NJDEP/Stakeholder

Ecological Evaluation Technical Guidance

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- Steve Byrnes, NJDEP BEERA
- Dan Cooke AMEC Environment and Infrastructure
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Purpose of EETG

To provide guidance on how to conduct and document

- Receptor Evaluation (SI, NJAC 7:26E-1.16, 3.6) results in NFA or RI of Ecological receptors
- Remedial Investigation of Ecological Receptors (RI, NJAC 7:26E 7:26E-4.1, 4.8); includes Ecological Risk Assessment

Tiered, risk-based process establishes lines of evidence for presence/absence of eco risk and provides data to determine site-specific ecological risk-based remediation goals

Human Health-based Soil Remediation Standards vs Ecological Risk-based Remediation Goals

Human Health Risk Assessment ⇨ Promulgated Soil Remediation Standards:

- Receptor - Human (child, adult)
- Residential, nonresidential exposure
- Exposure pathways: ingestion, dermal, inhalation exposure
- Endpoints: Cancer and non cancer

Ecological Risk Assessment ⇨ Site-specific Remediation Goals:

- Receptors – multiple trophic level / feeding guilds
- Aquatic and terrestrial habitats
- Exposure pathways –direct and via food chain:

Benthos
- Aquatic macroinvertebrates, crustaceans, molluscs
- Soil Invertebrates

Fish
- Forage
- Bottom Feeding
- Predatory/Water Column

Birds and Mammals
- Piscivore
- Carnivore
- Herbivore
- Insectivore
- Omnivore
- Sediment probing (bird)

Plants (terrestrial, aquatic)

- Endpoints: survival, growth, reproduction

EETG 2017 revisions – additional guidance for:

- **Section 5.3.4 - *Background Considerations*:** selection of, and data use from, background and reference locations

- **Sections 6.1.3.3 – *Toxicity Reference Values*:** TRV selection process

- **Section 6.4.5 - *Extractable Petroleum Hydrocarbons*:** evaluation of EPH in sediment (ecological screening criteria not available) and soil in environmentally sensitive natural resource (ESNR) areas

- **Section 6.4.9 – *Historic Fill Material and Dredged Material*:** evaluation of historic fill in/impacting ESNRs; explains why the approach is different from that used in industrial upland/non-ESNR areas. This approach is in accordance with N.J.S.A.58:10B-12h.(1).

Toxicity Reference Values (TRVs)

- Benchmark doses used to characterize risk for upper trophic level wildlife (birds and mammals) in food chain models
- Hazard Quotient (HQ) is calculated for each surrogate receptor/feeding guild for each contaminant detected in prey tissue:

$$HQ = \frac{\text{Average Daily Dose (mg COPEC)/kg bw/day)}}{\text{Toxicity Reference Dose (mg COPEC)/kg bw/day)}}$$

(aka Toxicity Reference Value, TRV)

TRVs (con't)

General definition: a dose above which ecologically relevant effects might occur to wildlife species following chronic dietary exposure and below which it is reasonably expected that such effects will not occur

- NOAEL = No Observed Adverse Effects Level, mg COPEC/kg bw/day
- LOAEL = Lowest Observed Adverse Effects Level, mg COPEC/kg bw/day

TRVs (con't)

Issues of concern

- EETG has comprehensive guidance on calculation of Average Daily Dose (numerator) but minimal guidance on TRV selection (denominator)

- Lack of consistent approach to selection of appropriate value among the myriad of TRVs in the literature has resulted in inconsistent / inappropriately diminished risk characterization and ecological remediation goals

First Tier: TRVs used for Lower 8 Mile Passaic River Superfund Site ERA

- TRVs support Record of Decision
- vetted by DEP, EPA, NOAA , USFWS, other agencies
- maintains consistency with statutory requirement for consistency with EPA
- Recommend use of TRVs from *Lower Eight Miles of the Lower Passaic River, Focused Feasibility Study Report (2014)* – Table 4-14 (http://passaic.sharepointspace.com/Public%20Documents/2014-02-20%20Appendix%20D%20Risk%20Assessment.pdf

Summary of TRVs for Avian and Mammalian Wildlife Receptors from the Passaic River FFS, 2014

(a) Units are µg COPEC/g BW-day (dry weight basis).
(b) Benchmarks based on methylmercury exposure
(c) Available at www.ourpassaic.org under "Lower 8 Mile documents, Appendix D, Table 4-14"

