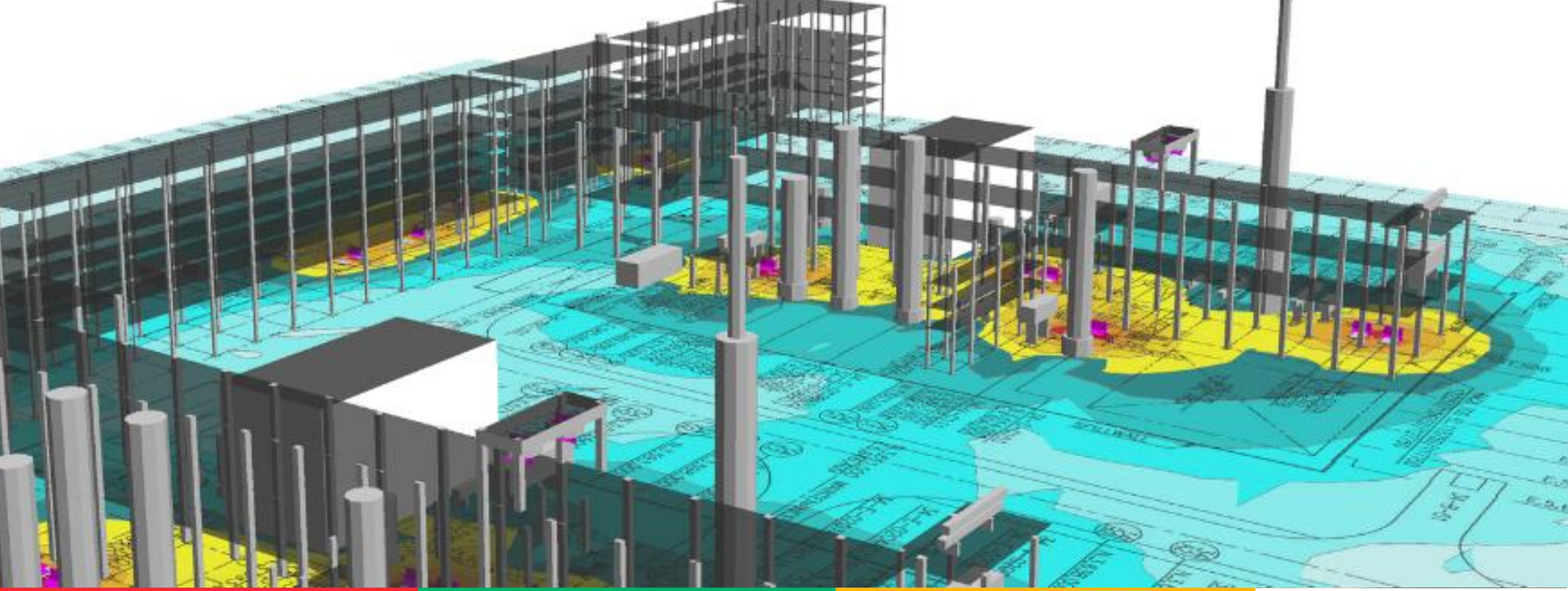

NOISE PREDICTION MODEL APPLICATIONS FOR SOUTH AFRICAN MINING INDUSTRY

Understanding noise management in mining operations

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Overview of an Acoustic Consultant

Acoustic consultants provide specialised acoustic solutions across a range of various industries including mining

Their work supports compliance, worker safety, and environmental responsibility.

🧪 **Noise Assessment & Monitoring**
- Measure noise from blasting, drilling, and machinery
- Analyze on-site and community noise environments

🧭 **Noise Prediction & Modelling**
- Use software to forecast noise propagation
- Plan proactively to manage future noise impacts

🛠️ **Tailored Noise Control Solutions**
- Design barriers, silencers, and machine modifications
- Recommend operational changes to reduce noise

⚖️ **Regulatory Compliance Support**
- Ensure compliance with noise laws and standards
- Prepare reports to avoid fines and delays

📈 **Operational Efficiency Improvement**
- Minimize noise disruptions to operations
- Improve worker communication and safety

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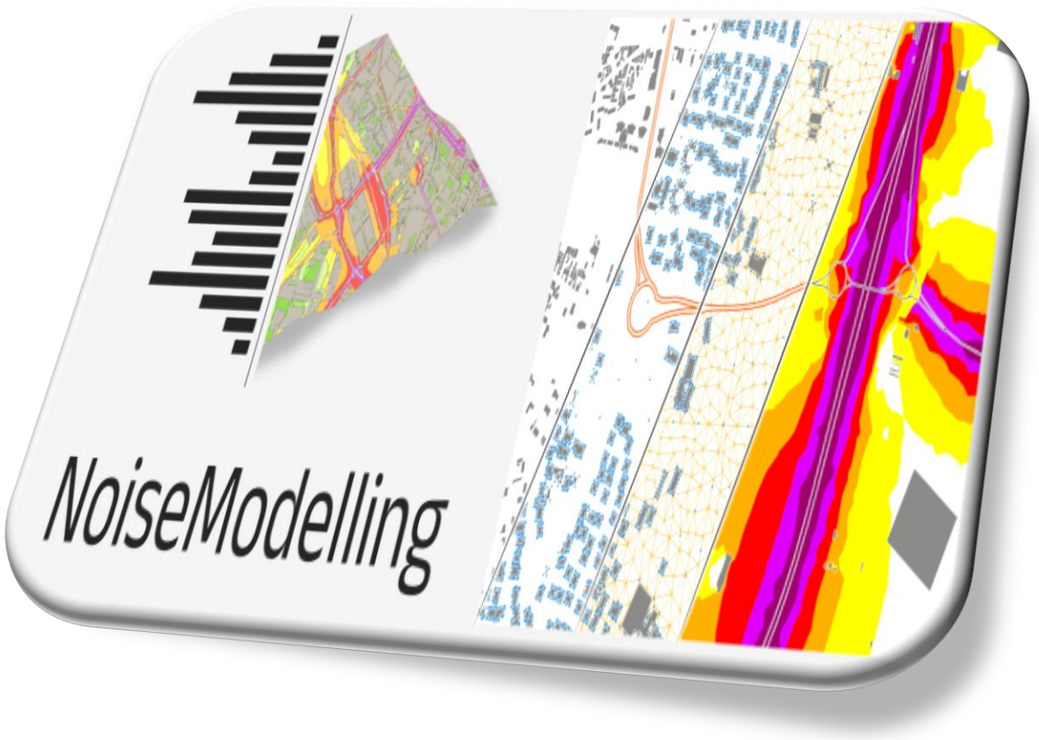
What is Noise Prediction Modelling?

