Noise Control Case Studies

TIM WIENS
CONESTOGA-ROVERS & ASSOCIATES

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A bit about your speaker…

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Presentation Overview…

1. Some Case Studies
2. Mystery
3. Drama
4. Danger

Environmental Noise Impact – an Overview

What drives off-site impacts:

- Sound Power / Energy Generated by Equipment
- Separation Distance
- Line-of-Sight
- Ambient Sound Level/Existing Acoustic Environment
- Increased Public Exposure/Annoyance

Establishing Basics I

The Minnesota Pollution Control Agency, “A Guide to Noise Control in Minnesota, 2008” defines the thresholds of audibility as follows:

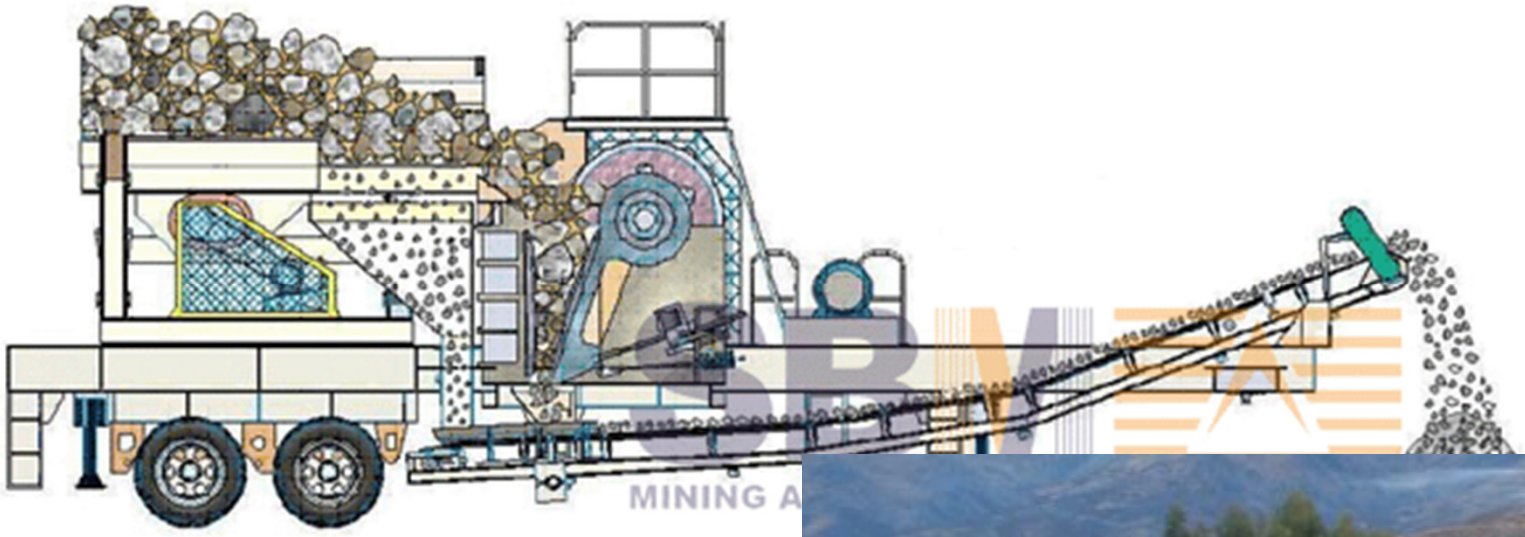
- 1 dBA (increase or decrease) = not noticeable
- 3 dBA (increase or decrease) = threshold of perception
- 5 dBA (increase or decrease) = clearly noticeable
- 10 dBA (increase or decrease) = perceived as twice as loud (or half as loud)

Basics II

Various “common” outdoor sound levels are listed below:

132 dBA	**Machine Gun @ 1 m**
80 dBA	Truck at @ 15 m
65 dBA	**Lawn mower @ 30 m**
60 dBA	**Average speech @ 1 m**
55 dBA	**Automobile 50 km/h at 30 m**
50 dBA	**Quiet urban nighttime**
50/45 dBA	Quiet suburban daytime/nighttime
30 to 40 dBA	**Quiet rural nighttime**

Case Study #1: Mobile Crushing Operation – Northern Ontario



Compliance Scenario:

- Mobile equipment adjacent to active pit/quarry
- Rural environment – read: extremely low background and limits
- Operations commence at grade
- Do not consider quarry / pit operations
- Mobile C of A Required: model and demonstrate compliance for every situation
- All that work for a 60 day permit!

