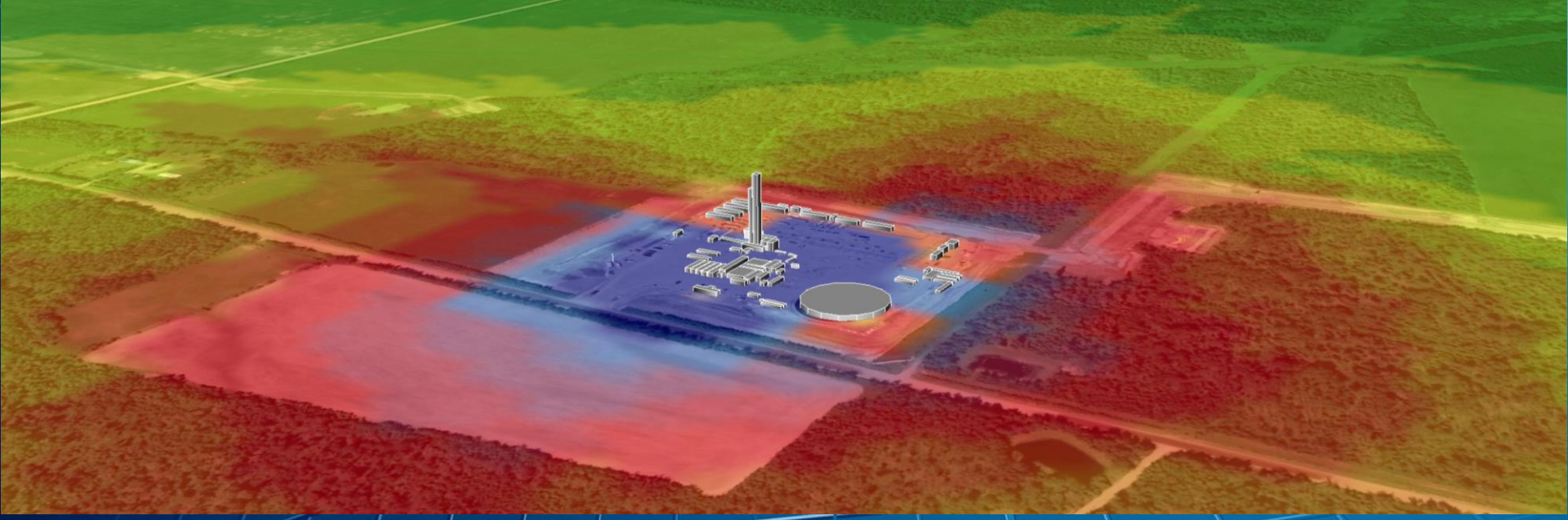

Noise Emissions Best Practises-Alberta Energy Industry

Wapiti Area Synergy Partnership-May 10, 2022

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Key Points

Noise and Sound Basics

Best Practise Framework

Noise Emission and Mitigation

Noise and Sound Propagation

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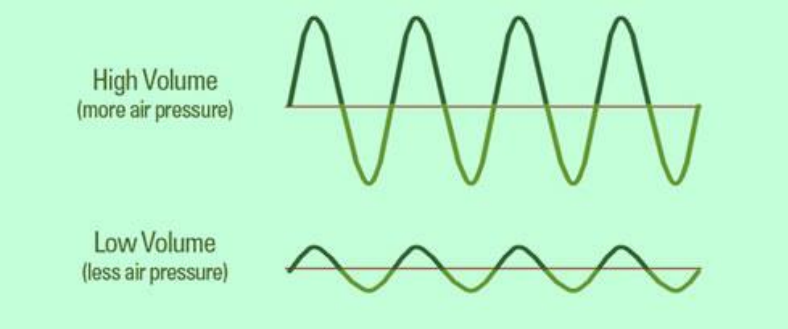
What is Sound?

Sound Measurement

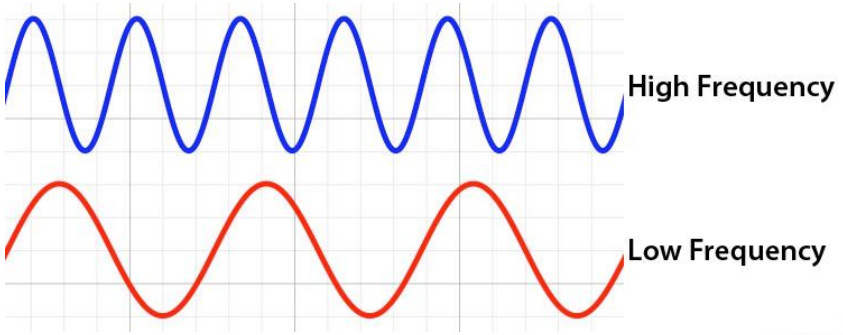
How Loud (level)

- Decibels (dB)
- How big the vibrations are



Character (Pitch)

