

Remediation Site Scope of Pollution Survey, Environmental Impact Assessment, and Cleanup Priority Ranking Regulations

Promulgated by Environmental Protection Administration order on May 7, 2003.

Article 1

These Regulations are determined pursuant to Article 12, Paragraph 4 of the Soil and Groundwater Pollution Remediation Act.

Article 2

Terms used in these Regulations are defined as follows:

1. Survey of the scope of pollution: means surveying the distribution and scope of soil and groundwater pollution at a remediation site
2. Environmental impact assessment: means assessing the remediation site's hazardousness for public health and the living environment including soil pollution pathway assessment, groundwater pollution pathway assessment and surface water pollution pathway assessment.
3. Cleanup priority ranking assessment: means to assess a remediation site's priority order for using the Soil Pollution and Groundwater Pollution Remediation Fund when performing remediation in accordance with environmental impact assessment results.

Article 3

For a survey of the scope of a remediation site's pollution the central competent authority shall fill out the following basic information:

1. Site name
2. Site location
3. Site owner and relevant information
4. Land use zoning categories within one kilometer of the site
5. Site layout plan
6. Has the pollution source been cleaned up?
7. Description of pollution source
8. Survey of scope of soil pollution
9. Survey of scope of groundwater pollution
10. Survey of scope of surface water pollution

The remediation site's basic information in the foregoing paragraph is provided in Table 1.

Article 4

For the survey of the scope of soil pollution the survey method and survey period, soil sampling locations and the number of sampling points, the sampling frequency, and testing items shall be planned based on the site's soil properties and pollutant characteristics.

After completion of the survey, a map of the scope of the soil pollution survey shall be drawn and on the map the scope of the site, the number of sampling points, the sampling point location, the sampling depth and the pollution scope shall be marked. When necessary, a note shall be added about the

pollution sources and their scope.

Article 5

For the survey of the scope of groundwater pollution the survey method and survey period, the location, depth and number of water quality monitoring wells, the sampling frequency, and the testing items shall be planned based on the site's hydrogeological properties and pollutant characteristics.

After completion of the survey, a hydrogeological cross-section map and a map of the scope of the groundwater pollution survey shall be drawn in accordance with the following regulations:

1. The hydrogeological cross-section map shall show the groundwater table and the type (unconfined, confined, leaky), depth, thickness, geographical properties, and hydraulic conductivity of all polluted aquifers. If there are pollution sources, a note shall be added about the location and scope of the pollution sources.
2. The map of the scope of the groundwater pollution survey must mark the site area, number of monitoring well points, monitoring well location, sampling depth, and maximum concentration distribution range. Also defined must be the groundwater flow direction, flow speed, type (unconfined, confined, leaky) and hydraulic conductivity of all polluted aquifers. When necessary, a note shall be added about the pollution sources and their scope.

Article 6

For those remediation sites that are located within a certain distance of competent authority officially announced drinking water intake points the pollution conditions of surface water bodies within the officially announced area must be surveyed.

Article 7

The soil pollution pathway impact grade of these Regulations includes the grade for the degree of pollution (SL_1) the grade for land use conditions within the scope of pollution (SL_2) and the pollutant hazardousness grade (SL_3).

The soil pollution pathway total score (SL) = $SL_1 \times SL_2 \times SL_3 / 1500$, SL may reach a maximum of 100 points

The calculation formula in the foregoing paragraph is provided in Table 2.

Article 8

The groundwater pollution pathway impact grade of these Regulations includes the grade for the degree of pollution (GW_1), the grade for land use conditions within the scope of pollution (GW_2), and the pollutant hazardousness grade (GW_3).

The groundwater pollution pathway total score (GW) = $GW_1 \times GW_2 \times GW_3 / 15000$, GW may reach a maximum of 100 points

The calculation formula in the foregoing paragraph is provided in Table 3.

Article 9

The surface water pollution pathway impact grade of these Regulations includes the grade for the degree of pollution (SW_1), the grade for land use conditions within the scope of pollution (SW_2) and the pollutant hazardousness grade (SW_3) .