Problematic Equipment:

1. Rock Crushing Equipment – 115 dBA
2. Trailerized Power Generator – 120 dBA, low f = tonal,
3. Front End Loader Route – 106 dBA

Potential Solutions	PROs	CONs
Setbacks	• Free	• Most sites unusable • Need > 2 km
Berms	• Free • Use on-site overburden	• Locate at s/r •Limit vehicle movements/access • 7 m tall berm = 28 m footprint at 2:1 slope • Max reduction
TAP	• Reduce noise at source rather than redirect it	• Cost

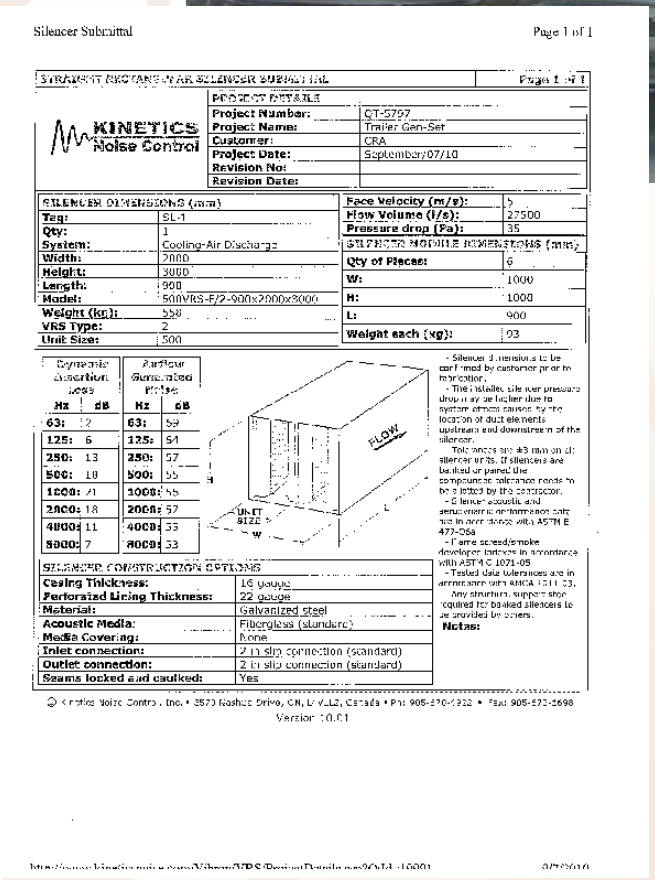
Solutions Implemented

1) BERMS: Mobile Equipment

2) SILENCER: Generator Exhaust

3) SOUND CURTAIN: Trailer

4) TAP: Rear Trailer Opening



Silencer Submittal Page 1 of 1

KINETICS Noise Control

PROJECT DETAILS	
Project Number:	CT-5797
Project Name:	Trailer Gen-Set
Customer:	CRA
Project Date:	September/07/10
Revision No:	
Revision Date:	

SILENCER DIMENSIONS (mm)	
Tag:	SL-1
Qty:	1
System:	Cooling-Air Discharge
Width:	2000
Height:	3000
Length:	900
Model:	50IVRS-F/2-900x2000x3000
Weight (kg):	550
VRS Type:	2
Unit Size:	500

Face Velocity (m/s):	5
Flow Volume (l/s):	27500
Pressure drop (Pa):	35

SILENCER MODULE DIMENSIONS (mm)	
Qty of Pieces:	6
W:	1000
H:	1000
L:	900
Weight each (kg):	93

Dynamic Insertion Loss		Surface Generated Noise	
Hz	dB	Hz	dB
63:	12	63:	59
125:	6	125:	54
250:	13	250:	57
500:	18	500:	55
1000:	21	1000:	56
2000:	18	2000:	57
4000:	11	4000:	55
8000:	7	8000:	53

- Silencer dimensions to be confirmed by customer prior to fabrication.
- The installed silencer pressure drop may be higher due to system effects caused by the location of duct elements upstream and downstream of the silencer.
- Tolerances are ±3 mm on all silencer units. If silencers are bolted or joined the components tolerance needs to be added by the contractor.
- Silencer acoustic and aerodynamic performance data was in accordance with ASTM E 477-06a
- Flame spread/smoke developer ratings in accordance with ASTM E 1021-06
- Tested data tolerances are in accordance with AMCA 311-03.
- Any structure, support shoe required for braked silencers to be provided by others.

