



DNELs/DMELs and Their Relationship to Health-Based OELs

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Introduction

Derived No Effect Levels (DNELs) and Derived Minimal Effect Levels (DMELs) are defined as "...the level of exposure above which humans should not be exposed." DNELs and DMELs are required to be prepared and be present on the REACH-compliant SDS (section 8.1) for any hazardous substance manufactured in, or imported into, the European Union at a volume of greater than or equal to 10 tons per year. They are typically derived from a No Observed Adverse Effect Level (NOAEL), Lowest Observed Adverse Effect Level (LOAEL), or Bench Mark Dose (BMD) from experimental animal studies. The process to derive DNELs and DMELs has been outlined in guidance provided by the European Chemicals Agency (ECHA). They are ultimately used in the risk characterization process of the Chemical Safety Report (CSR) when registering a hazardous substance for REACH.

This poster is designed to provide a brief overview of how DNELs/DMELs that are set for inhalation in the occupational setting compare to the chemical's health-based Occupational Exposure Limit(s) (OELs), and emphasize that although the processes of derivation are in some ways similar, there exist key significant differences.

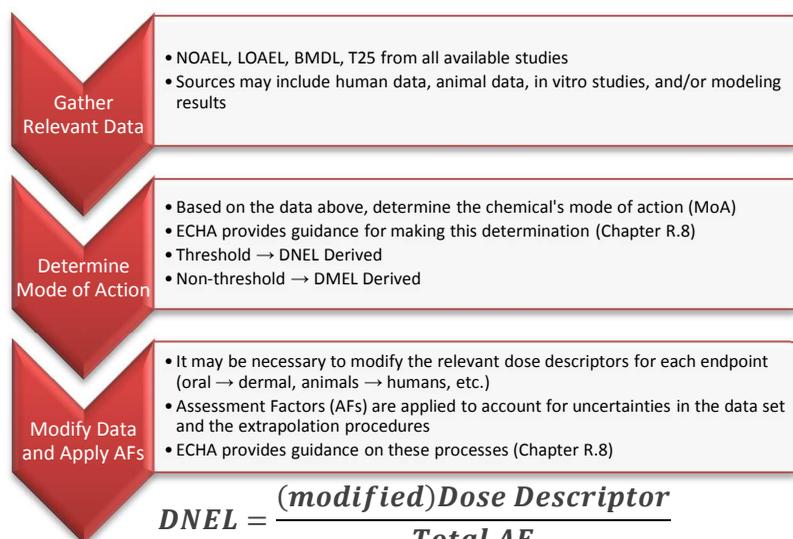
DNELs/DMELs

- Used in REACH risk characterization
- Established for workers, consumers, and the general public
- Routes of exposure include inhalation, dermal, and ingestion
- Durations of exposure include acute and long-term
- Health effects include systemic and local effects
- DNELs are "threshold" chemicals
- DMELs are for "non-threshold" chemicals (mutagens or carcinogens)
- Drive the selection of appropriate Risk Management Measures (RMMs) and Operation Conditions of Use (OCs)

Health-Based OELs

- Used in hazard determination, hazard communication, exposure reduction, regulatory compliance, and risk assessment.
- Established for workers only
- Route of exposure is inhalation only
- Durations of exposure include "acute" and long-term
- Set for protection of worker health and safety

DNEL/DMEL Derivation Process



$$DNEL = \frac{\text{(modified) Dose Descriptor}}{\text{Total AF}}$$

Example DNEL Derivation Worker-Inhalation-Long-Term-Systemic

Data:

- Rat 90-day inhalation NOAEL = 350 mg/m³ @ 6 hrs/day

Mode of action:

- Non-carcinogenic mode of action

Modify data per ECHA guidance:

$$\text{(corrected) Inhalation NOAEL} = 350 \text{ mg/m}^3 \times \frac{6 \text{ hrs/day}}{8 \text{ hrs/day}} \times \frac{6.7 \text{ m}^3}{10 \text{ m}^3} = 175 \text{ mg/m}^3$$

- Need 8 hr/day for human-worker
- 6.7 m³ = worker respiration rate at rest
- 10 m³ = worker respiration rate during light activity

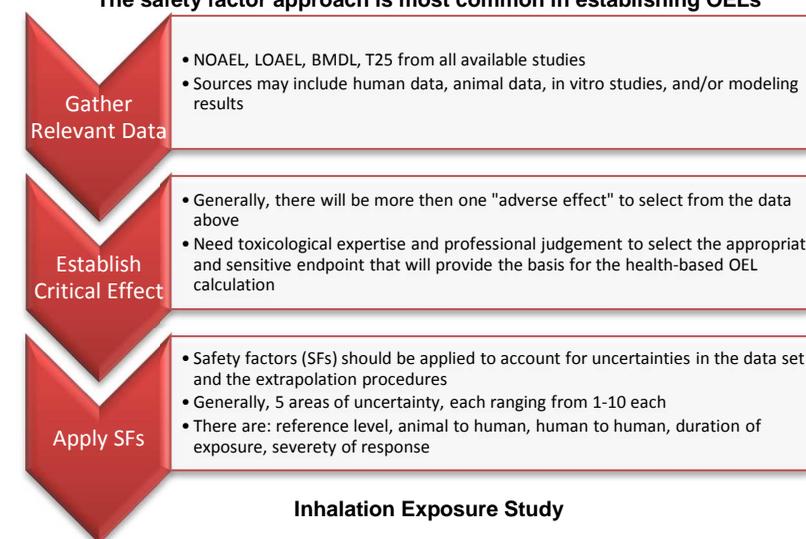
Apply Assessment Factors per ECHA guidance:

- Interspecies = 2.5
- Worker Interspecies = 5
- Sub-chronic to Chronic = 2
- Total AF = 2.5 x 5 x 2 = 25

$$DNEL = 175 \text{ mg/m}^3 \div 25 = 7.0 \text{ mg/m}^3$$

Health-Based OEL Derivation Process

The safety factor approach is most common in establishing OELs



Inhalation Exposure Study

$$OEL = \frac{\text{NOAEL or LOAEL}}{\text{Total SF}}$$

Example Health-Based OEL Derivation

Data:

- Rat 90-day inhalation NOAEL = 350 mg/m³ @ 6 hrs/day
 - Increase in cell size, not numbers for 1/10
 - No weight or histopathology changes in examining organs
 - No centrilobular hepatic necrosis (based on histopathology)

Modify data for 8 hr work shift:

$$\text{(corrected) Inhalation NOAEL} = 350 \text{ mg/m}^3 \times \frac{6 \text{ hrs/day}}{8 \text{ hrs/day}} = 263 \text{ mg/m}^3$$

- Need 8 hr/day for human-worker

Apply safety factors (these are considered "typical" default SFs):

- NOAEL used = 1
- Animal → Human = 1
- Human → Human = 3 (default for workers)
- Duration of exposure = 2 (subchronic study)
- Severity of Response = 3 (adaptive change – default)
- Total SF = 1 x 1 x 3 x 2 x 3 = 18

$$OEL = 263 \text{ mg/m}^3 \div 18 = 14.6 \text{ mg/m}^3$$

Even though the same NOAEL was used to derive both the DNEL and health-based OEL, the processes of deriving each are much different. Due to the fact that both of these values may be present in section 8 of the REACH-compliant SDS, it is imperative that the hazard communication professional know what each are used for and why the values are not the same.