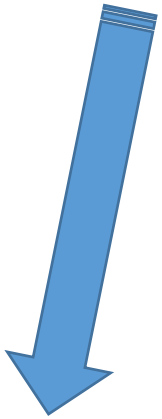
- Frequency
- How many vibrations



Sound Vs. Noise

noise: sound/s that are unwanted

noun

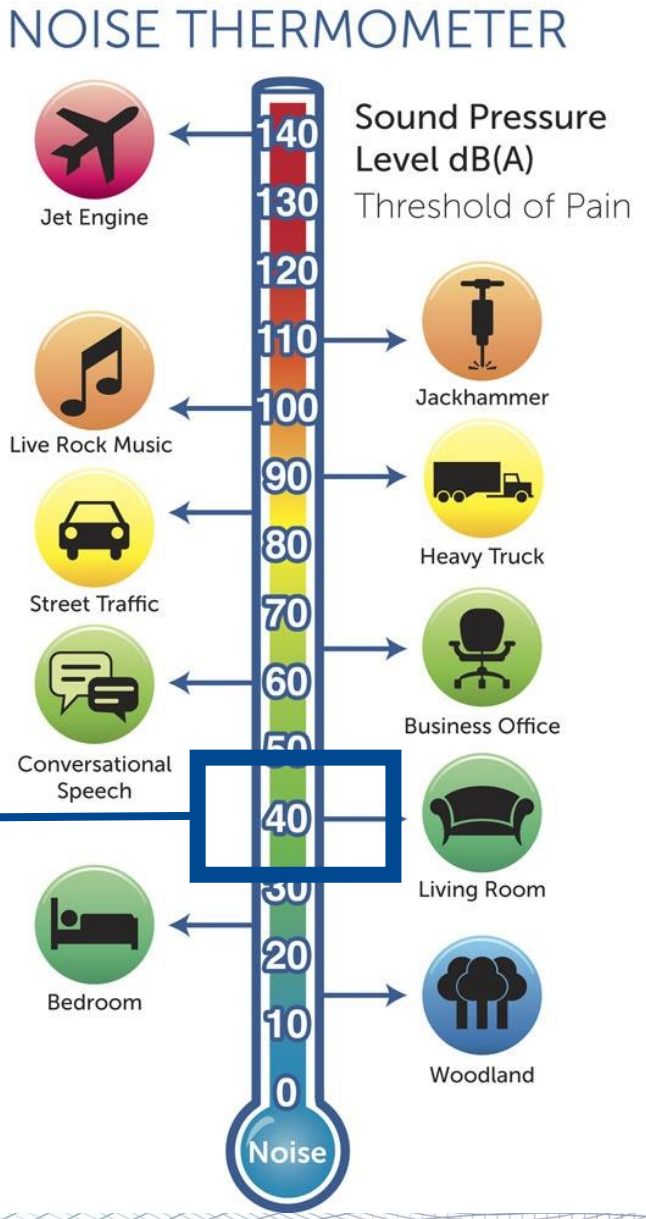


Perception/Expectation

Physics/Engineering

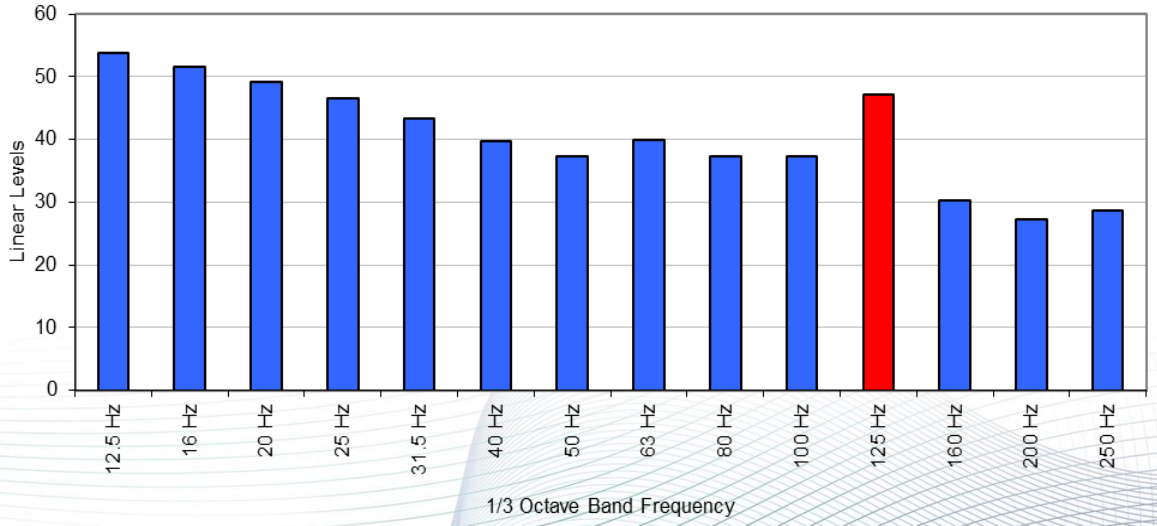
Noise Thermometer

AER Permissible Sound Level

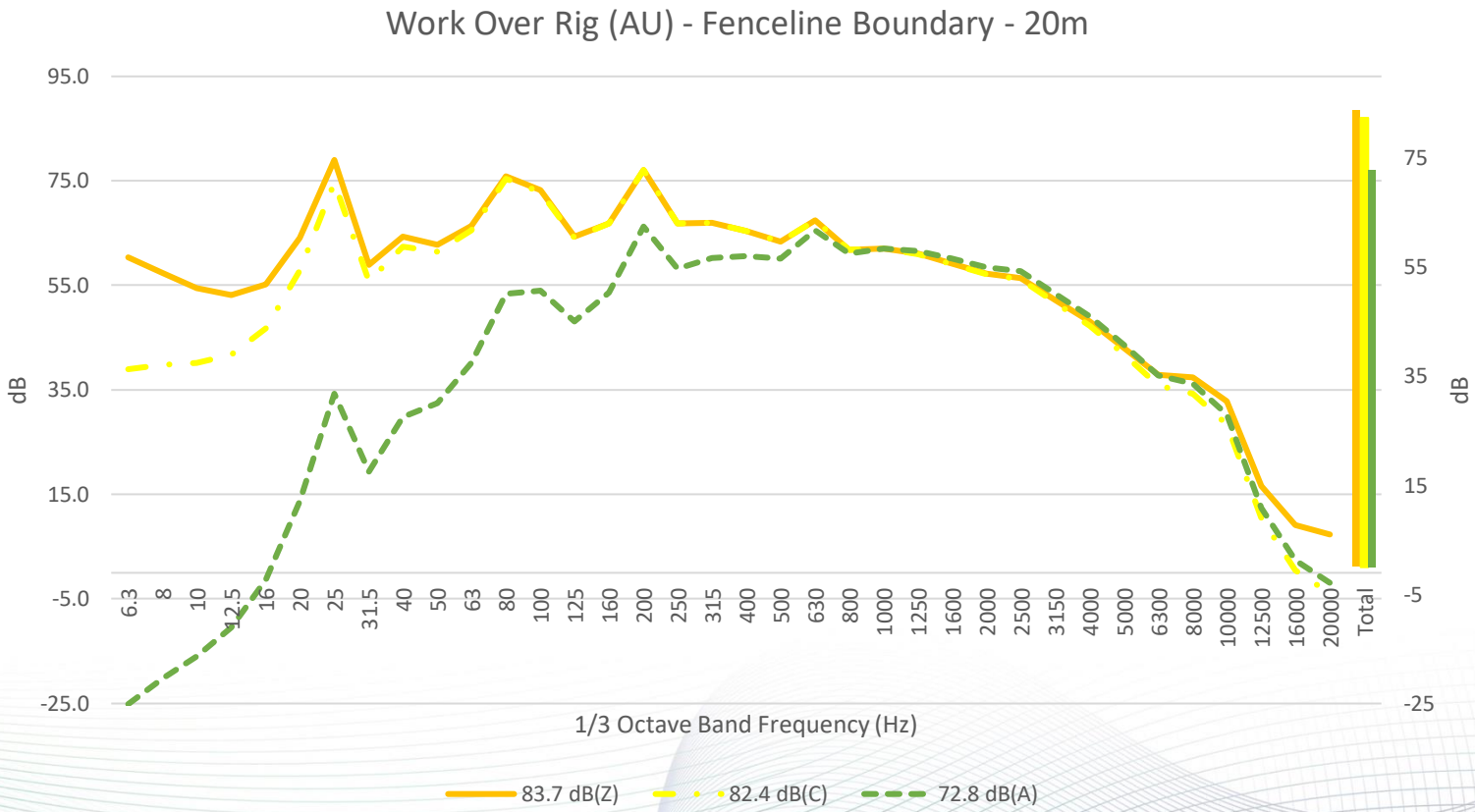


The Importance of Frequency

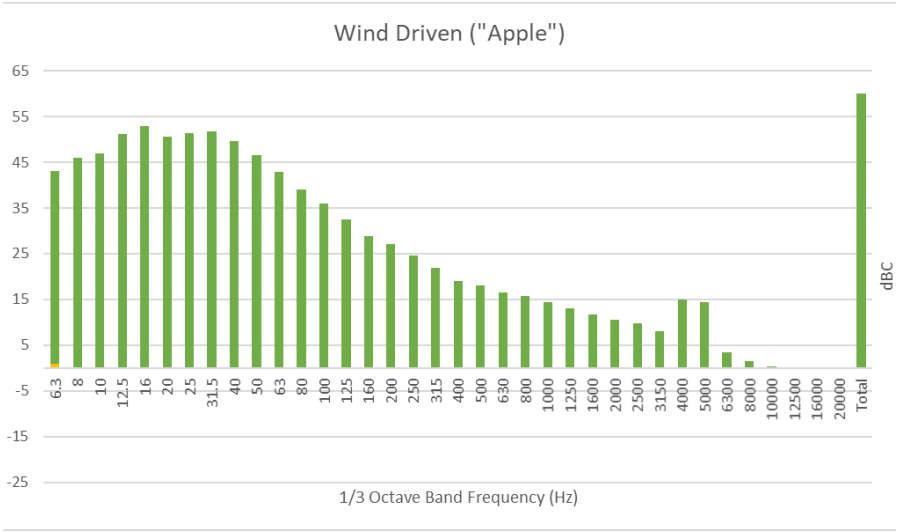
- Every person responds to sound differently, especially frequency.
- Some people are more annoyed by Low Frequency Noise (LFN).
- In response to complaints most regulators are introducing LFN criteria.