Notes:

SILENCER CONSTRUCTION OPTIONS	
Casing Thickness:	16 gauge
Perforated Lining Thickness:	22 gauge
Material:	Galvanized steel
Acoustic Media:	Fiberglass (standard)
Media Covering:	None
Inlet connection:	2 in slip connection (standard)
Outlet connection:	2 in slip connection (standard)
Seams locked and caulked:	Yes

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Version : 10.01

Results

- Controls implemented in 2010 on-site in rural Ontario
- Compliance confirmed independently
- MOE accepted results
- Noise reduction exceeded performance requirements

Case Study #2: Automotive Parts Facility
&
The Mysterious Cooling Tower Swap

Compliance Scenario:

- Heavy manufacturing facility
- 3rd party compressed gas storage on-site
- Mixed suburban area
- Surrounded by sensitive receivers on 4 sides

- POLITICS: Sensitive compliance “situation” and a vendor relationship to manage!

- TIMELINE: 3 year installation timeline for 15 controls

Problematic Equipment:

1. Cooling Tower(s)

THEN…

…NOW

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Problematic Equipment:

2. Dust Collectors – exhaust + pneumatics

Problematic Equipment:

3. Gas Storage and Supply - Compressor

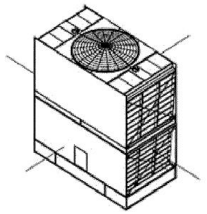
What We Did….

Cooling Tower: Replaced with ultra low BAC unit

Dust Collectors: Install silencers and Enclosure at Pneumatic Source

Air Inlet Lp Sound Pressure (dB)		
Octave Band	Distance 5 ft	100 ft
1	76	66
2	77	55
3	76	57
4	70	53
5	65	49
6	59	41
7	55	36
8	52	33
A-wgtd	**72**	**54**

End Lp Sound Pressure (dB)		
Octave Band	Distance 5 ft	100 ft
1	70	57
2	70	52
3	68	53
4	62	48
5	58	43
6	51	35
7	44	30
8	42	27
A-wgtd	**64**	**49**