💻 What is Noise Prediction Modelling?

- A method of simulating how sound propagates using specialized software
- Uses data about noise sources, terrain, and weather
- Predicts noise levels at various locations before or during operations

✅ What Is It Used For?

- Environmental noise impact assessments
- Planning new developments (e.g., mines, roads, factories)
- Ensuring compliance with noise regulations
- Designing noise mitigation strategies
- Informing stakeholders and communities



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How Are Noise Measurements Performed?

- We use Class 1 Sound Level Meters – high-precision instruments
- Instruments include octave and third-octave band filters
- Capture both loudness (sound pressure level) and frequency content
- Measurements are typically conducted during representative operational periods
- Data collected is used to validate prediction models and assess regulatory compliance

Limitations of Noise Prediction Modelling

- Depends heavily on accurate, detailed input data
- Models simplify complex environments (e.g., topography, weather)
- Real-world changes (e.g., seasonal wind) may not be fully reflected
- Needs to be validated with on-site measurements
- Complements, but does not replace actual noise monitoring

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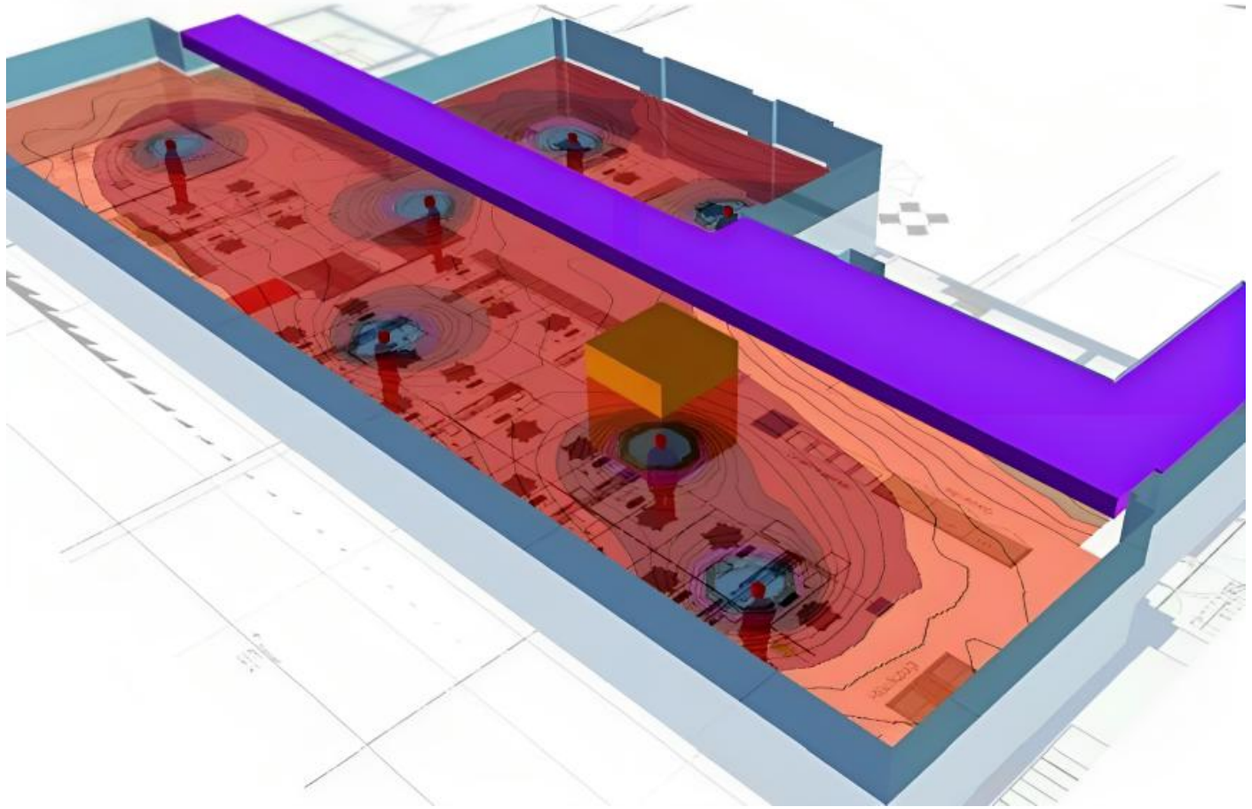
Importance of Noise Prediction In Mining



- **Indoor modelling**

Input room geometry (walls, roofs) and internal source spectra. SoundPLAN computes reflected/reverberant fields. Outputs include interior octave-band levels at workstations and reverberation estimates.