The surface water pollution pathway total score (SW) = $SW_1 \times SW_2 \times SW_3 / 3000$, SW may reach a maximum of 50 points

The calculation formula in the foregoing paragraph is provided in Table 4.

Article 10

All types of pollution pathway impact grades of these Regulations shall be calculated in accordance with the results of the survey of the remediation site's scope of pollution.

Article 11

The cleanup priority ranking grade of these Regulations includes the soil pollution pathway total score (*SL*), groundwater pollution pathway total score (*GW*) and surface pollution pathway total score (*SW*):

$$\text{Cleanup priority ranking total score (TOL)} = \sqrt{\frac{(\text{SL})^2 + (\text{GW})^2 + (\text{SW})^2}{3}}$$

The calculation formula in the foregoing paragraph is provided in Table 5.

Article 12

The cleanup priority ranking assessment of these Regulations shall evaluate the priority order pursuant to the following regulations:

1. The cleanup priority ranking total score of Article 11, Paragraph 2
2. The groundwater pollution pathway total score of Article 8, Paragraph 2
3. The soil pollution pathway total score of Article 7, Paragraph 2
4. The surface water pollution pathway total score of Article 9, Paragraph 2

Remediation sites with an identical surface water pollution pathway total score in the foregoing paragraph shall have an identical priority order.

Article 13

Depending on the needs of an individual site the central competent authority may adjust the priority order for using the Soil Pollution and Groundwater Pollution Remediation Fund in the foregoing paragraph in consideration of the remediation site's damage to society and the economy, its harm to the natural environment, its cultural impact and post-remediation benefits after review by the Soil Pollution and Groundwater Pollution Remediation Fund Management Committee.

Article 14

The central competent authority review the methods for surveys of the scope of pollution may every two years, environmental impact assessments, and cleanup priority ranking assessments.

Article 15

These regulations shall take effect on the date of promulgation.

Table 1 Table of Basic Remediation Site Information

Site name	
Site location	Address: _____ Land lot number: _____ Land use zone and type: _____
Site owner and relevant information	Name (company name and name of statutory responsible person): _____ I.D. card number (business registration certificate): _____ Contact telephone number: _____ Mobile phone number: _____ FAX: _____ Contact address: _____ Household register address: _____
Land use zoning categories within one kilometer of the site	A cadastral map must be submitted and the land use zoning category and circumstances of actual use must be described <If space provided in this column is not sufficient, please add another sheet of paper >
Site layout plan	<If space provided in this column is not sufficient, please add another sheet of paper >
Has the pollution source been cleaned up?	<input type="checkbox"/> No, not yet cleaned up. Please directly fill out Item 7. <input type="checkbox"/> Yes, already cleaned up. Please directly fill out Item 8.
Description of pollution source	<If space provided in this column is not sufficient, please add another sheet of paper >

Table 1 Table of Basic Remediation Site Information (continued)

Survey of soil and groundwater pollution within the site		
Survey of scope of soil pollution	The map of the scope of the soil pollution survey	<p>The following items must be included:</p> <ul style="list-style-type: none"> Site area Number of sampling points, point location (Note 1), sampling depth Maximum concentration distribution scope If there are pollution sources a note about their location (Note 1) and scope must be added
Rough estimate of polluted soil volume (see for reference map of the scope of the soil pollution survey)	<p>Polluted soil area: _____ (m²)</p> <p>Average depth of polluted soil: _____ (m)</p> <p>Polluted soil volume: _____ (m³)</p>	
Pollutant name and maximum pollutant concentration	<p>Pollutant name: _____ Maximum concentration (mg /kg) :</p> <p>_____</p> <p>Pollutant name: _____ Maximum concentration (mg /kg) :</p> <p>_____</p> <p>Pollutant name: _____ Maximum concentration (mg /kg) :</p> <p>_____</p> <p>Pollutant name: _____ Maximum concentration (mg /kg) :</p> <p>_____</p> <p><If space provided in this column is not sufficient, please add another sheet of paper ></p>	
Survey of scope of groundwater pollution	Hydrogeological cross-section map	<p>The following items must be included:</p> <ul style="list-style-type: none"> Groundwater water table The type of all aquifers (unconfined, confined, leaky) The aquifers' distribution depth, geological properties, hydraulic conductivity or transmissivity If there are pollution sources a note about their location (Note 1) and scope must be added A map of the scope of the groundwater pollution survey must be submitted
Map of the scope of the groundwater pollution survey	<p>The following items must be included:</p> <ul style="list-style-type: none"> Site area Number and location of monitoring well points Sampling depth, maximum concentration distribution scope Groundwater flow direction and flow speed of all polluted aquifers The type of all aquifers (unconfined, confined, leaky) The hydraulic conductivity or transmissivity of all polluted aquifers If there are pollution sources a note about their location (Note 1) and scope must be added A map of the scope of the soil pollution survey must be submitted 	
<p>If there is groundwater pollution, please directly fill out the following items. If there is no</p>		

