



NJDEP Attainment Guidance

Showing the NJDEP what you got....



Attainment of Standards & Site-Specific Criteria

2

- The purpose of guidance document is two-fold:
 1. Identify appropriate standards, criteria & conditions for COCs in all media during all phases of remediation (SI, RI, RA);
 2. Outline methods of demonstrating attainment of remediation standards, criteria and conditions.
- Guidance does not address demonstration of attainment for the following:
 - PHCs - *Protocol for Addressing Extractable Petroleum Hydrocarbons*
 - Ecological - *Ecological Evaluation Technical Guidance*
 - Vapor intrusion - *Vapor Intrusion Technical Guidance*
- Attainment by single-point or compliance averaging, options differ based on remedial phase.
- Demonstration of attainment must be documented in appropriate remediation document(s) pursuant to the TRSR and the ARRCs.
- Procedures to vary from the TRSR are outlined at N.J.A.C. 7:26E-1.7. The NJDEP recognizes that professional judgment may result in a range of interpretations on the application of guidance to site conditions.



Summary of Media, Pathways, Standards/Criteria

3

MEDIA	PATHWAY(S)	STANDARDS/CRITERIA	CITATION
Soil	Direct Contact (ingestion-dermal, inhalation)	Direct Contact Residential and Non-residential Soil Remediation Standards	N.J.A.C. 7:26D-4
		Extractable Petroleum Hydrocarbons	www.nj.gov/dep/srp/guidance/srra/eph_protocol.pdf
	Impact to Ground Water	Site-Specific Impact to Ground Water Soil Remediation Standards	N.J.A.C. 7:26D-1.1(b)
Ground Water	Ground Water	Ground Water Remediation Standards	N.J.A.C. 7:26D-2 (N.J.A.C. 7:9C)*
Surface Water	Human Health	Human Health Surface Water Quality Standards	N.J.A.C. 7:26D-3 (N.J.A.C. 7:9B)#
	Ecological	Aquatic Surface Water Quality Standards	N.J.A.C. 7:9B
Sediment	Human Health (Direct Contact Soil)	See Soil	N.J.A.C. 7:26D-4
	Ecological	Ecological Evaluation Technical Guidance	www.nj.gov/dep/srp/guidance/srra/ecological_evaluation.pdf
		Extractable Petroleum Hydrocarbons	www.nj.gov/dep/srp/guidance/srra/eph_protocol.pdf
"Vapor Intrusion"	Ground Water, Soil Gas, Indoor Air	Vapor Intrusion Technical Guidance	www.nj.gov/dep/srp/guidance/vaporintrusion/vig.htm

* The Ground Water Remediation Standards reference the Ground Water Quality Standards, N.J.A.C. 7:9C.

The Surface Water Remediation Standards reference the Surface Water Quality Standards, N.J.A.C. 7:9B.



Considerations to KIM in Selecting Standards

4

- Pursuant to N.J.S.A. 58:10B-12g(4), remediation is not required for COC < background. Background investigations (N.J.A.C. 7:26E-3.8 and 3.9).
- When determining appropriate standards it is critical to understand the intended future use of the Site. Questions to be considered:
 - will the site be used for residential or non-residential purposes ?
 - are institutional and/or engineering controls acceptable at the site?
- Development of a conceptual site model (CSM):
 - documents site characterization and remedial decisions for the life of the project;
 - incorporates the physical, chemical and biological processes that control the transport, migration and potential impacts to receptors; and
 - identifies data gaps in characterization process and supports remedial decision making.
 - The Department accepts CSMs as a valid scientific approach. CSMs document and support professional judgement.



Introduction to Remedial Phases

Site Investigation (SI)

- ▶ Purpose of the SI is to determine if remediation is necessary due to COCs detected above applicable remediation standard or criterion.
- ▶ In general, only single point compliance can be employed during the SI – any exceedance leads to RI.
- ▶ Exceptions to single point compliance use during SI include:
 - ▶ Pesticides in Soil – *Historically Applied Pesticides Site Technical Guidance* (August 2016)
 - ▶ Soil Gas – *Vapor Intrusion Technical Guidance* (August 2016)
 - ▶ Groundwater - Temporal averaging of groundwater results (Section 7 Attainment Guidance)
- ▶ TRSR allows responsible party to either conduct a remedial investigation or to immediately commence with a remedial action.