- **Minimizing Environmental Impact**

Noise prediction aids in minimizing the environmental impact of mining operations as well as reducing Noise-induced hearing loss (NIHL)

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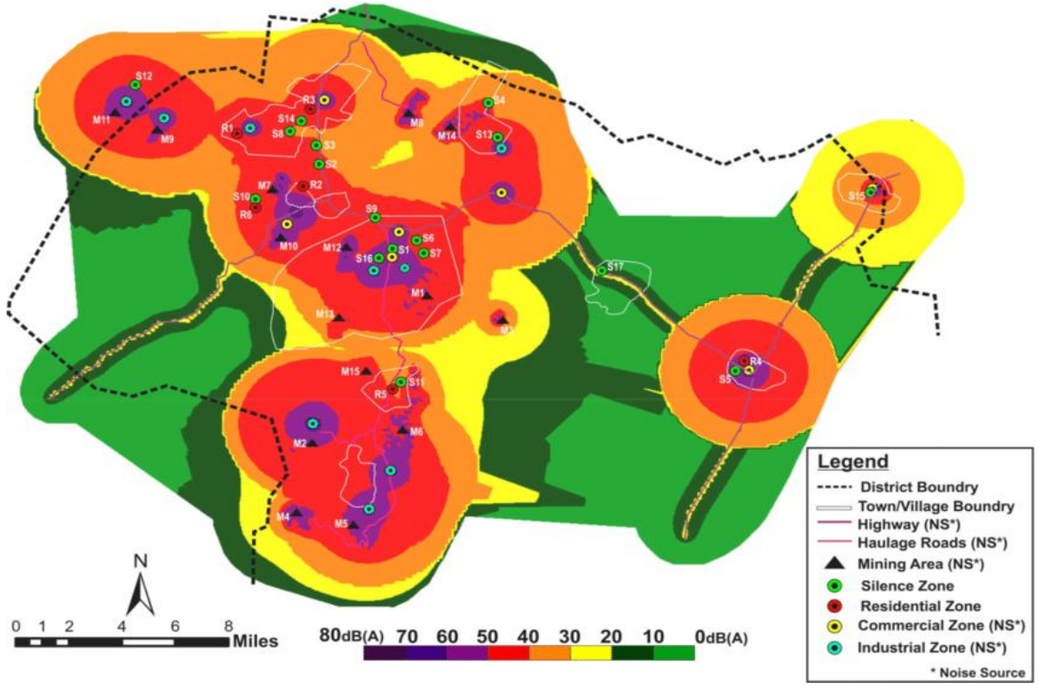
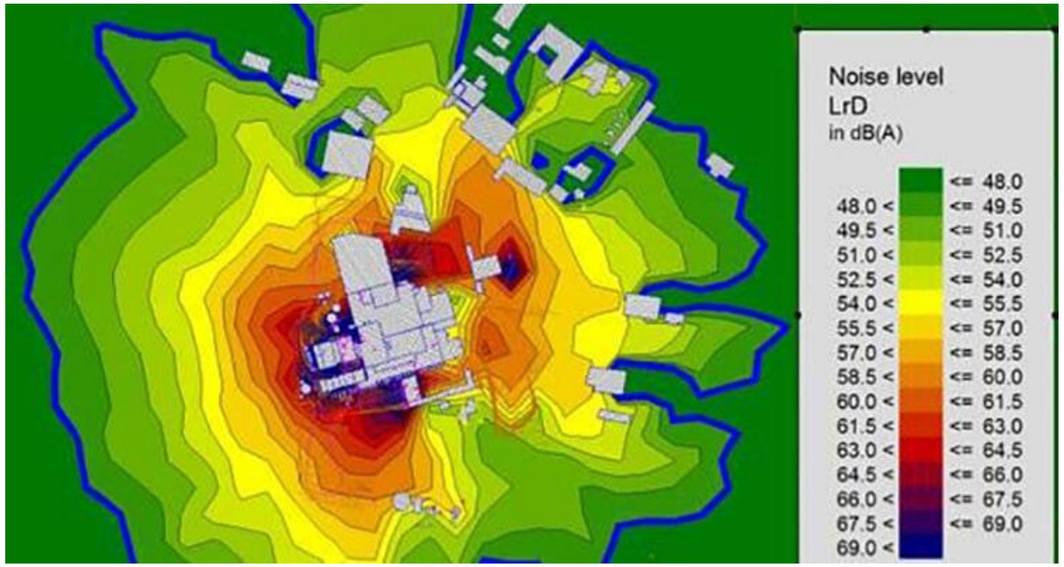
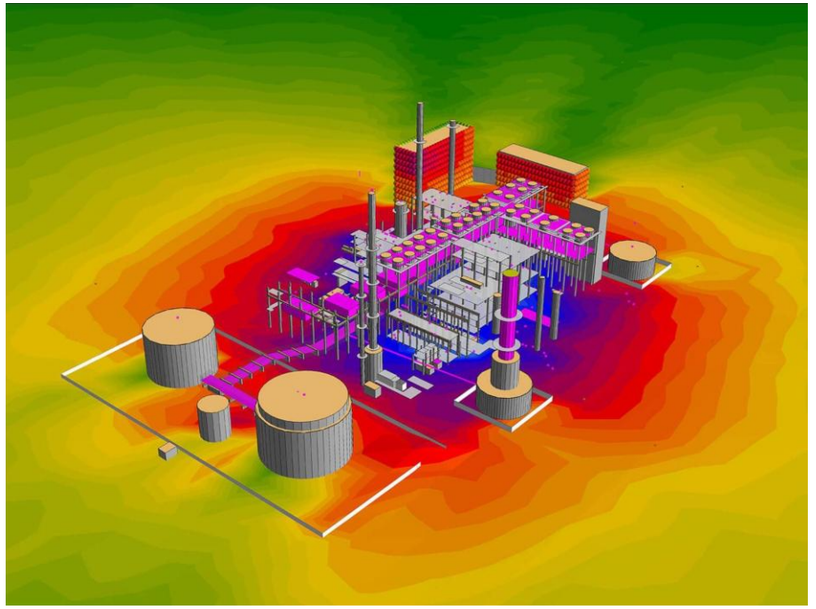
Importance of Noise Prediction in Mining