l. Note 1: "Transverse MercatorTM projection coordinates" are used as location coordinates

Table 1 Table of Basic Remediation Site Information (continued 2)

	Pollutant name and maximum pollutant concentration	Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ <If space provided in this column is not sufficient, please add another sheet of paper >
	Rough estimate of polluted groundwater volume (see for reference map of the scope of the groundwater pollution survey)	Average area of polluted aquifers _____ (m ²) Average thickness of polluted aquifers _____ (m) Average porosity of polluted aquifers _____ Polluted groundwater area _____ (m ³)
For remediation sites that are located within a certain distance of drinking water intake points, please fill out the following items. For those that are not, this table ends herewith.		
Survey of scope of surface water pollution	The location of water intake points and the scope of nearby surface water bodies shall be marked on a 1:5000-scale map.	
	Pollutant name and maximum pollutant concentration in surface water body near water intake points Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ Pollutant name: _____ Maximum concentration (mg /L) : _____ <If space provided in this column is not sufficient, please add another sheet of paper >	

Table 2 Soil Pollution Pathway Impact Grade

Grade for the degree of pollution (SL_1)

Observation items	Score
When the ratio of the maximum concentration of pollutants in soil to “soil pollution control values” is greater than 30:1, then 40 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in soil to “soil pollution control values” is greater than 20:1 and smaller than 30:1, then 30 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in soil to “soil pollution control values” is greater than 10:1 and smaller than 20:1, then 20 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in soil to “soil pollution control values” is greater than 1:1 and smaller than 10:1, then 10 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in soil to “soil pollution control values” is smaller than 1:1 or if there is no soil pollution, then 0 points are to be calculated.	
If pollution sources still exist on the site, then the score is to be multiplied with 1.5.	
From the above items SL_1 is obtained (maximum of 60 points). $SL_1 =$ _____	

Grade for land use conditions within the scope of pollution (SL_2)

Observation items	Score
If the pollution scope is within an officially announced drinking water source quality protection area, residential area, farmland with food crop cultivation whose cadmium and mercury concentrations exceed food sanitation standards or other areas, then 50 points are to be calculated.	
If the pollution scope is in an industrial park, commercial park or other areas, then 25 points are to be calculated.	
The highest of the above scores is to serve as SL_2 (maximum of 50 points). $SL_2 =$ _____	

Pollutant hazardousness grade (SL_3)

Observation items	Score
The polluted soil volume score shall be calculated in accordance with Table 2-1	
The score for soil pathway pollutant substances index shall be calculated in accordance with Table 2-1	
3. $SL_3 =$ the product of the two above items (maximum of 50 points). $SL_3 =$ _____	

Soil pollutant pathway total score (*SL*)

Observation items	<i>SL</i>
The soil pollution pathway total score (SL) = $SL_1 \times SL_2 \times SL_3 / 1500$, <i>SL</i> may reach a maximum of 100 points	

Table 2-1 Grading Table for Polluted Soil or Groundwater Volume Factors

Volume of polluted soil or groundwater (m ³)	Score
≤100	2
>100 – ≤1,000	4
>1,000 – ≤10,000	6
>10,000 – ≤100,000	8
>100,000 – ≤1,000,000	9
>1,000,000	10