COPEC	TRV[a]		Species	Common Name	Endpoint	Reference
	NOAEL	LOAEL				
Birds						
Copper	2.3	4.7	*Melagris gallopavo*	Domesticated Turkey	growth	Kashani et al., 1986
Lead	0.19	1.9	*Coturnix japonica*	Japanese Quail	reproduction	Edens and Garlich, 1983
Mercury[b]	0.013	0.026	*Anas platyrhynchos*	Mallard	reproduction	Heinz, 1974, 1976, 1979
LMW PAHs	0.67	6.7	*Agaleius phoenicius*	Red-winged Blackbird	survival	Schafer et al., 1983
HMW PAHs	0.048	0.48	*Columba livia*	Rock Dove	reproduction	Hough et al., 1983
Dieldrin	0.054	0.18	*Numida meleagris*	Helmeted Guineafowl	survival	Wiese et al., 1969
Total DDx	0.0090	0.027	*Pelecanus occidentalis*	Brown Pelican	reproduction	Anderson et al., 1975
Total PCBs	0.40	0.50	*Gallus gallus domesticus*	Chicken	reproduction	Chapman, 2003
2,3,7,8-TCDD	2.8E-06	2.8E-05	*Phasianus colchicus*	Ring-necked Pheasant	mortality, growth, reproduction	Nosek et al., 1992a, 1992b
Mammals						
Copper	3.4	6.8	*Neovison vison*	American Mink	reproduction	Aulerish et al., 1982
Lead	0.71	7.0	*Rattus norvegicus*	Brown Rat	reproduction	Grant et al., 1980
Mercury[b]	0.016	0.027	*Neovison vison*	American Mink	growth, reproduction	Wobeser et al., 1976a, 1976b as derived in USEPA, 1995
LMW PAHs	50	150	*Rattus norvegicus*	Brown Rat	growth	Navarro et al., 1991
HMW PAHs	0.62	3.1	*Mus musculus*	House Mouse	growth	Culp et al., 2000
Dieldrin	0.015	0.030	*Rattus norvegicus*	Brown Rat	reproduction	Harr et al., 1970
Total DDx	0.80	4.0	*Rattus norvegicus*	Brown Rat	reproduction	Fitzhugh, 1948
Total PCBs	0.069	0.082	*Neovison vison*	American Mink	reproduction	Chapman, 2003
2,3,7,8-TCDD	8.0E-08	2.2E-06	*Neovison vison*	American Mink	reproduction	Tillitt et al., 1996

Second Tier: TRVs from USEPA's Ecological Soil Screening Levels, various COPECs ("ECO-SSLs")

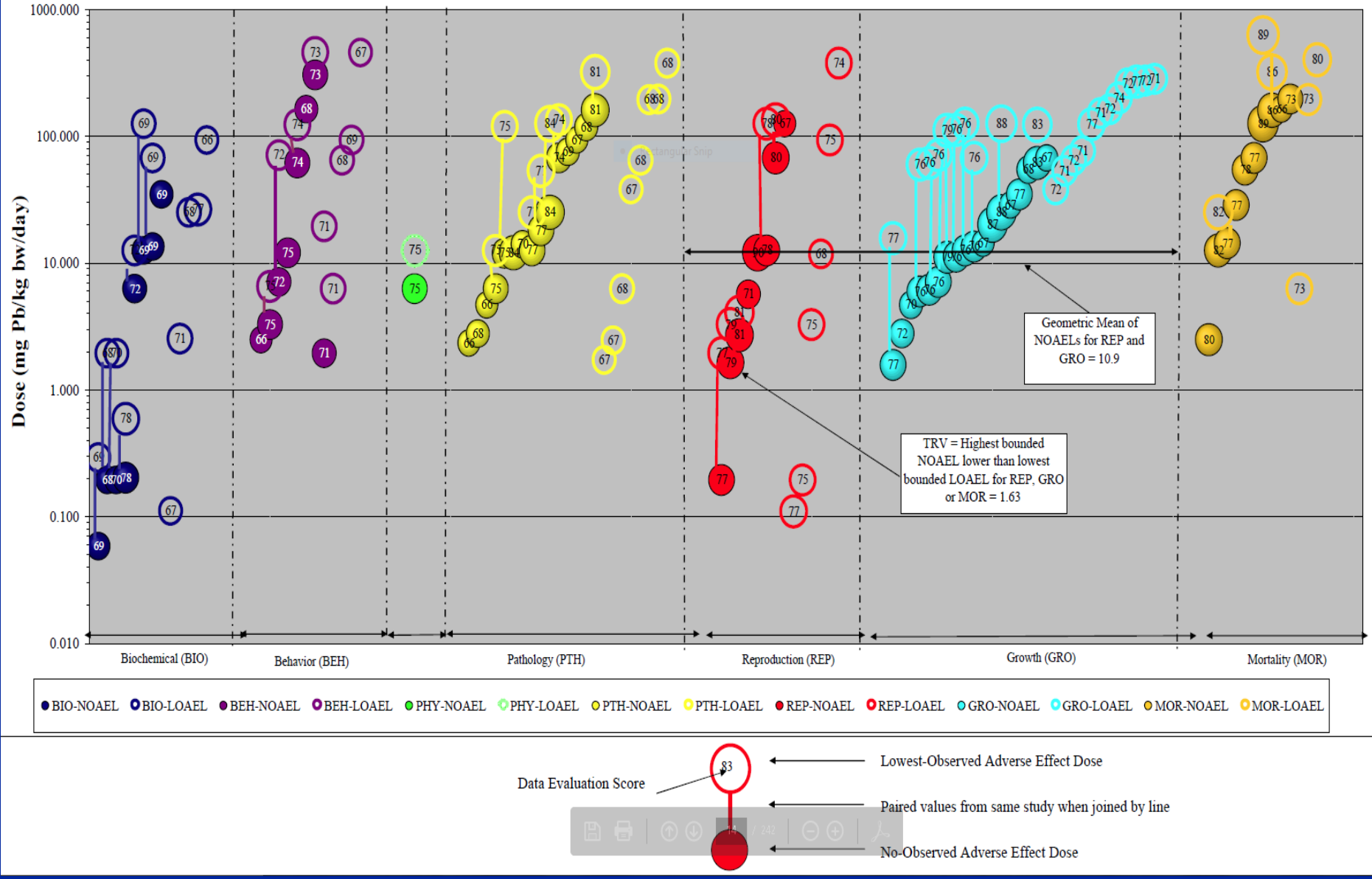
- Use the TRV that EPA used to derive Eco- SSL (numerous are presented)