- **Outdoor modelling**

Input georeferenced maps, digital terrain (DTM), building layouts, and meteorological conditions. Define sources with sound power spectra (often octave-band data). SoundPLAN then calculates noise contours (iso-level lines) and receptor levels for the site and surrounding community .







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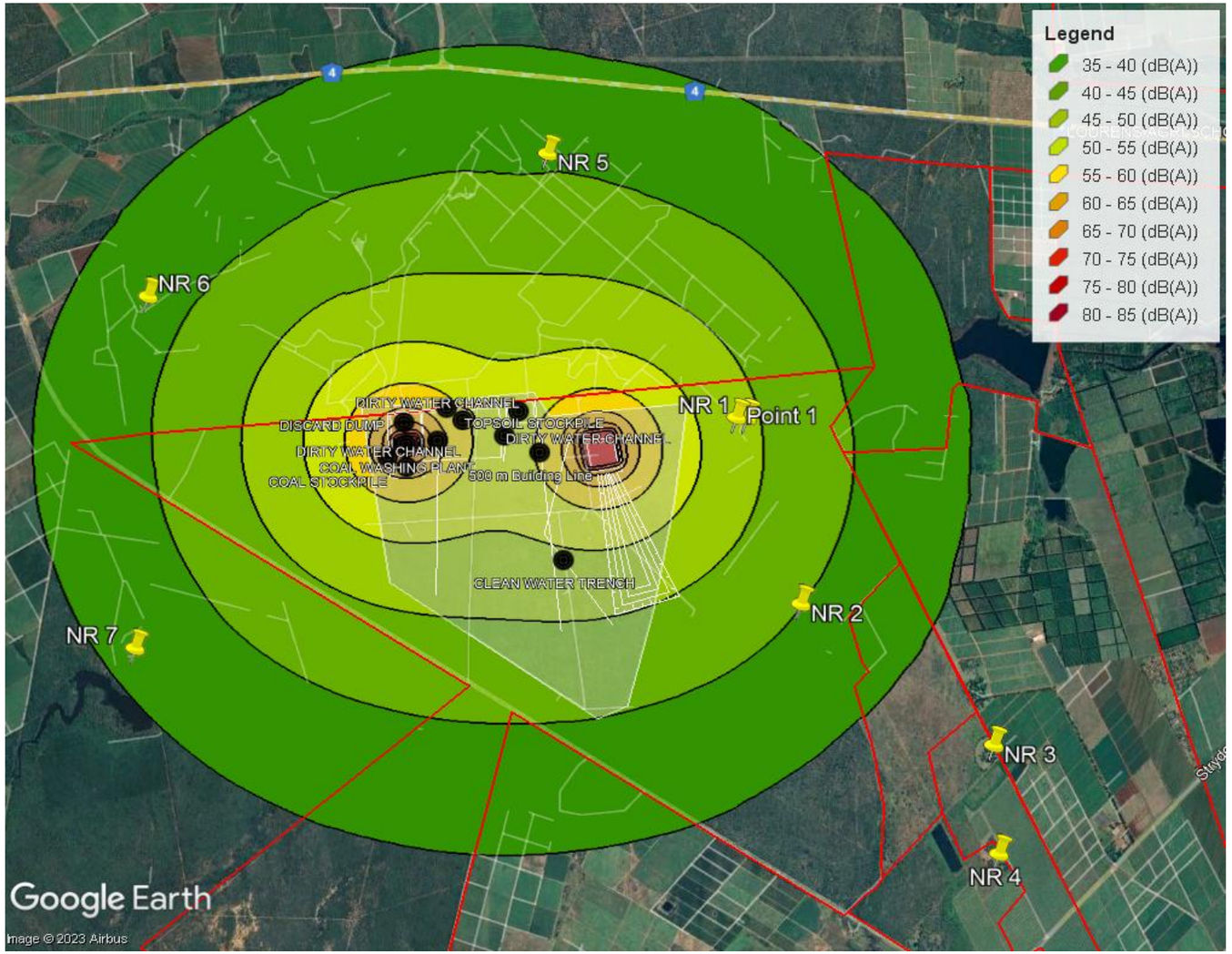

Open Cast Mine Example

A pit is modelled with diesel engines and crushers as point sources. The output is a set of contour maps (e.g. 85 dB(A) levels) around the site. This highlights which nearby villages fall in higher noise zones. An octave-band chart for a critical receptor might show, say, low-frequency dominance from haul trucks.