Table 2-2 Soil Pathway Pollutant Substances Index

Soil pollution pathway pollutant properties (taking as representative the pollutant with the highest concentration multiple)		<i>LD</i> ₅₀ (mg /kg) half lethal dose: _____	
		Carcinogen classification: _____	
Characteristics	Basis:	Range	Index
Pollutant toxicity	Half lethal dose <i>LD</i>₅₀ (mg /kg)	≤5	5
		>5 – ≤50	4
		>50 – ≤500	3
		>500 – ≤2,000	2
		>2,000	1
	Carcinogen classification	1	5
		2A	4
		2B	3
		3	2
		4	1

1. Note 1: Take the higher of the index figures obtained based on *LD*₅₀ pollutant toxicity and carcinogen classification. If the two index figures are identical in size and both smaller than 5, then one grade shall be added to the index figure in question for use in the grading table.
2. Note 2: For carcinogen classification please see for reference the carcinogen classification of the (IARC) for which IARC uses the following classification:
 Group 1 substances are classified as “carcinogenic to humans” ; Group 2A substances are classified as “probably carcinogenic to humans”; Group 2B substances are classified as “possibly carcinogenic to humans;” Group 3 substances are “unclassifiable (as to carcinogenicity in humans);” The Group 4 category is used for substances that are “probably not carcinogenic to humans.”
3. Note 3: When *LD*₅₀ and carcinogen classification do not yield relevant data, then the pollutant toxicity index shall be 1.

Table 3 Groundwater Pollution Pathway Impact Grade

Grade for the degree of pollution (GW_1)

Observation items	Score
When the ratio of the maximum concentration of pollutants in groundwater to “groundwater pollution limits” is greater than 30:1, then 16 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in groundwater to “groundwater pollution limits” is greater than 20:1 and smaller than 30:1, then 12 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in groundwater to “groundwater pollution limits” is greater than 10:1 and smaller than 20:1, then 8 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in groundwater to “groundwater pollution limits” is greater than 1:1 and smaller than 10:1, then 4 points are to be calculated.	
When the ratio of the maximum concentration of pollutants in groundwater to “groundwater pollution limits” is smaller than 1:1 or when there is no groundwater pollution then 0 points are to be calculated.	
If the groundwater at the site is already polluted and if pollution sources still exist on the site, then the score is to be multiplied with 1.5.	
From the above items GW_1 is obtained (maximum of 24 points). $GW_1 =$ _____	

Grade for land use conditions within the scope of pollution (GW_2)

Observation items	Score
If the pollution scope is within an officially announced drinking water source quality protection area, within the scope of a reservoir watershed, residential area, farmland with food crop cultivation whose cadmium and mercury concentrations exceed food sanitation standards or other areas, then 50 points are to be calculated.	
If the pollution scope is in an industrial park, commercial zone or other areas, then 25 points are to be calculated.	
The highest of the above scores is to serve as GW_2 (maximum of 50 points). $GW_2 =$ _____	

The pollutant hazardousness grade (GW_3)

Observation items	Score
The polluted groundwater volume score shall be calculated in accordance with Table 2-1	
The groundwater pathway pollutant substances index shall be calculated in accordance with Table 3-1 = LD_{50} Half lethal dose (or carcinogen classification) x solubility in water (or K_{oc} organic carbon partition coefficient x K hydraulic conductivity)	
3. GW_3 is the product of the two above items (maximum of 1250 points). $GW_3 =$ _____	

Groundwater pollution pathway total score (GW)

Graded items	GW
The groundwater pollution pathway total score (GW) = $GW_1 \times GW_2 \times GW_3 / 15000$, GW may reach a maximum of 100 points	