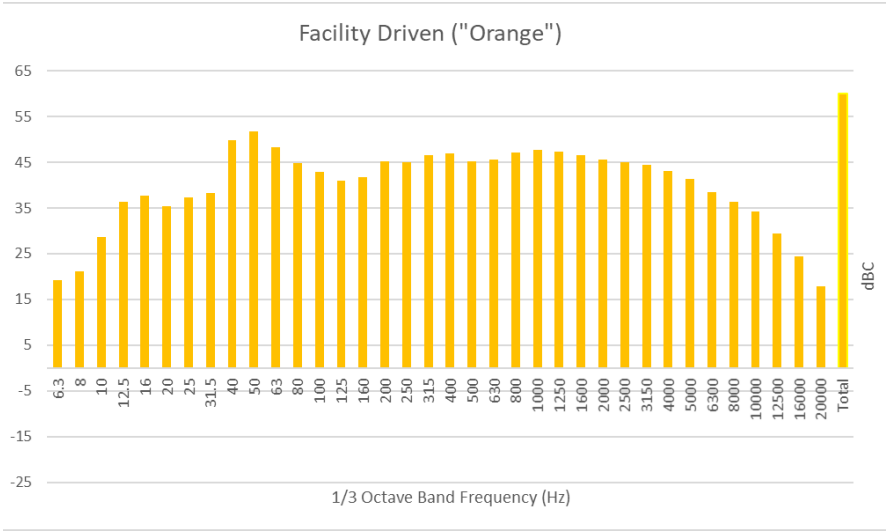


dBA vs. dBC Example



Apples and Oranges-both 65dBC

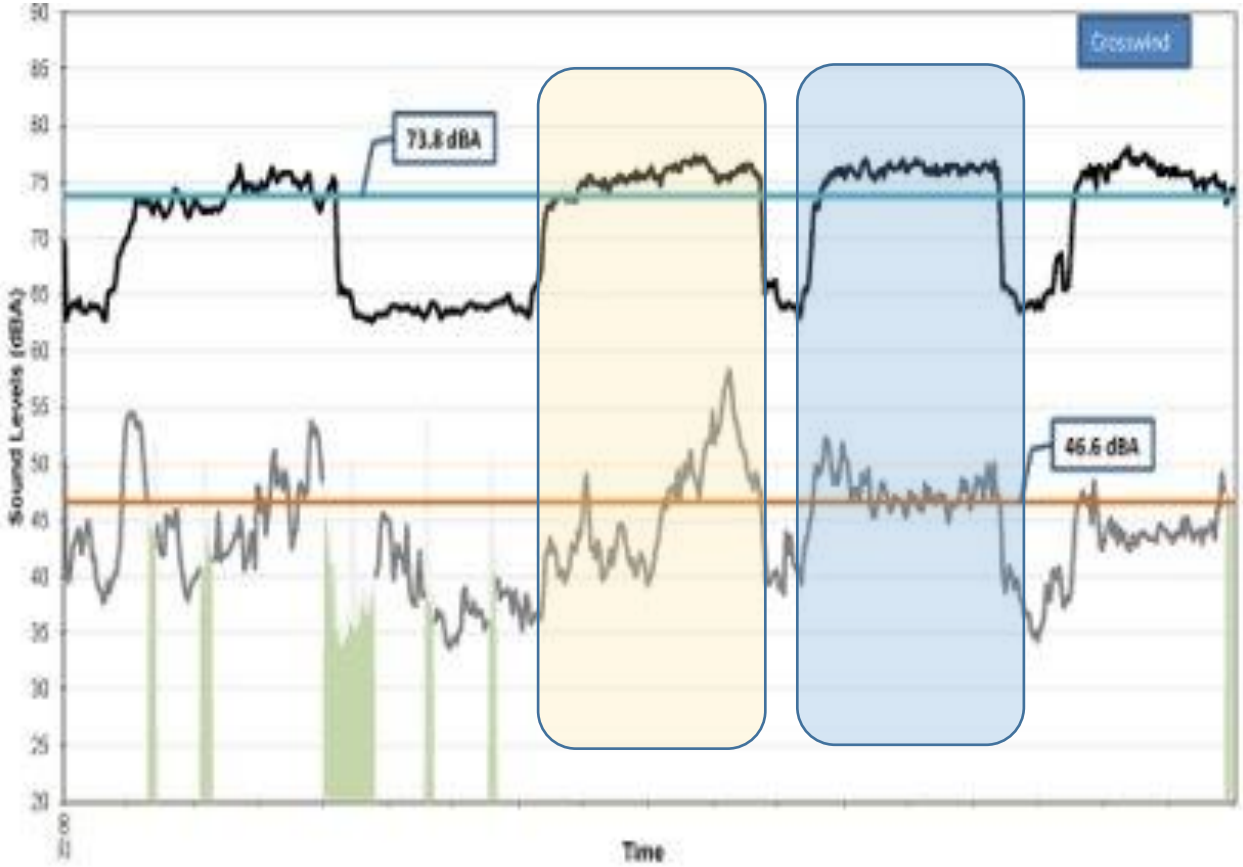




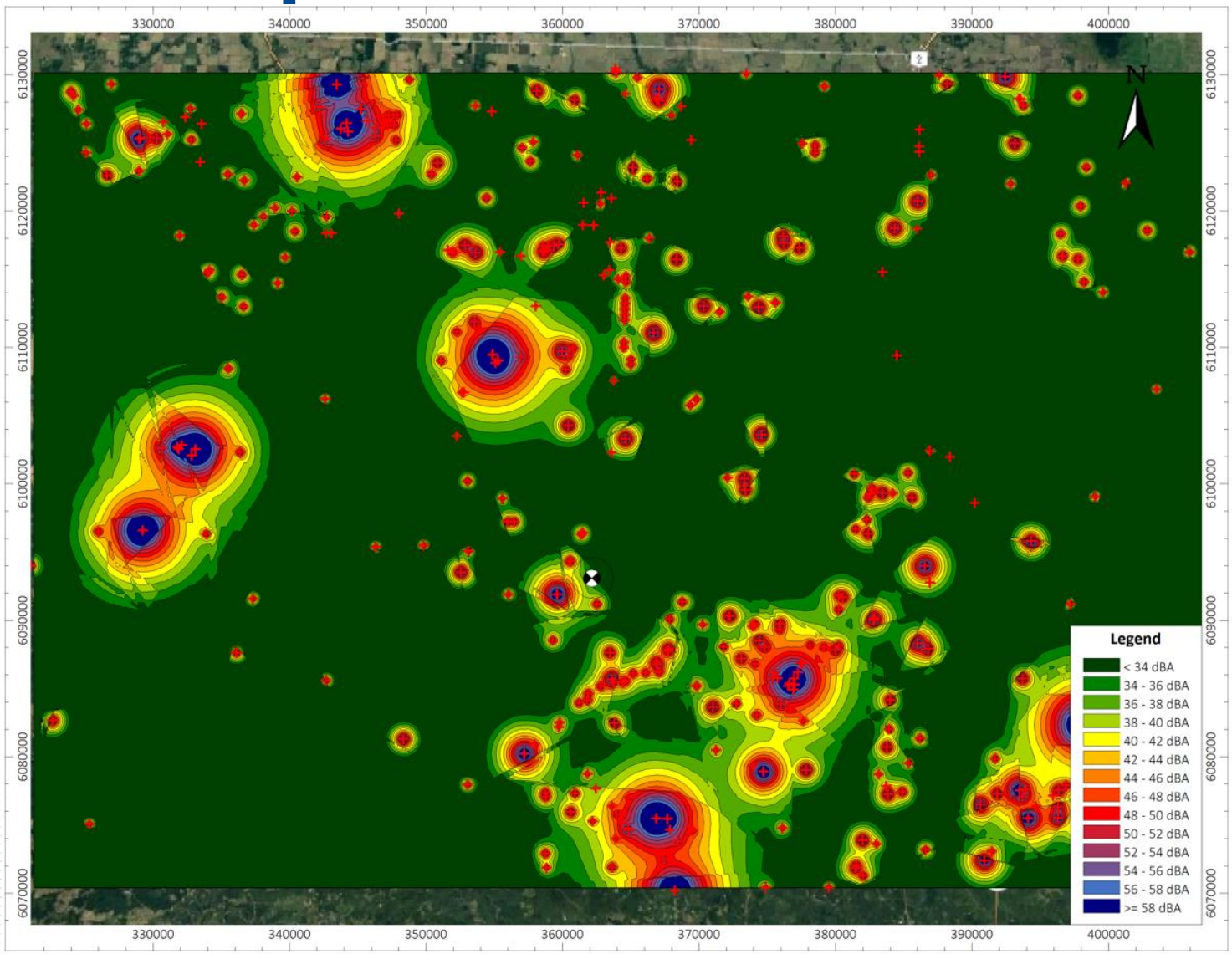
Complex Emissions-Frequency

Facility Name	Scenario	Location	Measurement Height	Measurement Date	Frequency Band	Document ID
Hydraulic Fracturing	Pumping Operation		1.5 m		16 Hz	Sample-NAW-000