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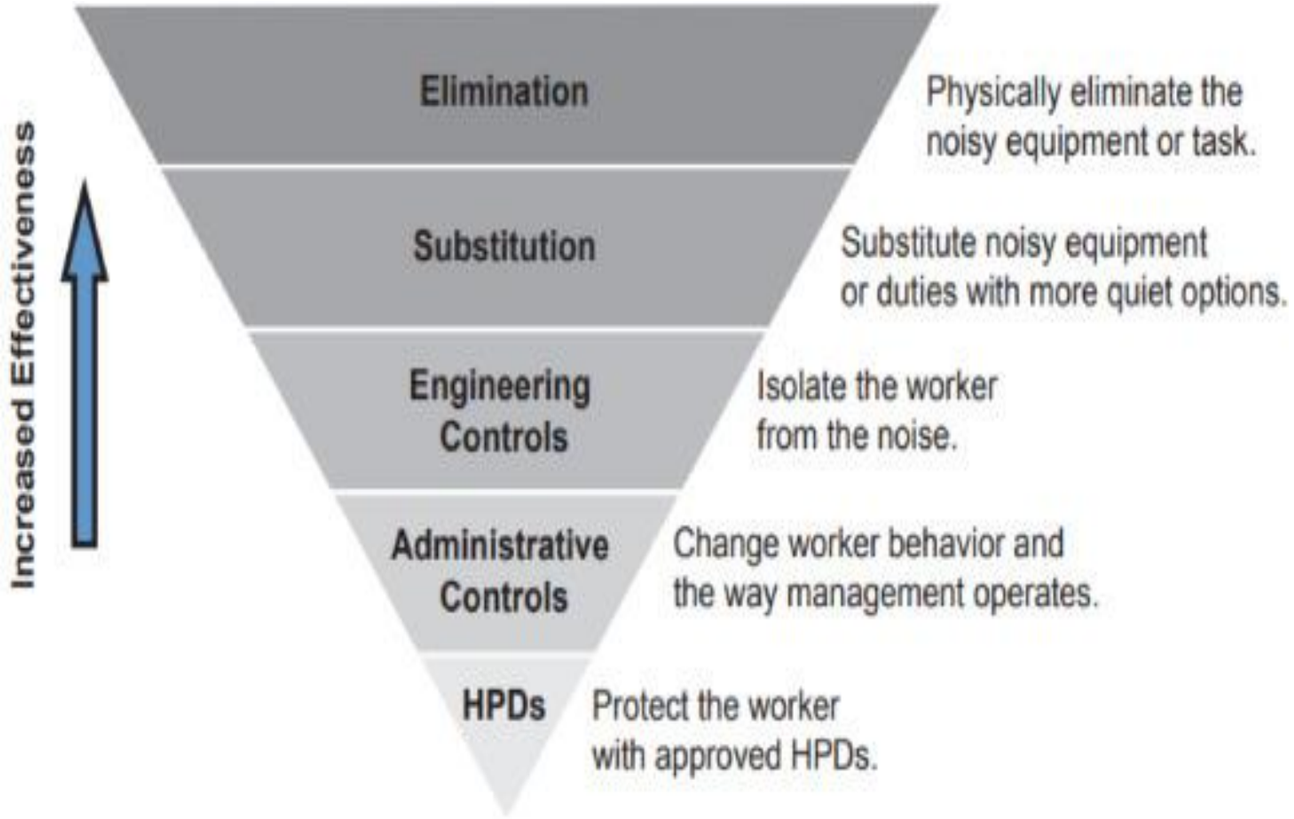
Legal Framework

- Noise prediction models are grounded in the regulatory landscape. In South Africa, mining operations must comply with the following:
- **International Standards:**
  - **ISO 9612 (2010):** Provides the “engineering method” for measuring and calculating occupational noise exposure
  - **ILO & WHO Guidelines:**
    - Emphasize the hierarchy of noise control:
      - Eliminate at the source
      - Block the path
      - Protect the receiver
    - Discourage relying solely on hearing protection
- **National Standards (South Africa):**
  - **SANS 10083 (2013):**
    - Aligns with ISO standards
    - Covers occupational noise measurement and hearing conservation



HPD = Hearing protection device.

