February 3, 2003. The ground water quality standards in effect at that time were the January 7, 1993 Ground Water Quality Standards. The Ground Water Quality Standards were amended effective November 7, 2005. The amended ground water quality standards became the new ground water remediation standards effective November 7, 2005. The ground water remediation standards of 14 contaminants decreased by an order of magnitude or more. (See Table 1 below)

**Table 1. Summary of November 7, 2005 Order of Magnitude Changes to the Ground Water Quality Standards (GWQS) – Class IIA Ground water**

Constituent	CASRN	Prior GWQS ug/l*	11/7/2005 GWQS
Acrylonitrile	107-13-1	50	2**
Adipates (Di(2-ethylhexyl)adipate) (DEHA)	103-23-1	400	30
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	10	0.2**
Beryllium	7440-41-7	20	1
Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7	30	3**
Dibromochloromethane (Chlorodibromomethane)	124-48-1	10	1**
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	1	0.02
Hexachlorobenzene	118-74-1	10	0.02**
Indeno (1,2,3-cd)pyrene	193-39-5	10	0.2**
Methanol	67-56-1	50,000	4,000
N-Nitrosodimethylamine	62-75-9	20	0.8**



Constituent	CASRN	Prior GWQS ug/l*	11/7/2005 GWQS
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.01	0.00001**
1,1,1,2-Tetrachloroethane	630-20-6	10	1
1,2,3-Trichloropropane	96-18-4	2	0.03**

\* ug/l = micrograms per liter

\*\* ground water standard is based on the Practical Quantitation Level (PQL) (health-based criterion is less than the PQL)

The remediation of all sites or areas of concern that are active cases on or after November 7, 2005 is required to use the ground water remediation standards in effect November 7, 2005 for the contaminants listed in Table 1.

Any site or area of concern at which any of the contaminants listed in Table 1 was detected in ground water, and for which a No Further Action (NFA) letter was issued by the Department prior to May 8, 2006 (six months after November 7, 2005 amendments), requires an Order of Magnitude evaluation conducted pursuant to the Brownfield Act at N.J.S.A. 58:10B-13e.

On November 25, 2015, the Department established interim specific ground water quality standards for 12 contaminants. No prior ground water quality standards existed for 11 of the contaminants. The remaining contaminant, 1,4-dioxane, had a prior interim specific ground water quality standard (10 ug/l) based on the practical quantitation level. The 10 ug/l interim ground water quality standard was established on February 11, 2008. The revised interim specific ground water quality standard (0.4 ug/l) was more than an order of magnitude lower than the previous interim specific ground water quality standard.

The remediation of all sites or areas of concern that are active cases on or after November 25, 2015 is required to use the 0.4 ug/l ground water remediation standard for 1,4-dioxane.

Any site or area of concern at which 1,4-dioxane was detected in ground water and for which a final remediation document was issued (either an NFA determination issued by the Department or a Response Action Outcome ) issued by the retained licensed site remediation professional (LSRP)] prior to May 26, 2016 (six months after November 7, 2005 amendments) requires an Order of Magnitude evaluation conducted pursuant to the Brownfield Act at N.J.S.A. 58:10B-13e.

On January 16, 2018, the Department adopted amendments to incorporate interim specific ground water quality criteria, interim practical quantitation levels (PQLs), and interim standards for 23 ground water contaminants as specific ground water quality criteria, PQLs, and standards. These amendments did not trigger the need for Order of Magnitude evaluations.



### **Indoor Air Remediation Standards (Vapor Intrusion Exposure Pathway)**

On May 17, 2021, the Department adopted amended [Remediation Standards](#) rules at N.J.A.C. 7:26D which included indoor air remediation standards for the first time.

The only indoor air remediation standard impacted by an order of magnitude or more decrease of an indoor air screening level is that of 1,1-dichloroethene. The change in the indoor air remediation standard for 1,1-dichloroethene [from 210 micrograms per cubic meter ( $\text{ug}/\text{m}^3$ ) (as a screening level) to 21  $\text{ug}/\text{m}^3$  (as a remediation standard) residential and 880  $\text{ug}/\text{m}^3$  (as a screening level) to 88  $\text{ug}/\text{m}^3$  (as a remediation standard) nonresidential] occurred on May 17, 2021. The remediation of all sites or areas of concern that are active cases on or after May 17, 2021 is required to use the 21  $\text{ug}/\text{m}^3$  (residential) and 88  $\text{ug}/\text{m}^3$  (nonresidential) indoor air remediation standards for 1,1-dichloroethene.