- The highest bound NOAEL lower than the lowest bound LOAEL for mortality, growth, reproduction

- NOAEL and LOAEL from the same study

- https://www.epa.gov/sites/production/files/2015- 09/documents/eco

Figure 5.1 Avian TRV Derivation for Lead



Third Tier: Literature Sources

- Be sure these literature sources were not rejected by USEPA during derivation of the Eco-SSLs

- Provide appropriate justification for literature source, and TRV selected from that source (e.g., type of study, receptor used, dosing methodology, other factors)

- Single study with bounded NOAEL and LOAEL

- Avoid statistical evaluations (geometric mean, etc.) of multiple TRVs/studies across several receptors due to uncertainty

- See EETG for additional references, e.g., U.S. Department of Energy. June 1996. Sample, BE, Opresko, D.M., and Suter, G.W. *Toxicological Benchmarks for Wildlife*: 1996 Revision. Oak Ridge National Laboratory. ES/ER/TM-86-R3.

Historic Fill Material and Dredged Material

Chapter 6.4.9

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Section 6.4.9
Special Considerations

Historic Fill Material in ESNRs

Definition - What it is:

- Non-indigenous material, deposited to raise the topographic elevation of the site
- Was contaminated prior to emplacement
- Is in no way associated with site operations at the location of emplacement
- Includes construction debris, dredge spoils, incinerator residue, demolition debris, fly ash, non-hazardous solid waste.

Section 6.4.9
Special Considerations

Historic Fill Material in ESNRs

Definition - What it isn't:

- Any material which is substantially chromate production waste
- Chemical production waste
- Waste from processing of metal or mineral ores, residues, slag or tailings
- A municipal solid waste landfill

N.J.S.A. 58:10B-12h.(1)
Brownfield and Contaminated Sites Act

Historic Fill Material in ESNRs

- there is a rebuttable presumption that the department shall not require any person to remove or treat the [historic] fill material in order to comply with applicable health risk or environmental standards.
- The department may rebut the presumption only upon a finding by the preponderance of the evidence that the use of engineering or institutional controls would not be effective in protecting public health, safety, and the environment.

N.J.A.C.7:26E-3.12, 4.7 and 5.4 require the remediating party to:

- Determine if historic fill is present
- Sample the historic fill for PAHs, metals, and EPH in accordance with N.J.A.C.7:26E-2.1(full TCL/TAL/EPH on 25% samples) **or** assume the fill is contaminated above human health-based residential soil remediation standards
- Determine the horizontal and vertical extent of historic fill to the property boundary
- Conduct a groundwater RI or submit CEA
- In non-ESNR areas, institutional controls (Deed Notice) and engineering controls (Cap) are "presumptive remedy"

See *Historic Fill Material Technical Guidance*, April 2015 for additional information: http://www.nj.gov/dep/srp/guidance/srra/fill_protocol.pdf?version_3_0

The Challenge:
Historic Fill is in or impacting ESNRs

- RP/LSRP must determine if there is a site-related contaminant discharge additive to HF contamination
- Ecological Evaluation for historic fill contaminants is required pursuant to N.J.A.C.7:26E-1.16, 3.6, and 4.8, similar to other contaminant sources (even if AOC is "historic fill-only")
- Data collection needed in ESNR to guide remedial decision-making (not "assumption of fill contamination above SRS" and not presumptive engineering control)
- If ecorisk-based remediation needed, impact to the resource from remedial action must be considered; capping remedy may or may not be appropriate in ESNRs; data-guided alternative remedial measures should be considered
- Potential for human exposure must be considered

When is it appropriate to delineate Historic Fill impacts in an Off-Site ESNR?

- If Historic Fill is not regional

- If Historic Fill is regional, but
  - contaminant source attribution is uncertain (possibly site related)
  - contaminants are aberrant qualitatively and/or quantitatively (e.g., elevated concentrations of Hg, PCBs)

Historic Fill is Regional (con't)

- Use professional judgement, multiple lines of evidence
- Obtain data to document consistent with regional levels
  - If similar – NFA/RAO or limited mitigation (e.g., bank stabilization)
  - If dissimilar - Follow N.J.A.C.7:26-1.16, 3.6, 4.8