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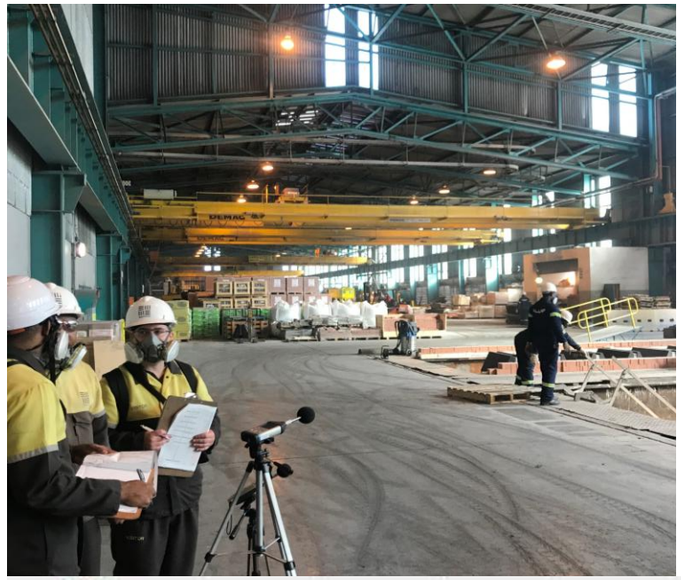
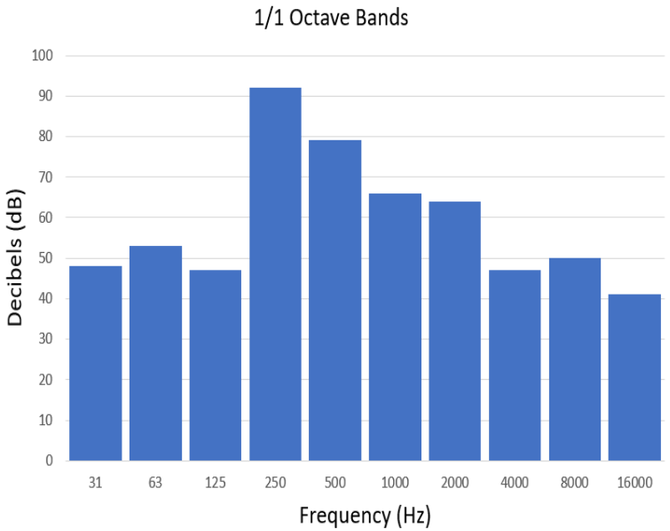
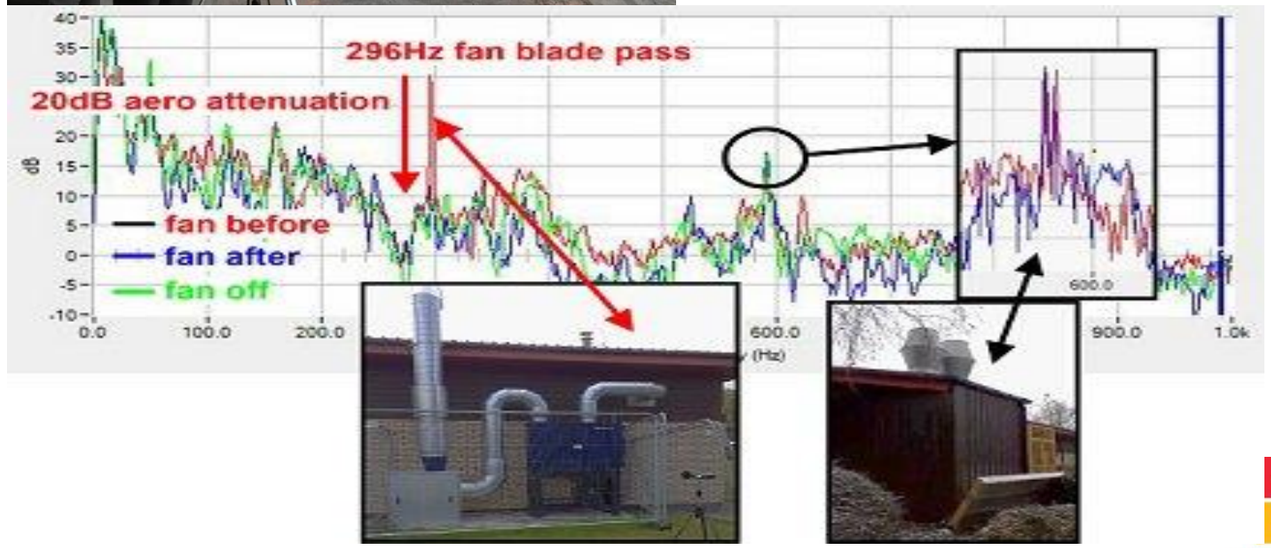
Proactive Noise Management Strategies: 3 Key Elements

To effectively manage noise, we combine these three critical elements:

1. **Frequency Analysis**
   - Identifies dominant noise frequency bands (Low or High Frequency noise)
   - Different frequencies affect people in different ways and different frequencies require different design strategies
   - Pinpoints specific noise sources by their spectral signature
   - Guides targeted noise control solutions matched to frequency characteristics
2. **Real-World Data**
   - Uses actual on-site noise measurements and environmental conditions
   - Validates and calibrates noise prediction models
   - Monitors noise levels over time for trends and changes
3. **Engineering Controls**
   - Designs and implements physical noise reduction solutions
   - Includes barriers, enclosures, silencers, and operational modifications
   - Focuses on source, path, and receiver control measures to reduce impact







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Case Studies on Noise Prediction and Modelling