Any site or area of concern at which 1,1-dichloroethene was detected in indoor air and that was issued a final remediation document prior to November 18, 2021 (six months after the May 17, 2021 amendments) requires an Order of Magnitude evaluation conducted pursuant to the Brownfield Act at N.J.S.A. 58:10B-13e.

### **Soil Leachate Remediation Standards (Migration to Ground Water Exposure Pathway)**

On May 17, 2021, the Department adopted amended [Remediation Standards](#) rules at N.J.A.C. 7:26D which included default soil leachate remediation standards for the first time.

There are no soil leachate remediation standards impacted by an order of magnitude or more decrease in a soil leachate screening level. Therefore, an Order of Magnitude evaluation does not need to be conducted.

### **Soil Remediation Standards (Soil-Water Partition Equation - Migration to Ground Water Exposure Pathway)**

On May 17, 2021, the Department adopted amended [Remediation Standards](#) rules at N.J.A.C. 7:26D which included default soil remediation standards using the soil-water partition equation for the migration to ground water exposure pathway for the first time.

Contaminants with soil remediation standards determined using the soil-water partition equation that are impacted by an order of magnitude or more decrease of the soil screening level using the soil-water partition equation are listed in Table 2 below.



**Table 2.**

Contaminant	CAS #	2013 former soil-water partition screening level (mg/kg)* (impact to ground water)	2021 soil-water partition standard (mg/kg) (migration to ground water)
Bis(2-ethylhexyl)phthalate	117-81-7	1,200	14
Copper (total)	7440-50-8	11,000	910
4,4'-DDE (p,p'-DDX)	72-55-9	18	0.47
4,4'-DDT	50-29-3	11	0.67
Hexachlorocyclopentadiene	77-47-4	320	2.5

\* mg/kg = milligrams per kilogram

The new migration to ground water soil-water partition remediation standards became effective as of May 17, 2021. The remediation of all sites or areas of concern that are active cases on or after May 17, 2021 are required to use the 2021 soil-water partition equation soil remediation standards for the contaminants in Table 2.

Any site or area of concern at which any of the contaminants listed in Table 2 were detected in soil and that was issued a final remediation document prior to November 18, 2021 (six months after the May 17, 2021 amendments) requires an Order of Magnitude evaluation conducted pursuant to the Brownfield Act at N.J.S.A. 58:10B-13e.

**Soil Remediation Standards (Ingestion-Dermal and Inhalation Exposure Pathways)**

On May 17, 2021, the Department adopted amended [Remediation Standards](#) rules at N.J.A.C. 7:26D which included amended soil remediation standards for the soil ingestion-dermal and soil inhalation exposure pathways.

Contaminants with soil remediation standards impacted by an order of magnitude or more decrease of the soil ingestion-dermal remediation standards and/or soil inhalation remediation standards are listed in Tables 3 (residential exposure scenario) and 4 (nonresidential exposure scenario) below.



**Table 3 Residential Exposure Scenario**

Contaminant	CAS #	Prior 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)
Ethylbenzene	100-41-4	7,800 (ingestion-dermal)	10 (inhalation)
Hexachlorocyclopentadiene	77-47-4	45 (inhalation)	2.7 (inhalation)

**Table 4 Nonresidential Exposure Scenario**

Contaminant	CAS #	Prior 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)
Ethylbenzene	100-41-4	110,000 (ingestion-dermal)	48 (inhalation)

The new soil remediation standards listed in Tables 3 and 4 became effective as of May 17, 2021. The remediation of all sites or areas of concern that are active cases on or after May 17, 2021, are required to use the 2021 soil-water partition equation soil remediation standards for the contaminants noted in Tables 3 and 4.

In addition to the contaminants listed in Tables 3 and 4, prior rulemaking activities triggered order of magnitude changes in soil remediation standards for the ingestion-dermal and inhalation exposure pathways as described below.

On June 2, 2008, the Department adopted new Remediation Standards rules at N.J.A.C. 7:26D. The soil remediation standards contained in those rules were effective on June 2, 2008. Compared to the Soil Cleanup Criteria (which were used as site-specific soil remediation standards), 12 contaminants were impacted by a decrease in the adopted remediation standard by an order of magnitude or more.



On September 18, 2017, the Department updated the soil remediation standards for 19 contaminants, three of which were impacted by a decrease in the updated remediation standard by an order of magnitude or more.

Also, increases in standard concentrations of several contaminants have resulted in contaminants no longer being subject to order of magnitude provisions.

Taking these changes into consideration, any site or area of concern at which any of the contaminants listed in Table 5 below were detected in soils and that were issued a final remediation document during the dates listed in Table 5 requires an Order of Magnitude evaluation conducted pursuant to the Brownfield Act at N.J.S.A. 58:10B-13e.