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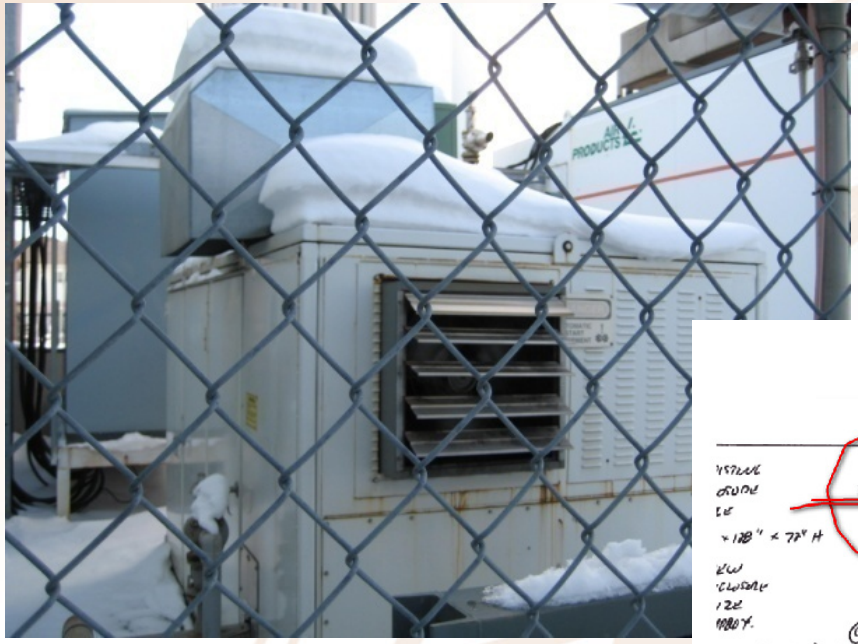
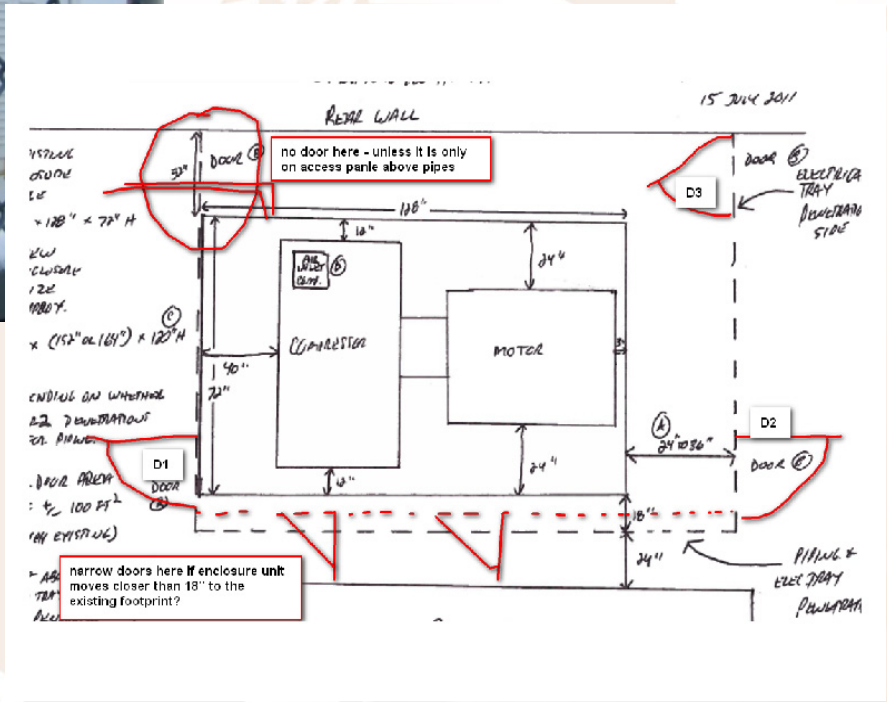
Sound Power (dB)		
Octave Band	Center Frequency (Hertz)	Lw
1	63	95
2	125	93
3	250	94
4	500	89
5	1000	85
6	2000	79

What We Did….

Gas Compressor: Enclosure





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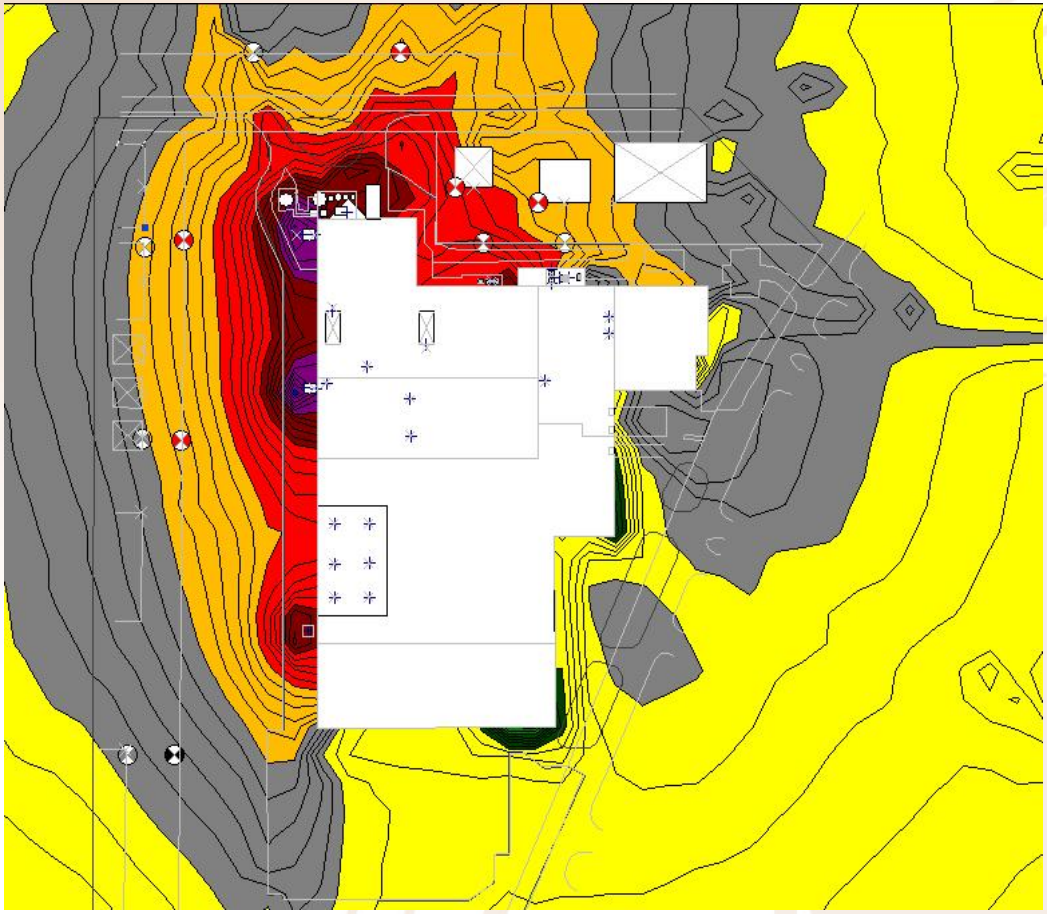
Compressor before…..