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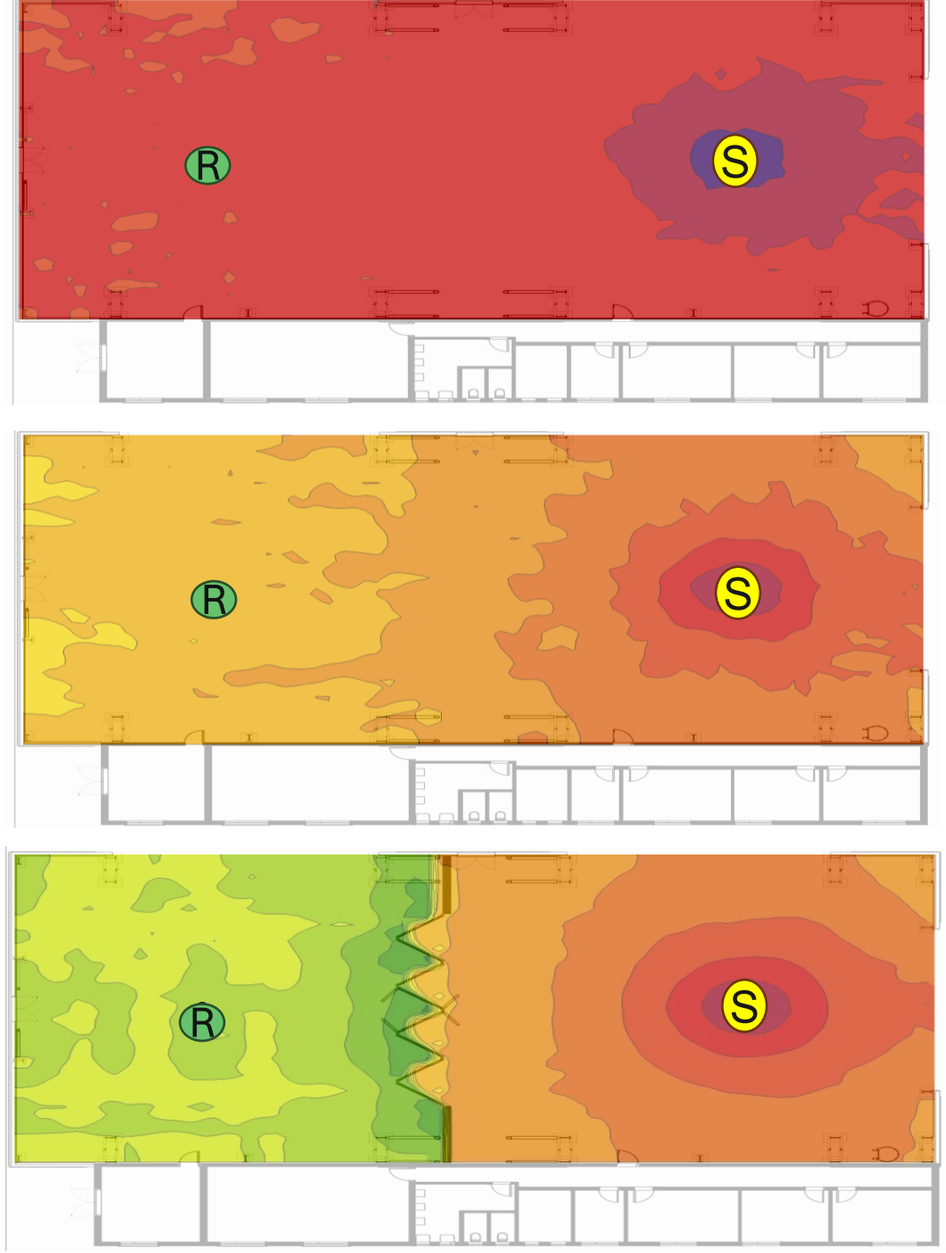
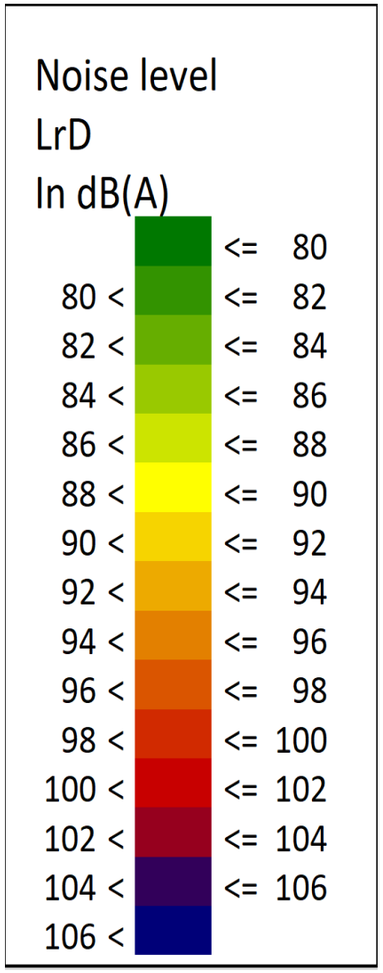
Workshop Case Study





Indoor Plant Example

- An enclosed workshop with grinders and compressors is modelled. Results include predicted levels at operator booths and a frequency plot. For instance, the model might reveal a 1/3-octave peak at 4000 Hz at the control desk, indicating a sharp machine tone. Engineers could then target an enclosure or isolator for that machine.

- Spectral Source Identification: In practice, we often correlate model predictions with measurements by toggling sources. OSHA notes (and as we do) that turning machinery on/off or adding temporary mufflers helps attribute spectral peaks to specific machines . For example, if a tone disappears when one compressor is muffled, we confirm it as the culprit. This guides the model calibration and focus of controls

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Noise Mitigation and Engineering Controls

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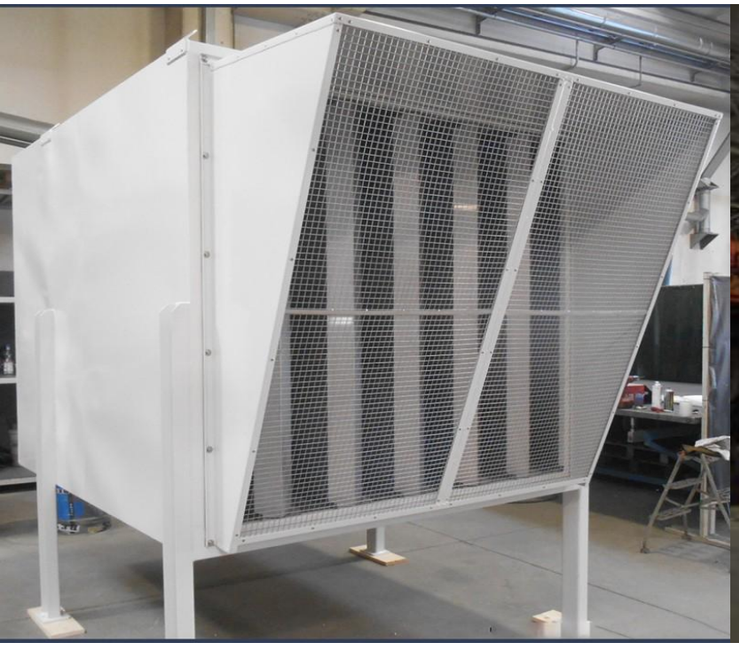