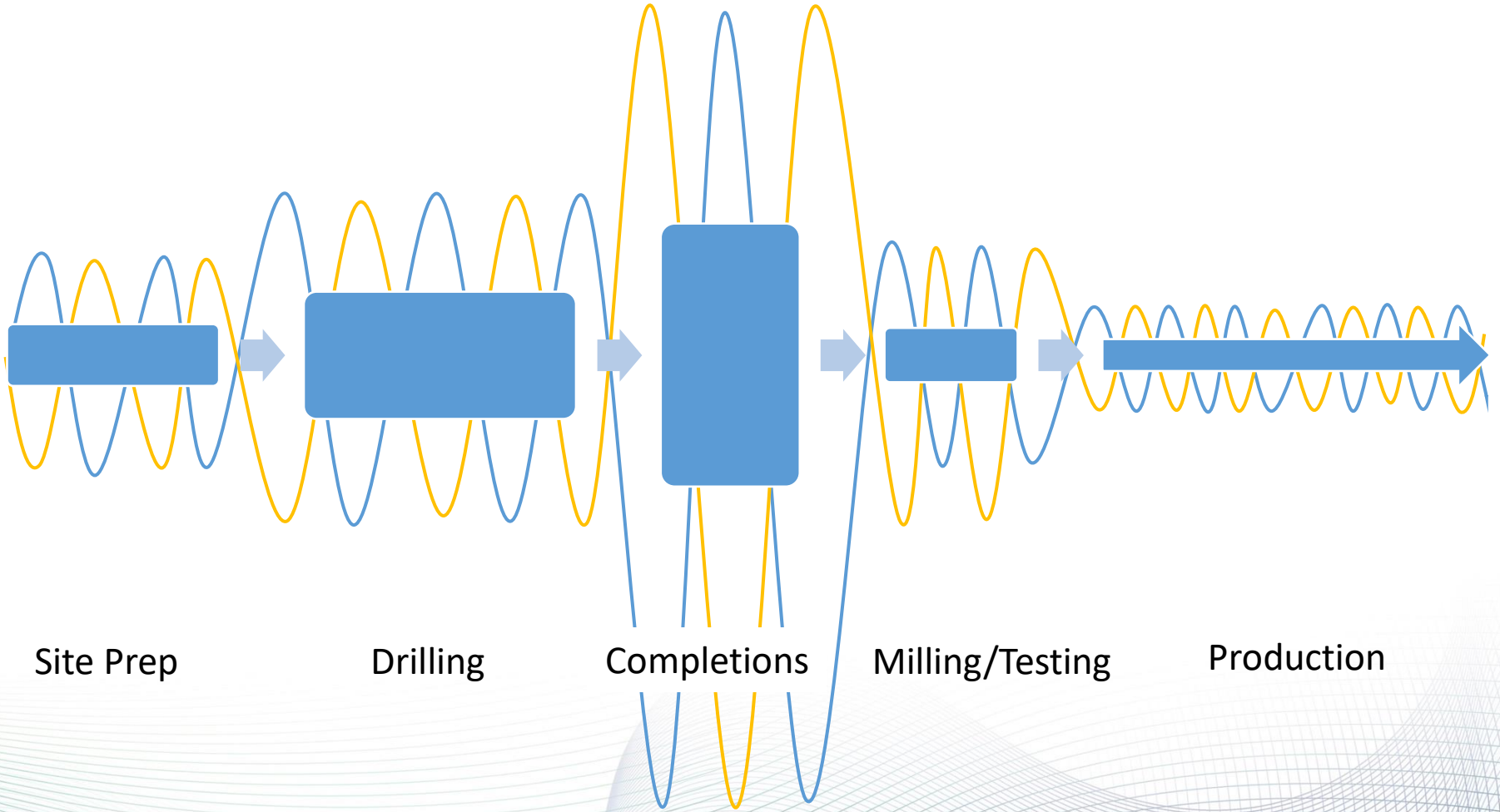
Complex Emissions-Time



Complex Emissions-Time



Emissions – Wellpad Timeline

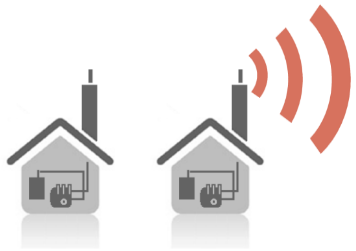


Sound & Decibel Math

1 Sound Source:

25 dB at the receiver

2 Equal Sound Sources:



3 dB higher than one source

28 dB at the receiver

3 Equal Sound Sources:

5 dB higher than one source

30 dB at the receiver

Best Practises Framework

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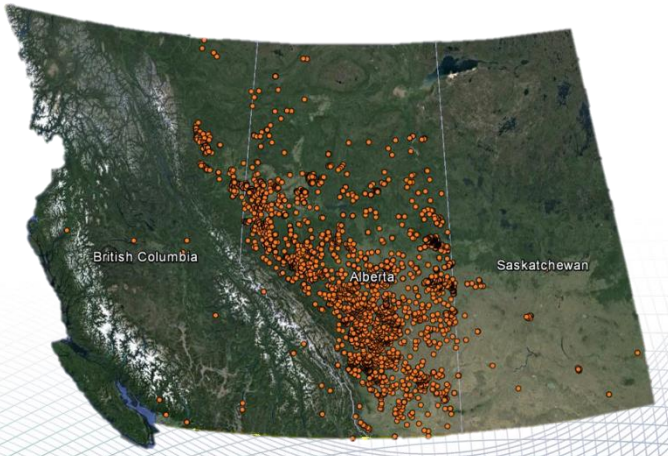
Noise Control Directive 038

Alberta Energy Regulator (AER)

- Grandparent of other noise regulations
- Developed in response to complaints
- Includes requirements for **Before Construction (modeling)** & **Compliant Investigations (monitoring)**
- Thousands of D-038 assessments have been completed in the past 30 years



PSL: Permissible Sound Level

- PSL is set for the nearest or most impacted dwelling(s) and is dwelling specific
- The cumulative facility noise levels plus average ambient levels must be less than the PSL
- PSL relaxed for:
  - High ambient, near road or rail or other non-energy noise
  - Temporary events
  - Grand-fathered facilities (expires in 2018)

PSL: Permissible Sound Level

For a typical rural residence far away from a major roadway:

Permissible Sound Level	**=**	**Basic Sound Level**	**+**	**Daytime Adjustment**	**+**	**Class A Adjustment**	**+**	**Class B Adjustment**