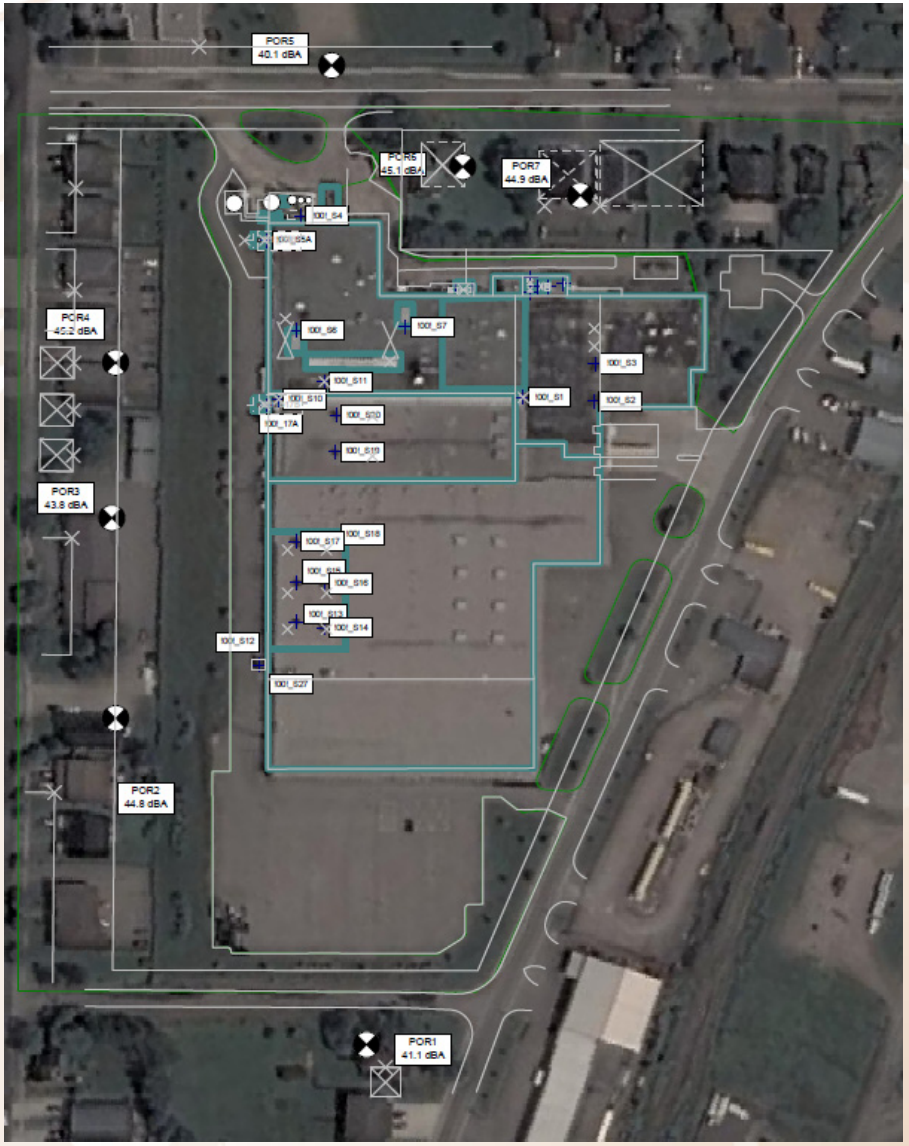
….after

Noise Modelling Predictions

Before…



…After



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Case Study #3: Dirty Exhausts

- Operating an animal feed mill in a rural area does not excuse your noise pollution
- The facility has several tall silos with exhausts as high as 42 m
- Noisy, tall exhausts and an adjacent residential area do not go well together

Solution = Just add a silencer!