Table 3-1 Groundwater Pathway Pollutant Substances Index

Groundwater pollution pathway pollutant properties (taking as representative the pollutant with the highest concentration multiple)		<i>LD</i> ₅₀ (mg /kg) half lethal dose: _____	
		Carcinogen classification: _____	
		Solubility in water (mg /L) : _____	
		<i>K</i> _{oc} (L/kg) organic carbon partition coefficient: _____	
		<i>K</i> (m/s).Hydraulic conductivity: _____	
Characteristics	Basis:	Range	Index
Pollutant toxicity	Half lethal dose <i>LD</i>₅₀ (mg /kg)	≤5	5
		>5 – ≤50	4
		>50 – ≤500	3
		>500 – ≤2,000	2
		>2,000	1
	Carcinogen classification	1	5
		2A	4
		2B	3
		3	2
		4	1
Pollutant solubility	Solubility in water (mg /L)	>10⁵	5
		>1×10⁴ – ≤1×10⁵	4
		>5×10² – ≤1×10⁴	3
		>1×10¹ – ≤5×10²	2
		≤1×10¹	1
	Organic carbon partition coefficient <i>K</i>_{oc} (L/kg)	>5×10⁴	5
		>5×10³ – ≤5×10⁴	4
		>5×10² – ≤5×10³	3
		>50 – ≤5×10²	2
		≤50	1

Table 3-1 Groundwater Pathway Polluting Substances Index (continued)

Characteristics	Basis:	Range	Index
Hydraulic conductivity of aquifer	Hydraulic conductivity: <i>K</i> (m/kg)	$>10^{-3}$	5
		$\leq 1 \times 10^{-3} - > 1 \times 10^{-5}$	4
		$\leq 1 \times 10^{-5} - > 1 \times 10^{-7}$	3
		$\leq 1 \times 10^{-7} - > 1 \times 10^{-9}$	2
		$\leq 10^{-9}$	1

1. Note 1: Take the higher of the index figures obtained based on *LD*₅₀ pollutant toxicity and carcinogen classification. If the two index figures are identical in size and both smaller than 5, then one grade shall be added to the index figure in question for use in the grading table.
2. Note 2: For carcinogen classification please see for reference the carcinogen classification of the (IARC) for which IARC uses the following classification:
Group 1 substances are classified as “carcinogenic to humans” ; Group 2A substances are classified as “probably carcinogenic to humans”; Group 2B substances are classified as “possibly carcinogenic to humans;” Group 3 substances are “unclassifiable (as to carcinogenicity in humans);” The Group 4 category is used for substances that are “probably not carcinogenic to humans.”
3. Note 3: When *LD*₅₀ and carcinogen classification do not yield relevant data, then the pollutant toxicity index shall be 1.
4. Note 4: In principle pollutant solubility is to be determined based on the index figure for water solubility. If the pollutant is an organic pollutant, it is to be determined based on the index figure for the organic carbon partition coefficient.
5. Note 5: if water solubility and organic carbon partition coefficient do not yield relevant data, then the pollutant solubility index figure shall be 1.

Table 4 Surface Water Pollution Pathway Impact Grade

Grade for the degree of pollution (SW_1)

Observation items	Score
If within the scope of the site survey there is any drinking water intake point that meets the following conditions, it should be given a hazard grade in accordance with the pollution circumstances at its water intake points.	
If the highest pollutant concentration in water exceeds two times the “drinking water source quality standards,” then a score of 20 points shall be calculated.	
If the highest pollutant concentration in water is greater than one to two times the “drinking water source quality standards,” then a score of 10 points is to be calculated.	
If the ratio of the highest pollutant concentration in water and the “drinking water source quality standards,” is smaller than 1:1 or if there are no surface water pollutants, then a score of 0 points is to be calculated.	
If the surface water at the site is already polluted and if pollution sources still exist on the site, then the score is to be multiplied with 1.5.	
From the above items SW_1 is obtained (maximum of 30 points). $SW_1 =$ _____	

Grade for land use conditions within the scope of pollution (SW_2)

Observation items	Score
If the pollution scope is within a drinking water source quality protection area officially announced by the Environmental Protection Administration, within the scope of a reservoir watershed, residential area, farmland that produces food crops which exceed food sanitation standards or other areas, then 20 points are to be calculated.	
If the pollution scope is in an industrial park, commercial park or other areas, then 10 points are to be calculated.	
The highest of the above scores is to serve as SW_2 (maximum of 50 points). $SW_2 =$ _____	