Permissible Sound Level	**=**	**40 dBA**	**+**	**10 dBA**	**+**	**0 dBA**	**+**	**0 dBA**

PSL is 40 dBA Nighttime (50 dBA Daytime)

Noise Impact Assessment (NIA)

"An NIA is required to ensure that operators consider possible noise impacts before a facility is constructed or in operation."

- AER Directive 038: Noise Control

LFN: Low Frequency Noise

- AER Directive 038: Noise Control

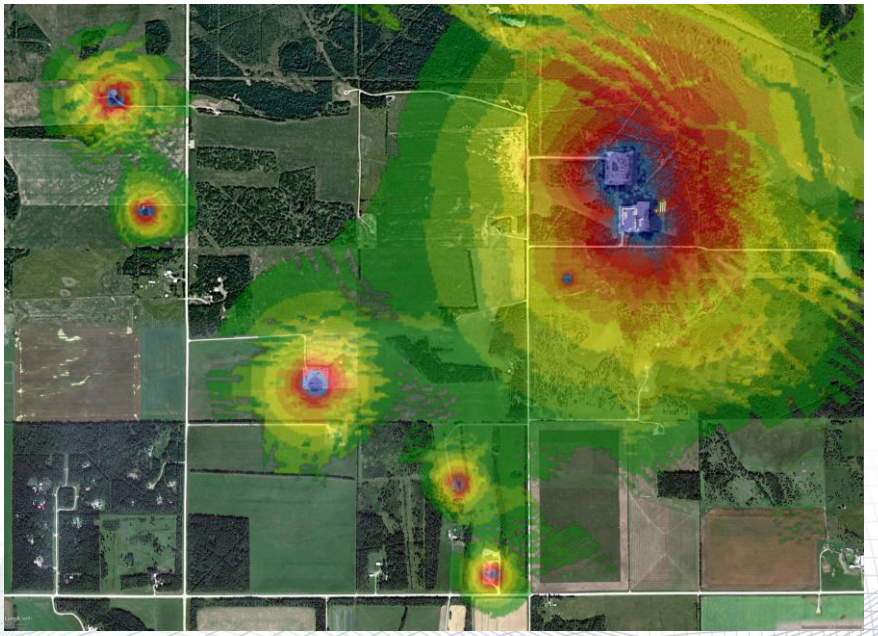
"LFN may be a problem in some situations where the dBA value is satisfactory but the concern is a dominant low frequency that increases annoyance levels at nearby dwellings."

- LFN is difficult to determine from theory
- Determining LFN requires second stage special investigation
- If LFN is discovered than a 5 dB penalty is applied
- Most jurisdictions are adding LFN criteria

Noise Control Directive 038

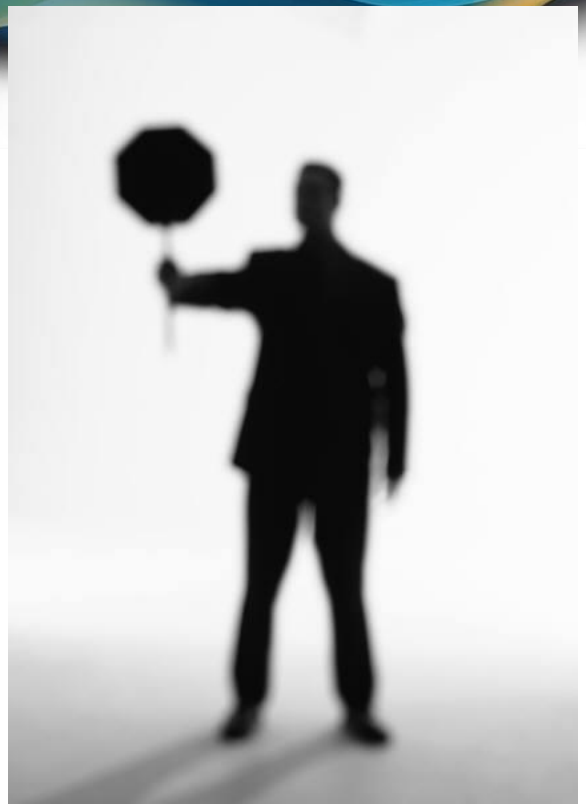
Alberta Energy Regulator (AER)

- Specific procedure, including “representative conditions”.
- 2007 revision included requirements for LFN.
- Cumulative assessment, all energy industry noise sources, including third parties.



Check out a Case Study

Why Complete an NIA?



3.2 NIA Required

5) An applicant must complete an NIA for any new facility where there is a reasonable expectation of a continuous noise source or for modifications to existing facilities where there is a reasonable expectation of changes in noise source. The EUB may where it deems necessary require an NIA for a facility.