How does one safely clean a silencer at 42 m above ground?

CRA proposed a **cleanable silencer** with access doors

PROs

- "Easy to clean" removable filters
- Access doors on two sides
- Construction material allows for control to be pressure washed, without risk of corrosion

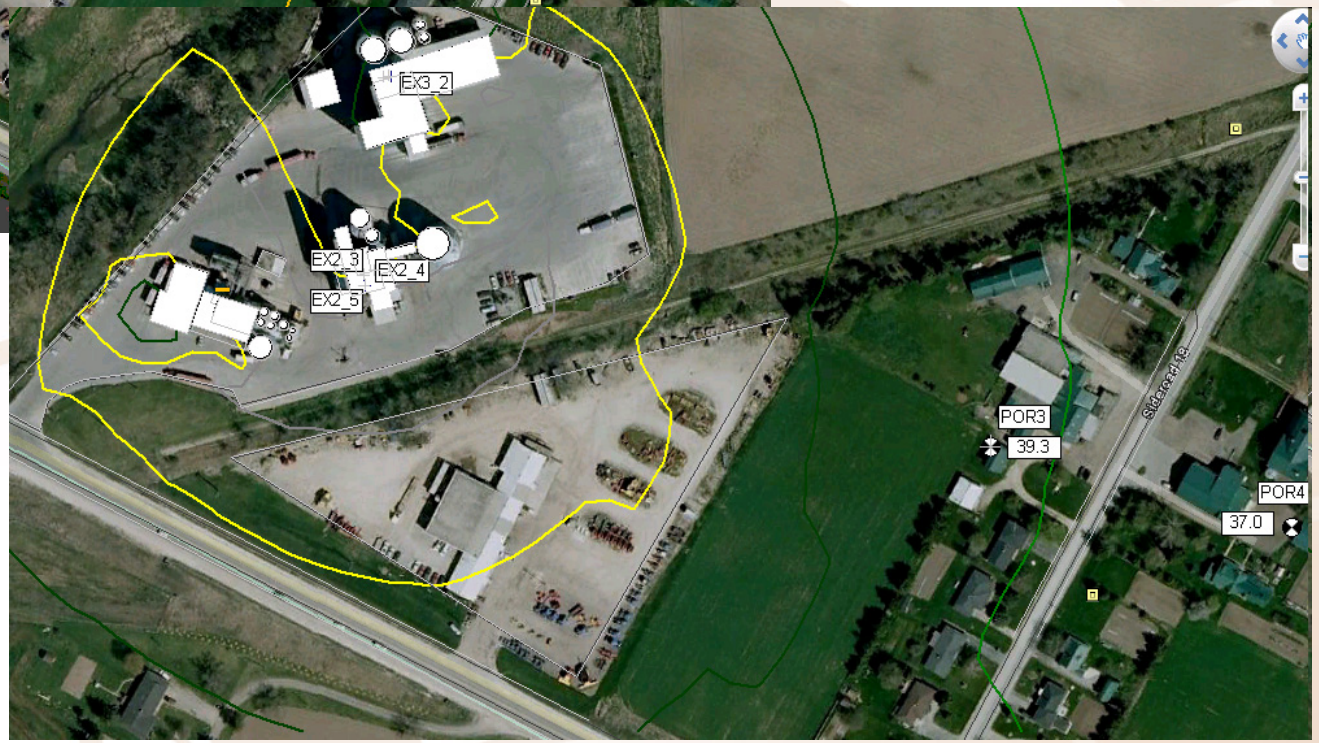
CONs

- Cost
- Requires modification of maintenance logs
- Maintenance frequency?

Results

- Reduction of 17 dBA achieved at source without a large pressure drop
- Guy wires added for additional safety when opening access panels
- Increase of stack height of only 3.5 m – better air dispersion results!