**Table 5**

<p><b>Contaminants subject to Order of Magnitude evaluation - Final remediation documents issued prior to November 18, 2021*</b></p>	<p><b>Ethylbenzene Hexachlorocyclopentadiene (Residential only)</b></p>
<p><b>Contaminants subject to Order of Magnitude evaluation- Final remediation documents issued between June 2, 2008** and November 17, 2021***</b></p>	<p><b>Benzaldehyde Butylbenzylphthalate (Nonresidential only) Caprolactam Cobalt (Residential only)</b></p>
<p><b>Contaminant subject to Order of Magnitude evaluation- Final remediation documents issued between June 2, 2008 and March 18, 2018****</b></p>	<p><b>1,1'-Biphenyl</b></p>
<p><b>Contaminant subject to Order of Magnitude evaluation - Final remediation documents issued prior to March 19, 2018*****</b></p>	<p><b>Cyanide</b></p>
<p><b>Contaminants subject to Order of Magnitude evaluation - Final remediation documents issued prior to December 3, 2008*****</b></p>	<p><b>Bromomethane (Nonresidential only) 4-Chloroaniline Dibromochloromethane Naphthalene Nitrobenzene (Nonresidential only)</b></p>



\* = This date is the first day after the six-month phase in period from the effective date of the most recent amendments of the Remediation Standards (N.J.A.C. 7:26D)

\*\* = This date is the effective date of the initial adoption of the Remediation Standards (N.J.A.C. 7:26D)

\*\*\* = This date is the last day of the six-month phase in period from the effective date of the most recent amendments of the Remediation Standards (N.J.A.C. 7:26D)

\*\*\*\* = This date is the last day of the six-month phase in period from the effective date of the September 18, 2017, updates to the Remediation Standards (N.J.A.C. 7:26D)

\*\*\*\*\* = This date is the first day after the six-month phase in period from the effective date of the September 18, 2017, updates to the Remediation Standards (N.J.A.C. 7:26D)

\*\*\*\*\* = This date is the first day after the six-month phase in period from effective date of the initial adoption of the Remediation Standards (N.J.A.C. 7:26D)

**3. Under what conditions would the Department compel additional remediation because a new soil remediation standard decreases by an order of magnitude or more?**

**a. Sites or areas of concern with a Department-approved or LSRP-certified Remedial Action Work Plan or Remedial Action Report but no Final Remediation Document has been issued.**

- (1) The Order of Magnitude evaluation applies to the contaminants identified in section 2 ("Applicability") above.
- (2) An evaluation is needed to determine the protectiveness of the proposed or the implemented remedy relative to the new remediation standards.
- (3) If the remedy is not protective to the new remediation standard, additional remediation will be required.
- (4) If the proposed or implemented remedy will be or continues to be protective, no additional remediation would be needed. Contamination, as defined by the new remediation standard(s), would need to be accurately reflected in the deed notice.

**b. For sites or areas of concern with a final remediation document:**

- (1) The Order of Magnitude evaluation applies to the contaminants listed in section 2 above if the concentration of a contaminant present at the site or area of concern is greater, by an order of magnitude or more, than the new remediation standard.



- (2) An evaluation is needed to determine the protectiveness of the implemented remedy.
- (3) If the remedy is not protective to the new remediation standard, additional remediation will be required.
- (4) If the remedy continues to be protective, no additional remediation would be needed. Contamination, as defined by the new remediation standard(s), would need to be accurately reflected in the deed notice.

#### **4. When will the Department require the Order of Magnitude evaluation?**

##### **a. Sites or areas of concern with a Department-approved or LSRP-certified Remedial Action Work Plan or Remedial Action Report, but no Final Remediation Document has been issued.**

As these sites or areas of concern are active cases, the Department will require the person responsible for conducting the remediation to conduct the Order of Magnitude evaluation and perform any additional remediation pursuant to the Technical Requirements at N.J.A.C. 7:26E-5.1(d)4 prior to the issuance of a Final Remediation Document.

##### **b. Sites or areas of concern with a Final Remediation Document**

###### **(1) Sites with engineering and/or institutional controls**

The person responsible for maintaining the engineering and/or institutional control must perform the Order of Magnitude evaluation as part of the biennial protectiveness certification pursuant to the Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C-7.

###### **(2) Sites without engineering and/or institutional controls**

The Order of Magnitude evaluation will be conducted whenever a site “re-enters” the Site Remediation Program (i.e., an ISRA trigger, child-care facility license renewal, property sale that requires update of site conditions for loan approval, etc.). The evaluation shall be conducted pursuant to the Technical Requirements, N.J.A.C. 7:26E-3.2(a)5 and 6.