5.2 Risk-Assessed Noncompliance

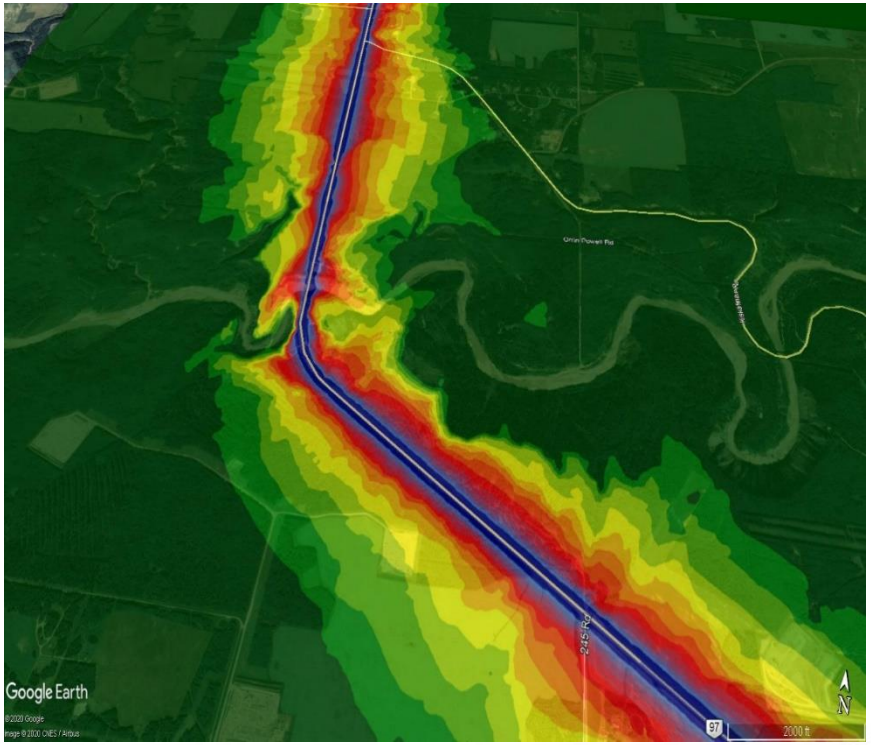
The EUB may conduct random comprehensive sound surveys on facilities and audits on facility applications. The EUB expects sound levels to be in compliance and NIAs to be complete and technically relevant. Possible noncompliance events are listed in Table 5. For details regarding EUB compliance and enforcement, see *Directive 019: EUB Compliance Assurance—Enforcement*, available on the EUB Web site and from Information Services.

Table 5. Risk-assessed noncompliances

Risk	Noncompliance event
High	Failure to complete an acceptable noise impact assessment prior to application
High	Failure to meet the permissible sound levels at the nearest or most impacted dwelling

If the EUB determines that a noncompliance event causes noise levels greater than the PSL or an unacceptable noise impact on nearby residents, the EUB may suspend operations.

Complex Emissions-Sources



- Traffic Noise Travels
- Work in BC to quantify and factor into mitigation planning
- Traffic noise propagates further
- Considered as part of AER regulations

Best Practise-Cycle

01 SCREENING + RISK

- Due Diligence
- Assess Risk
- Scope and Budget
- Data Driven Decisions

02 ENGINEERING + INSIGHTS

- Detailed Modeling
- Stakeholder Reporting
- “Art of the possible”
- “Low Hanging Fruit”

04 MEASUREMENT + MONITORING

- Monitoring
- Diagnostics
- Occupational
- DIY Options

03 MITIGATION + PROCUREMENT

- Noise Control Specifications
- Competitive Bids
- Cost Benefit Analysis
- Warranty

Noise Emissions and Mitigation

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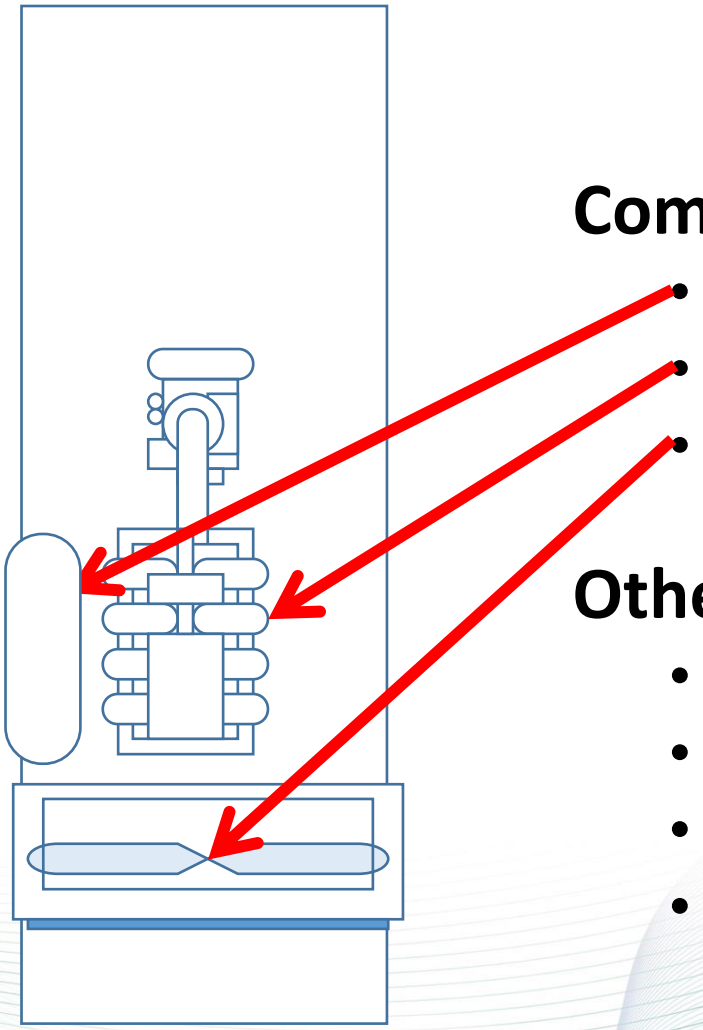
Noise Emissions - Sources



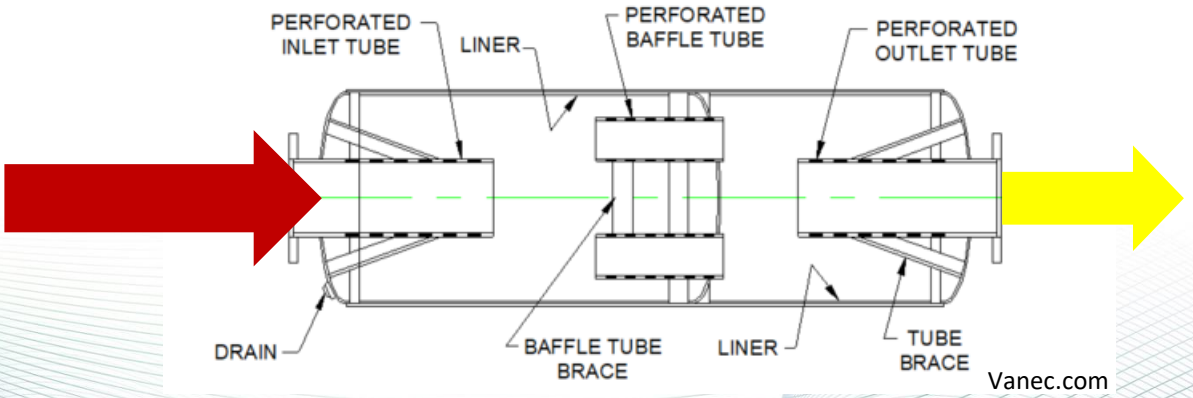
Common major noise sources:

- Engine exhausts
- Engine casings
- Cooler fans

Other noise sources:

- Mobile equipment
- Valves, piping
- Electric motors, pumps
- Sand systems

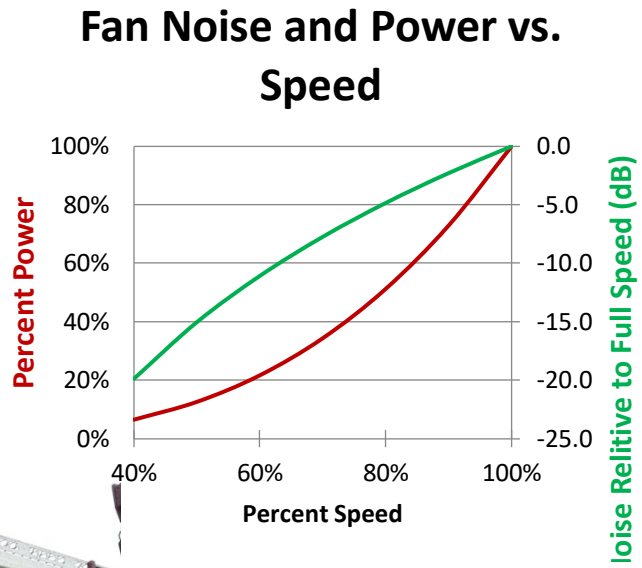
Noise Emissions – Engine Exhaust



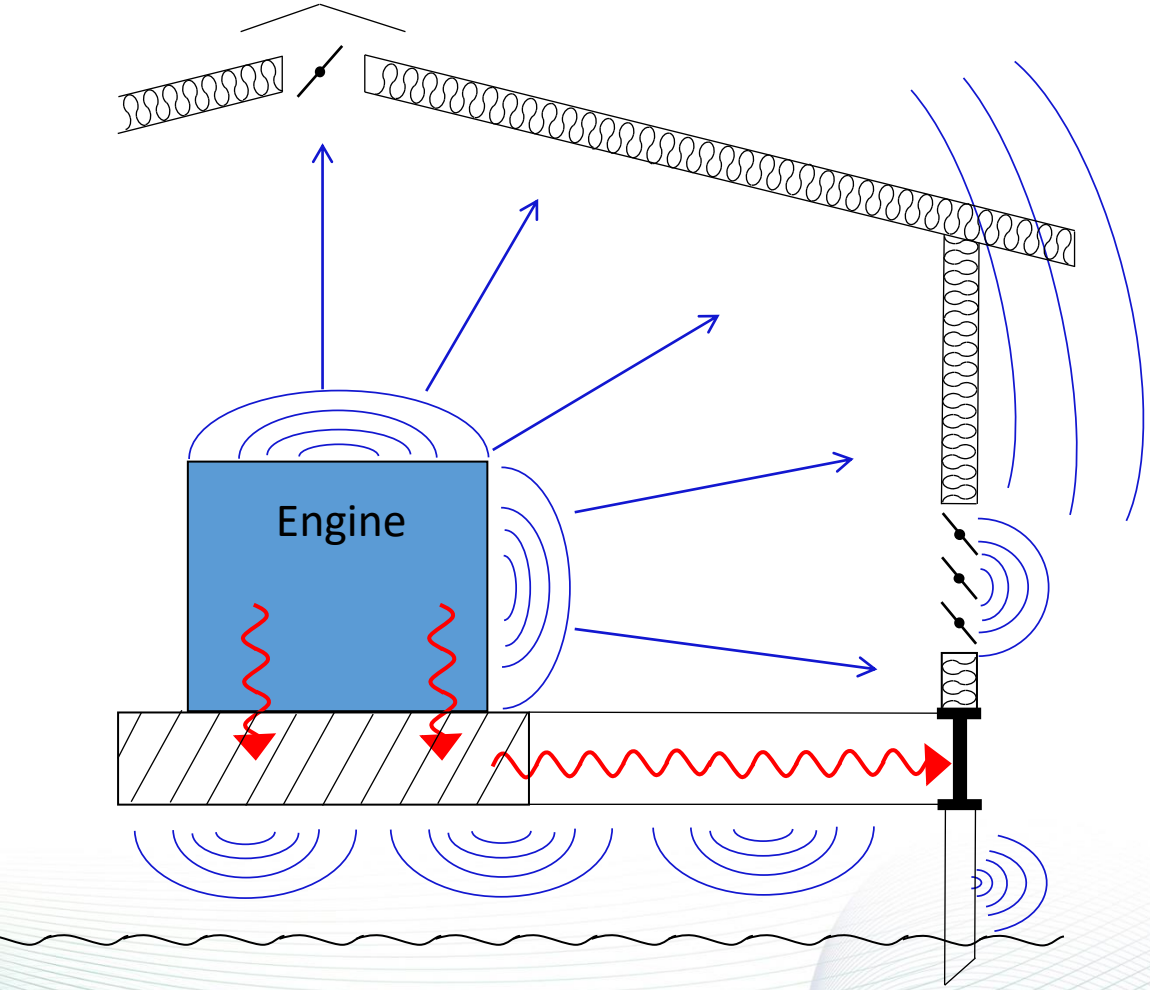
Vanec.com

Noise Emissions – Fans

Cooler Side Near Field Sound Map



Noise Emissions – Engine Casing



Noise Control Philosophy

- **Path based :** Add control between the source and receiver

  Silencers, enclosures, barriers, insulation, etc.

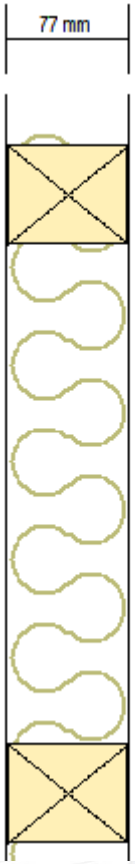
- **Source based :** Reduce the sound emitted by the source

  Design specs, slow fans, electrification.

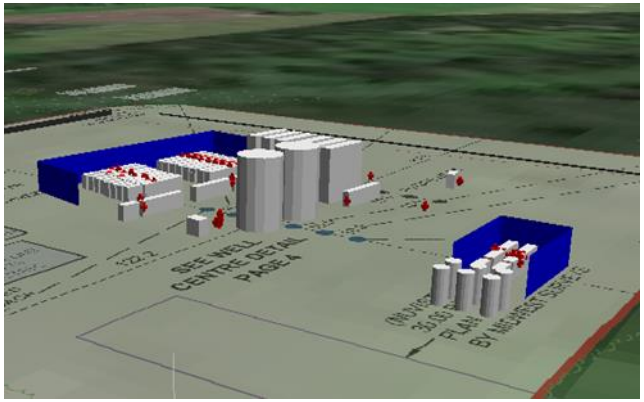
- **Administrative:** Limit noisy activities to certain times.