…After



Before…

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Case Study #4: Urban Street - "When Urban Safety Planning goes Wrong"

- Historic 4 m berm to block traffic noise from Allen Road

- Residents walk over the berm to reach near-by stores and restaurants

- Safety concerns

- City builds a pedestrian walkway with traffic lights

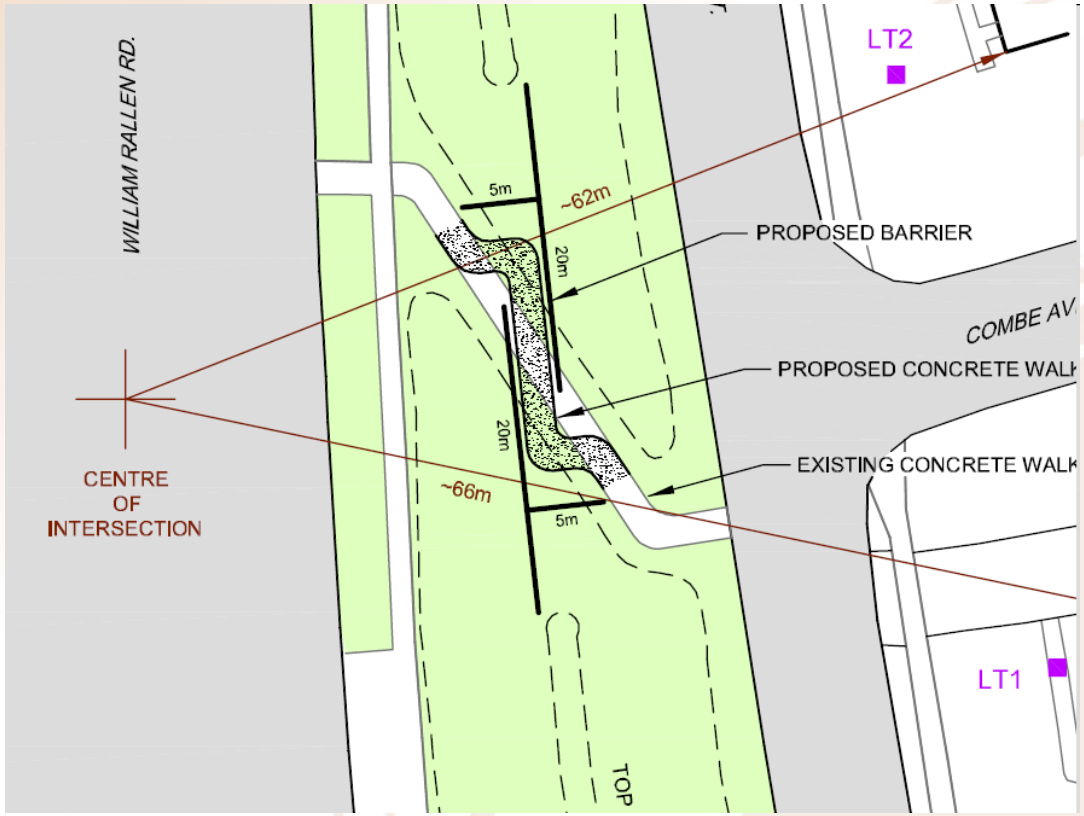
Problem?

Initial Thought…

- FIX THE BERM!!

PROs	CONs
• Proven 3 dBA performance	• Revert to previous scenario, costing tax $ • Safety risk of residents walking over the berm

Proposed Solution



- CRA proposed a combination of barrier walls and a restructuring of the existing path
- Proposed solution allows residents to access the commercial plaza
- Achieve blocked LOS
- Use see-through panels

Case Study #5: Doing it Right from the Start

Compliance Scenario:

- 3 LFGTE Co-Generators = A LOT of NOISE
- Nearest POR is 300 m away!!

Noise was a Design Consideration from Go!

