Noise Study for the Thorndyke Resources Operations Complex (T-ROC) Central Conveyor and Pier Project

Produced for Thorndyke Resources

Poulsbo, WA

Produced by Environalysis, LLC

Seattle, WA

September 1, 2011

EDITED APRIL 2014

Introduction

Thorndyke Resources requested that Environalysis examine the noise impacts of the Thorndyke Resources Operations Complex (T-ROC) Central Conveyor and Pier Project. Our examination included:

- Measuring existing noise levels simultaneously at four residential properties, three of them being the residences or residential property closest to the proposed operations.

- Measuring the sound pressure levels of a comparable gravel-loading facility and conveyor systems.

- Modeling the noise impacts of operating the 4.0--mile long conveyor and loading barges and ships from a 990-foot long pier.

- Determining the noise impacts of constructing the conveyor and pier.

- Comparing the project's noise impacts to the existing background sound environment and to the applicable Jefferson County noise codes.

- Recommending noise mitigation measures where necessary

Methodology

The noise monitoring task used Larson-Davis™ model 814 and 820 integrating Type 1 sound level meters to simultaneously measure existing sound levels on four residential properties. Noise monitoring was conducted for a continuous 48-hour period.

The modeling phase involved using the CadnaA™ noise prediction software to determine the project's noise impacts at the four monitoring sites and other noise sensitive locations. The project vicinity and the locations where the noise measurements were taken are shown in Figure 1.

In order to model the noise impacts of the T-ROC Central Conveyor and Pier noise data on each component was obtained from various sources as listed in Table 1.

Table 1. Sources of Sound Pressure Data

Component	Source of Data
T-ROC Operations	
Conveyor belt	Fred Hill Materials Central Hub (Shine Pit)
Pier loading System	Construction Aggregate Ltd. Sechelt, B.C.
Conveyor transfer point	Manke Operation at Johns Prairie in Shelton WA
Ship Arrival & Departure	Orca Sand & Gravel Sound Assessment 2004 in Port McNeil BC
Construction of Central Conveyor & Pier	
Caterpillar D-9	Fred Hill Materials Central Hub (Shine Pit)
Vibratory Pile Driver	EPA
Impact Pile Driver	EPA
Cat Excavator	Fred Hill Materials Central Hub (Shine Pit)

The sound pressure levels measured from existing operating sources were used in the CadnaA™ noise model to determine the project's impacts. This program requires detailed (octave-band) noise measurements of all major machinery proposed for the T-ROC facility. Other inputs included topographical information imported from an AutoCAD project base map and the locations of the conveyor system obtained from the project's design drawings. The noise modeling assumed a 24-hour a day, 7-day a week work schedule. The source of the aggregate for the Central Conveyor will be the Meridian mining area with processing occurring at a new hub to be located east of the current Central Hub.

Figure 1. Project Vicinity- Noise Monitoring Locations

1.1 REGULATION OF NOISE

Local Regulations

The maximum permissible sound levels are cited in Jefferson County's ordinance (Section 18.30.190) are based on Washington State WAC 173-60. Section 18.30.190 states:

> "The intensity of sound emitted by any commercial or industrial activity shall not exceed levels established by the Washington State Department of Ecology under Chapter 173-60 WAC, and by Jefferson County under Resolution No. 67-85, "Establishment of Environmental Designations for Noise Abatement Areas for Jefferson County." [Ord. 11-00 § 6.19]"

The State's standards are shown in Table 1 and the one most applicable to the Proposal is shown in **bold.** The maximum permissible noise levels are the limits a project can generate at its boundary with other land uses-- they are not the sum of a project and the background non-project sound levels.

Table 1. Washington State Maximum Permissible Sound Levels in dBA

Land Use of Source:	Land Use of Receiving Property		
	Class A-Residential	**Class B-Commercial**	**Class C-Industrial**
A-Residential	55	57	60
B-Commercial	57	60	65
C-Industrial	**60**	65	70

Notes: Between the hours of 10 p.m. and 7 a.m. the maximum limits for residential receivers are to be reduced by 10 dBA within residential receivers. For noises of short duration these limits can be exceeded by a maximum of 5 dBA for 15 minutes/hour, 10 dBA for 5 minutes/hour or 15 dBA for 1.5 minutes/hour.