Introduction to Remedial Phases

6

Remedial Investigation (RI)

- ▶ The purpose of the RI is to:
 - ▶ Delineate the extent of COCs to the appropriate remediation standard, in each environmental medium, at each AOC.
 - ▶ Characterize nature & extent of contamination as appropriate to determine the necessity for RA, and support development/evaluation of proposed remedial alternatives.
- ▶ Single point compliance is required during RI delineation; however compliance averaging can be used to determine if RA is necessary.
- ▶ Demonstrating attainment using compliance averaging is detailed in Section 6 (soil) and Section 7 (ground water) of Attainment Guidance.
- ▶ If COC are determined to be present at concentrations above the applicable standard, you must determine whether RA is necessary



Introduction to Remedial Phases

Remedial Action (RA)

- ▶ If contamination is present at a site or AOC at concentrations above applicable remediation standard, a remedial action may be required (consider background, offsite contribution, compliance averaging, TI).
- ▶ Requirements for remedial actions are included in:
 - ▶ Groundwater Technical Guidance
 - ▶ Soil Investigation Technical Guidance
- ▶ Compliance averaging to demonstrate attainment of an applicable standard can be completed before (during RI) or after RA is completed.

Soil – Applicable Standards, ARSs, and Criteria

8

Direct Contact

1. Standards in Table 1A & 1B of App. 1 N.J.A.C. 7:26D
 2. Human health criteria developed via other guidance documents; and/or
 3. ARSs developed pursuant to the Remediation Standards (N.J.A.C. 7:26D-7):
 - Appendix 4 - ingestion-dermal exposure pathway; or
 - Appendix 5 - inhalation exposure pathway
- ▶ ARSs developed for the ingestion-dermal exposure pathway require Department approval prior to their use.
 - ▶ ARSs for the inhalation exposure pathway do not require Department approval assuming guidance is followed.
 - ▶ ARS developed based on the following options require Department approval:
 - New toxicity information, pursuant to N.J.A.C. 7:26D-7.3(b)1; or
 - New or alternative modeling, pursuant to N.J.A.C. 7:26D-7.3(b)2.



Soil – Applicable Standards, ARSs, and Criteria

9

Impact to Groundwater

- ▶ Required to develop IGW soil standard for each COC detected in soil pursuant to N.J.A.C. 7:26D-1.1 (b)
- ▶ The site-specific IGW standard is to be based upon the classification of the groundwater located at the site:
 - ▶ **Class I** (exceptional ecological areas; Pinelands), or **Class II** (potable), or **Class III** (aquifers, salt water intrusion)
- ▶ Department pre-approval of IGW soil remediation standard not required if using any of the following methods:
 - ▶ *SPLP, SWPE, or DAF*
- ▶ Department pre-approval of IGW soil remediation standard is required if using any of the following methods:
 - ▶ SESOIL or Soil ATD123
- ▶ If more than one method is used to develop an IGW soil standard for a given COC, then the greatest value calculated should be used.



Soil - Applicable Standards, ARSs, and Criteria

10

► **Interim Standards**

- For any COC not listed in Appendix 1 tables, see 7:26D-5 to develop interim standards

► ***Ecological Soil and Sediment Screening Levels***

- contained in Ecological Evaluation Technical Guidance

► ***Petroleum Hydrocarbon Soil Screening Levels***

- contained in Protocol for Addressing Extractable Petroleum Hydrocarbons

► ***VI Soil Screening Levels***

- None established currently, refer to VI TG Section 2.1 and 3.1.2.4



Soil – Demonstrating Attainment of Standards

11

- ▶ Demonstration of attainment to soil remediation standards typically involves comparison of COC concentrations to the most stringent remediation standard.
- ▶ In general, most stringent standard will be either the residential direct contact soil remediation standard or the IGW soil remediation standard.
- ▶ There are six (6) contaminants for which the non-residential inhalation exposure pathway soil criterion is the most conservative and thus the direct contact soil remediation standard:

**acenaphthylene, benzo(ghi)perylene, cobalt, manganese, phenanthrene,
chromium**
- ▶ Methods of Attainment varies per phase of investigation (SI, RI, RA)



Soil – Demonstrating Attainment – SI

12

- ▶ During the **SI** for soil, compliance for all COCs for all exposure pathways for all soil standards are based on **single-point compliance**.
- ▶ If any COC concentration level in any sample exceeds the lower of either the RDC soil standard or the IGW soil standard, then the person responsible for conducting the remediation is required to conduct a RI pursuant to N.J.A.C. 7:26E-4.
- ▶ Alternatively, pursuant to N.J.A.C. 7:26E-4.2(c), the person responsible for conducting the remediation can proceed directly to the RA (N.J.A.C. 7:26E-5).