CRA worked with the client and designed the Facility to mitigate noise impacts to achieve < 40 dBA noise impact

Building Design Requirements

- Wall construction = 12-inch concrete block
- “Sandwich" roof construction = 18-gauge steel, 4 inches of rigid insulation, 60-millimetre membrane
- 1.2 m parapet wall around the entire perimeter of the rooftop
- Man doors are comprised of two layers of 18-gauge steel and insulation.
- Overhead bay doors – two sheets of 26 gauge sheet steel + insulation
- Skylights two layers of polycarbonate plastic + air space
- Client would not add absorption on walls
- Radiators use building structure as barrier, no LOS

Control Requirements

- Co-generator Unit Exhausts with Silencers
- Room Intakes and Exhausts with Silencers and 12-gauge steel ducts

Uncontrolled Equipment

- Radiators
- Aftercooler Chiller

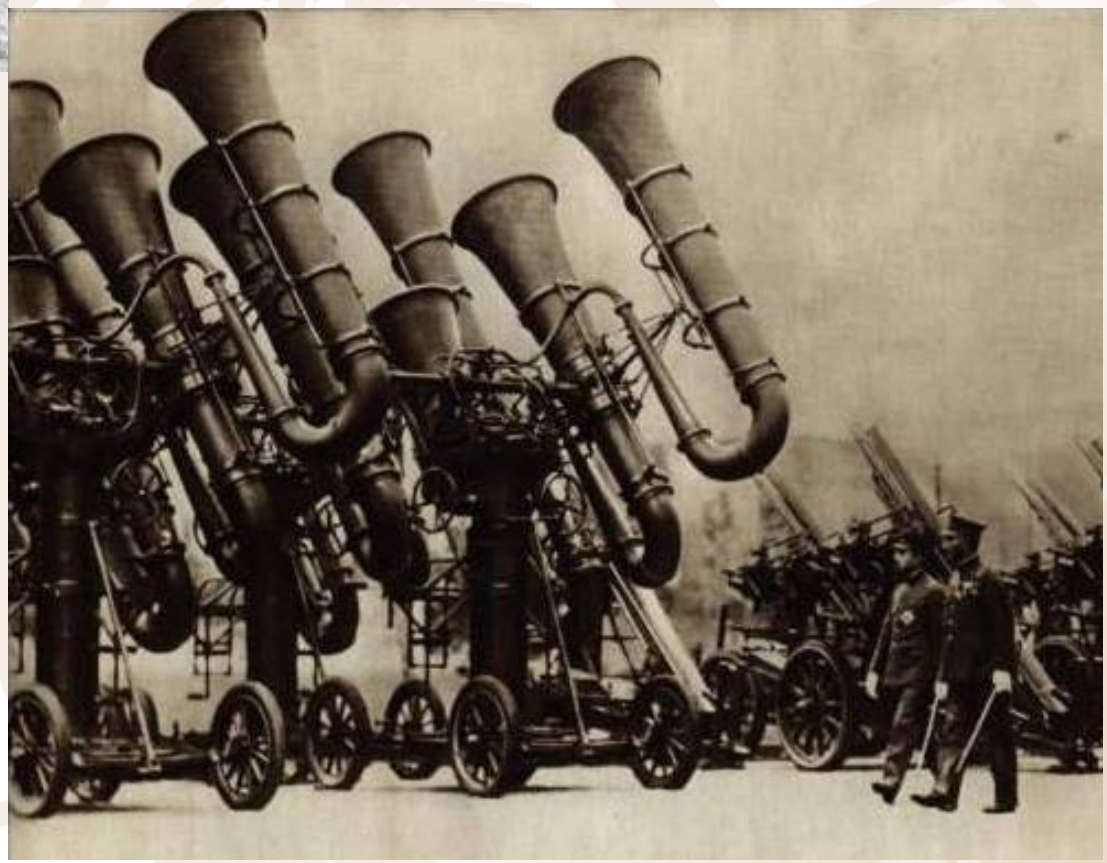
Did it Work?

Source	DESIGN PWL (dBA)	Measured PWL (dBA)
HVAC 1 – Control Room	92	85
HVAC 2 – Office	74	78
Generator Room Intakes	91	79
Skylights	83	76
Compressor Room Exhaust	96	82
Generator Room Exhausts	91	83
Bay Doors – Closed	92	88
Radiators	**98 / 103 with tonal adjustment**	**101 / 106 with tonal adjustment**
Aftercooler Chiller	**100**	**104**
Compressor Room Louvres	96	90

Results

- Majority of the sources were insignificant (including Roof, Walls)
- The total Facility-wide impact was 39 dBA at critical POR1

QUESTIONS?



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