Pollutant hazardousness grade (SW_3)

Observation items	Score
The polluted soil volume score shall be calculated in accordance with Table 2-1	
The surface water pathway polluting substances index shall be calculated in accordance with Table 4-1 = LD_{50} half lethal dose (or carcinogen classification) x log K_{ow} Log value of octanol-water partition coefficient (or BCF bioconcentration factor):	
3. $SW_3 =$ the product of the two above items (maximum of 250 points). $SW_3 =$ _____	

Surface water pollution pathway total score (SW)

Graded items	SW
The surface water pollution pathway total score (SW) = $SW_1 \times SW_2 \times SW_3 / 3000$, SW may reach a maximum of 50 points	

Table 4-1 Surface Water Pathway Polluting Substances Index

Surface water pollution pathway pollutant properties (taking as representative the pollutant with the highest concentration multiple)		<i>LD</i> ₅₀ (mg /kg) half lethal dose: _____	
		Carcinogen classification: _____	
		log <i>Kow</i> Log value of octanol-water partition coefficient: _____	
		<i>BCF</i> bioconcentration factor: _____	
Characteristics	Basis:	Range	Index
Pollutant toxicity	Half lethal dose <i>LD</i>₅₀ (mg /kg)	≤5	5
		>5 – ≤50	4
		>50 – ≤500	3
		>500 – ≤2,000	2
		>2,000	1
	Carcinogen classification	1	5
		2A	4
		2B	3
		3	2
		4	1
Bioaccumulation	Log value of octanol-water partition coefficient log <i>Kow</i>	>6	5
		>4 – ≤6	4
		>3 – ≤4	3
		>2 – ≤3	2
		≤2	1
	Bioconcentration factor <i>BCF</i>	>5×10 ⁴	5
		>5×10 ³ – ≤5×10 ⁴	4
		>5×10 ² – ≤5×10 ³	3
		>50 – ≤5×10 ²	2
		≤50	1

1. Note 1: Take the higher of the index figures obtained based on *LD*₅₀ pollutant toxicity and carcinogen classification. If the two index figures are identical in size and both smaller than 5, then one grade shall be added to the index figure in question for use in the grading table.
2. Note 2: For carcinogen classification please see for reference the carcinogen classification of the (IARC) for which IARC uses the following classification:
 Group 1 substances are classified as “carcinogenic to humans” ; Group 2A substances are classified as “probably carcinogenic to humans”; Group 2B substances are classified as “possibly carcinogenic to humans;” Group 3 substances are “unclassifiable (as to carcinogenicity in humans);” The Group 4 category

is used for substances that are “probably not carcinogenic to humans.”

3. Note 3: When LD_{50} and carcinogen classification do not yield relevant data, then the pollutant toxicity index shall be 1.
4. Note 4: The index figure for bioaccumulation is in principle calculated based on the log K_{ow} value. If there is no log K_{ow} value, it shall be calculated based on BCF .
5. Note 5: If it is impossible to look up relevant data for log K_{ow} and BCF , then the bioaccumulation index figure shall be 1.

Table 5 Cleanup Priority Ranking Grading Table

Site name: _____

Site location (address or land lot number): _____

Graded items	Total score
Soil pollutant pathway total score (<i>SL</i>), <i>SL</i> maximum of 100 points	<i>SL</i> = _____
Groundwater pollution pathway total score (<i>GW</i>), <i>GW</i> maximum of 100 points	<i>GW</i> = _____
Surface water pollution pathway total score (<i>SW</i>), <i>SW</i> maximum of 50 points	<i>SW</i> = _____
4. Cleanup priority ranking total score (<i>TOL</i>) = $\sqrt{\frac{(SL)^2 + (GW)^2 + (SW)^2}{3}}$	<i>TOL</i> = _____

i. Note 1: The central competent authority determines pursuant to Article 12 of these Regulations that the assessment of the cleanup priority ranking and the priority order for using the Soil Pollution and Groundwater Pollution Remediation Fund.