Soil – Demonstrating Attainment – RI

13

- Single-point compliance required for delineation of COC.
- Single-point or compliance averaging to determine necessity of RA.
- DC exposure pathways, delineation compliance is dependent upon the remedial action selected and the current and/or future use of the site.
- Delineation for the DC pathway must continue until the applicable soil remediation standard is achieved, regardless of depth of water table.
- A contaminant gradient may be established by showing that contaminant levels decrease as follows:
 - 10% or more between the initial sample and each of two sequential delineation samples; or
 - Factor of 5X or more between the initial sample and a single delineation sample; or
 - A reasonable combination of laboratory samples and field instrument readings.
- Regardless of the type of remedial action presumed for the site, one must:
 - Demonstrate delineation to the applicable direct contact and IGW exposure pathway
 - Delineate for the presence of free and/or residual product pursuant to the TRSR
 - Evaluate for the presence of sheen pursuant to the Department policy



Soil RI - Direct Contact Delineation & Future Use

14

Unrestricted use remedial action

- ▶ Horizontal and vertical delineation to the residential DC soil remediation standard

Limited restricted use remedial action

- ▶ Horizontal and vertical delineation to the NRDC soil remediation standard for the AOC (or Site) subject to the restriction.
- ▶ Pursuant to N.J.A.C. 7:26E-4.2(a)2, must delineate to the RDC soil remediation standard for any off-property soil contamination from the Site.

Restricted Use Remedial Action

- ▶ Horizontal and vertical delineation is to consist of the following:
 - ▶ For residential sites: to the RDC soil remediation standard at the boundary of the restricted area.
 - ▶ For non-residential sites: to the NRDC soil remediation standard at the boundary of the restricted area, and to the RDC soil remediation standard at the property boundary.



Soil RI - Delineation - IGW Exposure Pathway

15

- ▶ Horizontal and vertical delineation of the IGW exposure pathway will be considered complete when all soil COC concentrations \leq IGW remediation standard developed/selected.
- ▶ If a site-specific IGW soil standard is not developed, delineation to default IGWSSLs is required.
- ▶ Single-point compliance is required for delineation during the RI;
- ▶ A contaminant gradient may be established by showing that contaminant levels decrease as follows:
 - ▶ 10% or more between initial sample and each of two sequential delineation samples; or
 - ▶ Factor of 5X or more between the initial sample and a single delineation sample; or
 - ▶ A reasonable combination of laboratory samples and field instrument readings.
- ▶ For the IGW exposure pathway, delineation is only required within the vadose zone.



Soil RI - Determining Need for RA

16

- ▶ Following completion of RI delineation to the remediation standards, must determine whether attainment of the applicable soil remediation standard has been attained or whether an RA is required.
- ▶ Determination of need for RA can be based on either of the following:
 - ▶ Single-Point Compliance - all sample values < applicable SRSs (DC & IGW); or
 - ▶ Compliance Averaging
- ▶ If attainment of applicable standards has not been achieved, then a remedial action is required.

Soil RI - Determining Need for RA

17

Direct contact exposure pathway

- Single-point compliance or Compliance averaging (Mean, 95 UCL, spatial weighted average)
- If any single point exceedance or average exceeds DC standard, RA is required.
- If contamination extends offsite, offsite area shall be addressed separately comparing COCs to the most restrictive DC standard, irrespective of land use.