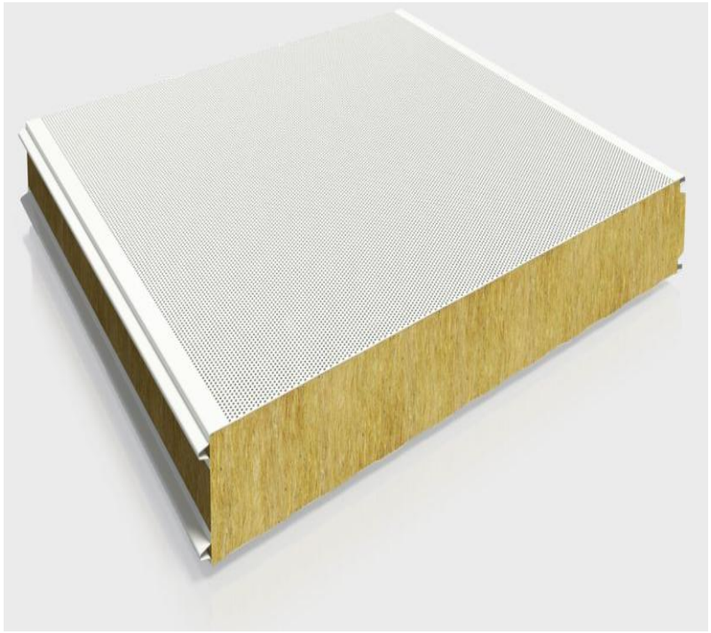

Noise Control Measures

Noise Source Control

- Use inherently quiet equipment and local silencing. Examples: install low-noise engines/motors, regular maintenance to eliminate loose parts, fit compressor and fan silencers or mufflers. Enclose noisy machinery in acoustic cabins or canopies. As ILO recommends, strive to remove noise at the source (e.g. use alternative methods or quieter processes) .

Path Control

- Insert barriers or absorbers between source and receiver. This includes erecting solid or absorptive walls around noise-emitting areas, using baffles or curtains in plants, and adding sound-absorbing material on surfaces. Increasing distance and using terrain or berms also attenuate noise naturally. These methods reduce propagation along the path .

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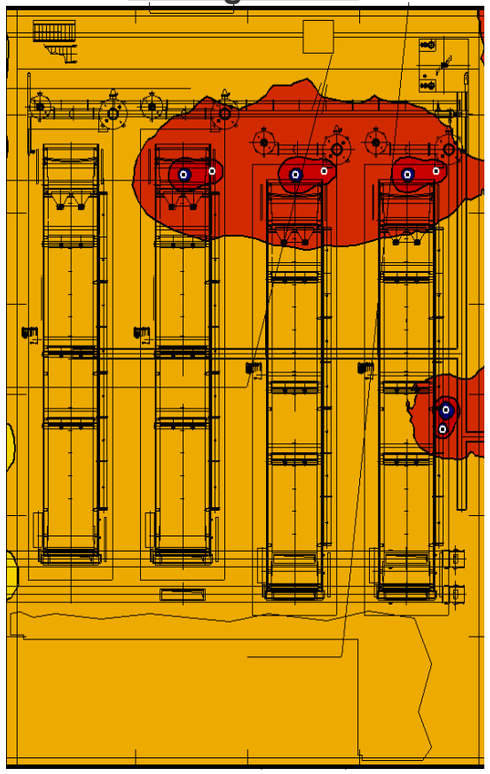
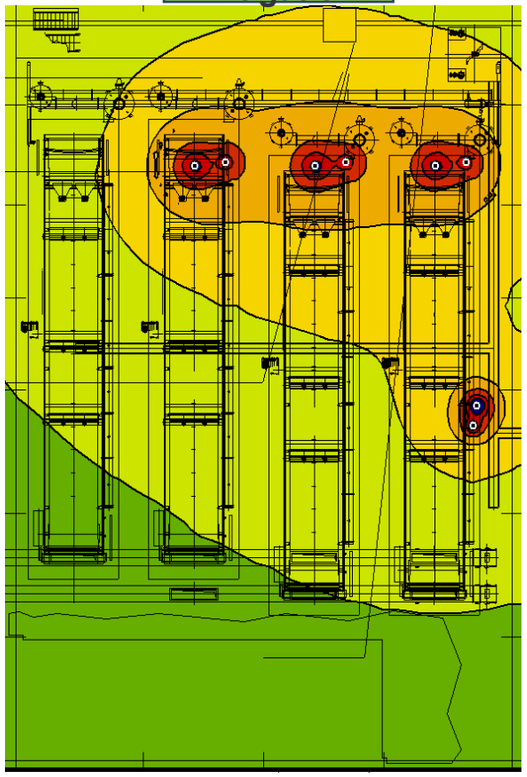
Acoustic Treatment of a Pump Station

An acoustic enclosure incorporating panels and attenuators was constructed around the pump station house to mitigate excessive noise emissions at the source

Without Mitigation



With Mitigation



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Conclusion

Importance of Noise Management

Effective noise management is crucial for ensuring worker safety and protecting the environment in mining operations.

Importance of Noise Prediction in Mining

Accurate and relevant information from onsite noise measurements and frequency analysis provides sufficient information so that noise prediction models can be created. The noise prediction models can indicate areas that require noise reduction using noise control measures. These measures can then be used in the noise prediction model to indicate if the proposed noise control measures provide sufficient and effective noise reduction.

Mitigation Strategies

Implementing effective noise mitigation strategies can significantly reduce noise exposure in mining environments.

Q & A

Thank you for your attention!!
I’d like to open the floor for any questions

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