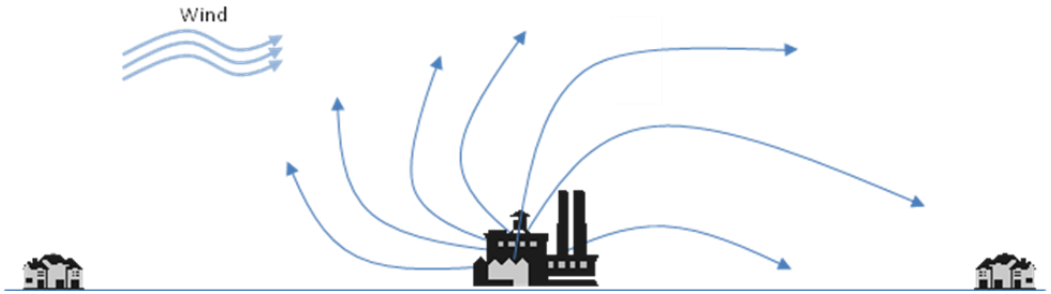
Effective Noise Control Considers Acoustics and Operations

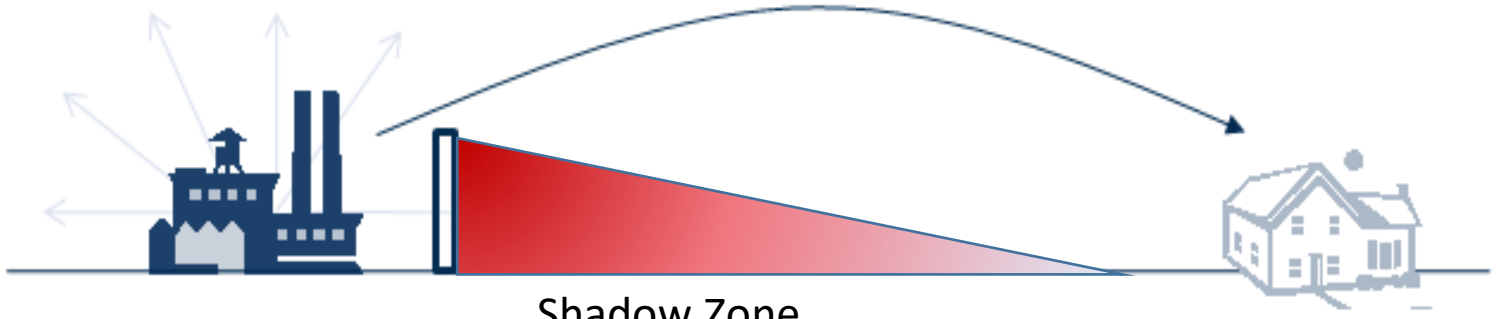
Noise Mitigation – Portability



Noise Mitigation – Noise Walls





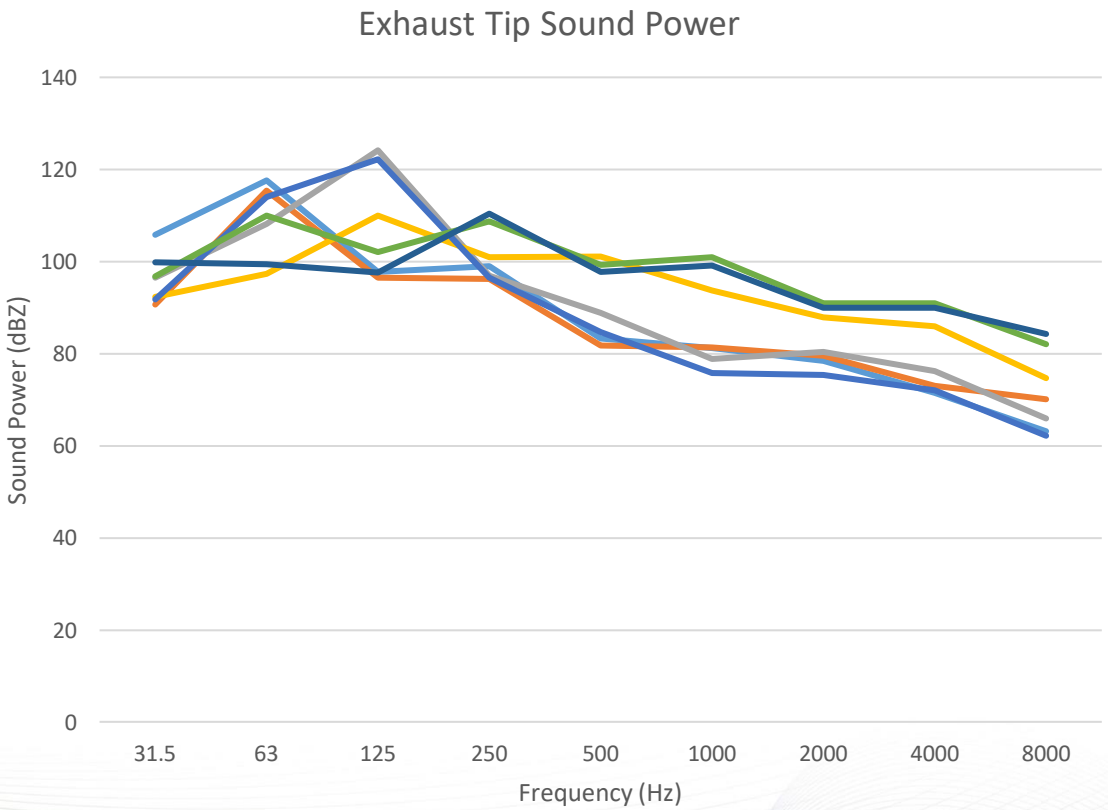


Shadow Zone

Noise Mitigation – Evolution

Noise Source	SPL (dBA)
Truck 8 Exhaust Muffler Tip	44.0
Truck 8 Exhaust Muffler Shell	43.5
Truck 7 Cooler Exhaust	42.3
Blender West Engine Exhaust Tip	42.1
Truck 8 Cooler Inlet	39.7
Truck 11 Engine Casing	38.5
Sand Conveyor	36.6

Noise Mitigation – Leveraging Data



Research Wishlist

Research – Wishlist

- **Sound and Annoyance:** Experience indicates that not all sounds result in uniform annoyance.
  - What other factors are related to annoyance?
  - How do cumulative effects change perception or stakeholder engagement?
  - Leverage new technology to extend past "single values" dBC/dBA into full datasets.
- **Environmental Propagation:** Variations in the environment cause large sound fluctuations in sound.
  - Existing modeling technology based on dated studies and limited data sets in low frequencies.
  - Large scale control studies using modern technology and full data set (frequency and temporal).
  - Benefit to mitigation planning and policy development.