IGW exposure pathway

- Single-point compliance or Compliance averaging (Mean, 95 UCL, spatial weighted average)
- **Compliance for the IGW pathway is based on the full extent of the contamination. Onsite and offsite areas are not evaluated separately.**
- Demonstrate that no further remediation is required for the IGW pathway by meeting the requirements of the following guidance documents:
 - Guidance for the Evaluation of Immobile Chemicals for the IGW Pathway
 - Site Soil and GW Analytical Data Evaluation (Metals/SVOC & VOCs Petroleum Mixtures)



Soil - Direct Contact – RA Verification

18

- ▶ Any of the following can be used to determine if RA is complete for DC pathways:
 - ▶ Single-point compliance
 - ▶ Compliance averaging by:
 - ▶ Arithmetic mean
 - ▶ 95 percent UCL of the mean
 - ▶ Spatially weighted average (e.g., Thiessen polygons)
 - ▶ 75 percent / 10X procedure
- ▶ The remedial action is considered complete for DC exposure pathways if:
 - ▶ **single-point compliance** - concentration of each COC \leq the applicable DC remediation standard; or
 - ▶ **compliance averaging** - the average COC concentration \leq to its applicable DC soil remediation standard.
- ▶ If the concentration of any COC $>$ DC soil remediation standard using either single-point compliance or compliance averaging, one can either:
 - ▶ Continue RA until concentration of each COC \leq applicable DC soil remediation standard; or
 - ▶ Implement an institutional control and/or engineering control pursuant to N.J.A.C. 7:26C-7.



Soil - Direct Contact – RA Verification

19

Unrestricted use remedial action

- ▶ N.J.A.C. 7:26E-1.8, Unrestricted use RA means “any RA that does not require the continued use of either ECs or ICs to meet the established health risk or environmental standards.”
- ▶ Unrestricted use soil RAs - COC concentrations \leq most stringent DC soil remediation standard as determined by either single-point compliance or compliance averaging.

Limited restricted use remedial action

- ▶ Limited restricted use soil Ras - COC concentrations $>$ applicable residential SRS but \leq applicable non-residential DC SRS as determined by single-point compliance or compliance averaging. **Does not apply to residential sites.**
- ▶ Areas not included within institutional control must attain “unrestricted use”.

Restricted Use Remedial Action

- ▶ N.J.A.C. 7:26E-1.8, restricted use RA means “any RA that requires the continued use of ECs or ICs in order to meet the established health risk or environmental standards.”
- ▶ Residential - if any COC $>$ RDC soil remediation standard, then it will be necessary to establish both ICs and ECs pursuant to N.J.A.C. 7:26C-7.
- ▶ Non-residential - if any COC $>$ both its residential and non-residential DC soil remediation standards, then it will be necessary to establish both ICs and ECs.



Soil IGW – Remedial Action Verification

20

- ▶ Following options can be used to determine if a remedial action is complete for the IGW pathway:
 - ▶ Single-point compliance
 - ▶ Compliance averaging by:
 - Arithmetic mean
 - 95 percent UCL of the mean
 - Spatially weighted average (e.g., Thiessen polygons)
 - 75 percent/10x procedure

- ▶ The remedial action is considered complete for soils for the IGW pathway for the site or AOC if:
 - ▶ single-point compliance - concentration of each COC \leq the applicable IGW exposure pathway soil remediation standard; or
 - ▶ compliance averaging - the average COC concentration \leq the applicable IGW exposure pathway soil remediation standard.

- ▶ If the concentration (or average concentration) of any COC $>$ applicable IGW soil remediation standard, the RA shall continue until each COC \leq applicable IGW pathway soil remediation standard.



Groundwater – Standards, ARSs, and Criteria

21

1. Groundwater Remediation Standards

- ▶ For each COC detected in GW, must determine applicable GWRS for the GW classification where the site is located (N.J.A.C. 7:26D-2) :
 - ▶ Class I (exceptional ecological areas – Pinelands)
 - ▶ Class II (potable)
 - ▶ Class III (aquitards, salt water intrusion)
- ▶ Numeric criteria for Class II-A GW (NJAC 7:9C-1.7(c))
- ▶ Narrative standards determine numeric criteria for Class I & III GW (NJAC 7:9C-1.7)
- ▶ Development of Interim Standards where COC has no GWQS (NJAC 7:9C-1.7(c)2-6)

2. Vapor Intrusion Pathway

- ▶ Groundwater Screening Levels for VI exposure pathway are provided in VI TG
- ▶ Section 2.1.2 (not Section 7.3.2) provides method for averaging of GW analytical results when determining if a VI investigation is required.



Groundwater – Demonstrating Attainment

22

- ▶ Single-point compliance is required during all phases of groundwater investigation to demonstrate attainment, except as noted below.
- ▶ Temporal compliance averaging (intra well) is allowed for groundwater:
 - ▶ NJDEP allows averaging of data from same location over multiple events.
 - ▶ Requires one original and two confirmation events, spaced evenly amongst 60-day period.
- ▶ Spatial compliance averaging (inter well) is not allowed for groundwater. Cannot average across multiple locations.

Groundwater - Demonstrating Attainment – SI

23

- ▶ If all COCs < GWRS, then no further action/remediation is required
- ▶ If any COC > GWRS then RI of GW is required (cannot go directly to RA)
- ▶ Background, Offsite Source, and DAP should be considered given the site location and COCs
- ▶ If concentration of any COC > GWRS, GW may be resampled to confirm
 - ▶ Two confirmation samples must be collected/analyzed from the same well, spaced in time over 60-day period, using the same purging/sampling methods
 - ▶ Original and two confirmation samples are averaged to determine if > GWRS.
 - ▶ Same confirmation procedure can be used to compare GW results to VI GWSL
- ▶ If initial GW COC concentrations > 3x GWRS, then compliance averaging for GW is not allowed/feasible



Groundwater - Demonstrating Attainment - RI

24

- ▶ Groundwater RI requires horizontal and vertical delineation to the GWRS in all perimeter/vertical compliance monitoring wells. If COC > GWRS at compliance monitoring point, then additional delineation is required.
- ▶ Background should be considered for the site location and COCs
- ▶ **Spatial compliance averaging cannot be used to demonstrate attainment**
- ▶ Temporal compliance averaging can be utilized at any monitoring point to demonstrate attainment
 - ▶ Same well
 - ▶ Collection of two confirmation samples evenly spaced over 60 days
 - ▶ Similar purging and sampling methods
- ▶ Classification Exception Area (CEA) required for area where GW concentrations will remain > GWRS



Groundwater - Demonstrating Attainment - RA

25

- ▶ GW contaminated > GWRS (and background) requires RA - active remediation, monitored natural attenuation, and establishment of IC (or combinations thereof).
- ▶ A RA permit must be obtained for the GW RA
- ▶ RA must continue until all COC concentrations < GWRSs (or background, offsite, DAP) - often involves maintaining CEA until GWRS are attained.
- ▶ **Attainment of the GWRS is achieved when each COC < GWRS for two consecutive confirmatory sampling events (NJAC 7:26C-7.9(f))**
- ▶ During confirmatory sampling, if any COC concentration > GWRS, the GW may be resampled/averaged during two additional confirmatory sampling events
- ▶ If the COC concentration average(s) < GWRSs, then the MW is compliant for the confirmatory event (Potentially up to 6 monitoring events)



Surface Water – Standards, ARSs, and Criteria

26

- ▶ Must determine the human health-based surface water (SW) remediation standards pursuant to N.J.A.C. 7:26D-3 for each COC detected in surface water (SW) from the site or in groundwater samples collected immediately adjacent to SW.
- ▶ SW Standards (N.J.A.C. 7:9B) selection based on surface water use/designation
- ▶ Pursuant to N.J.A.C. 7:26D-3.2(b), ARSs are not allowed for surface water
- ▶ Ecological surface water screening levels must be considered and are discussed in the Department “Ecological Evaluation Technical Guidance”



Surface Water – Demonstrating Attainment – SI & RI

27

Site Investigation

- Single-point compliance to determine attainment of the SWRSs during SI
- If no COC > SWRS, then no further action is required for SW; however, still must evaluate data versus SW screening levels for ecological receptors (EE TG)

Remedial Investigation & Remedial Action

- **Must use single-point compliance to demonstrate attainment for the RI and RA of SW**
- Alternative methods for determining compliance can be applied on a site-specific basis using applicable technical guidance specified in the Site Remediation Reform Act (SRRRA, N.J.S.A. 58:10C-14c).
- **RI and/or RA considered complete when SW COC concentrations originating from Site or AOC \leq applicable SWRS for each COC.**
- If concentrations of COCs in SW > SWRS, then RI/RA is to continue until attainment is achieved via single-point compliance.