Motor vehicle traffic traveling on public roads is exempt from the noise regulations summarized in Table 1.

Jefferson County has established standards in Section 18.25.100(3)(f) of the County Code for noise sources located in areas designated as aquatic shorelines. The maximum noise level for sources within this designation is 50 dBA at a distance of 100 feet.

Existing Conditions

The results of onsite noise monitoring are summarized in Table 2 and shown graphically in Figures 2-5. The weather was dry with light winds during the 48-hour noise-monitoring period.

Table 2. Summary of Noise Monitoring

Noise Monitoring Site	Location	48-Hour LEQ	Range of Hourly LEQs	LMAX	LMIN	Notes
SLM-1	62 Soaring Eagle Road	39	26-52	86	23	Measured at edge of bluff at a quiet residential site
SLM-2	184 Groves Way	43	25-49	79	21	Measured at edge of bluff at one of residences closest to the pier
SLM-3	Near a Summer Cabin	45	30-53	68	28	Unoccupied at time of measurement
SLM-4	24559 Johnson St.	41	25-47	78	20	East side of Hood Canal

Figure 2. Noise Monitoring Data
SLM-1 62 Soaring Eagle Road

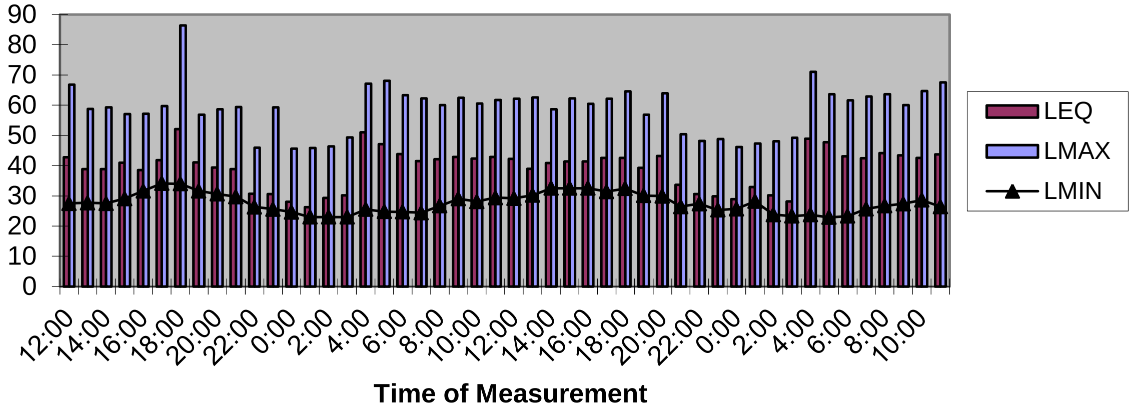
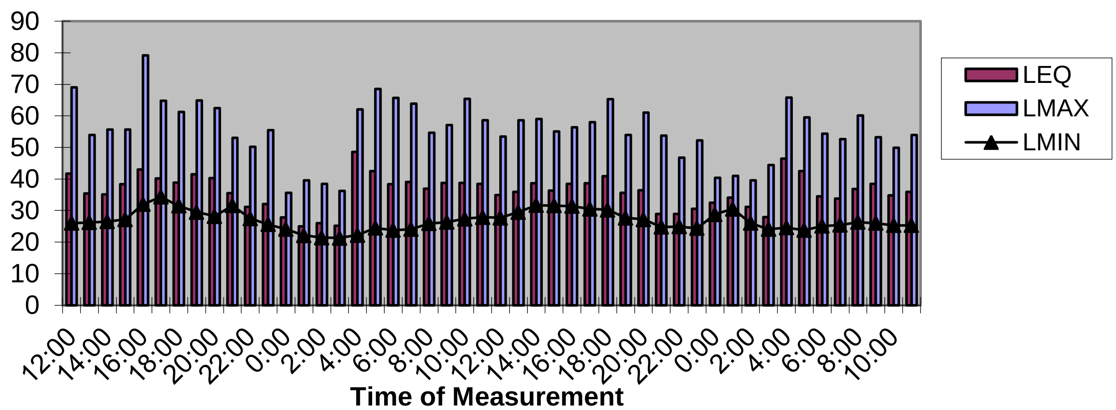
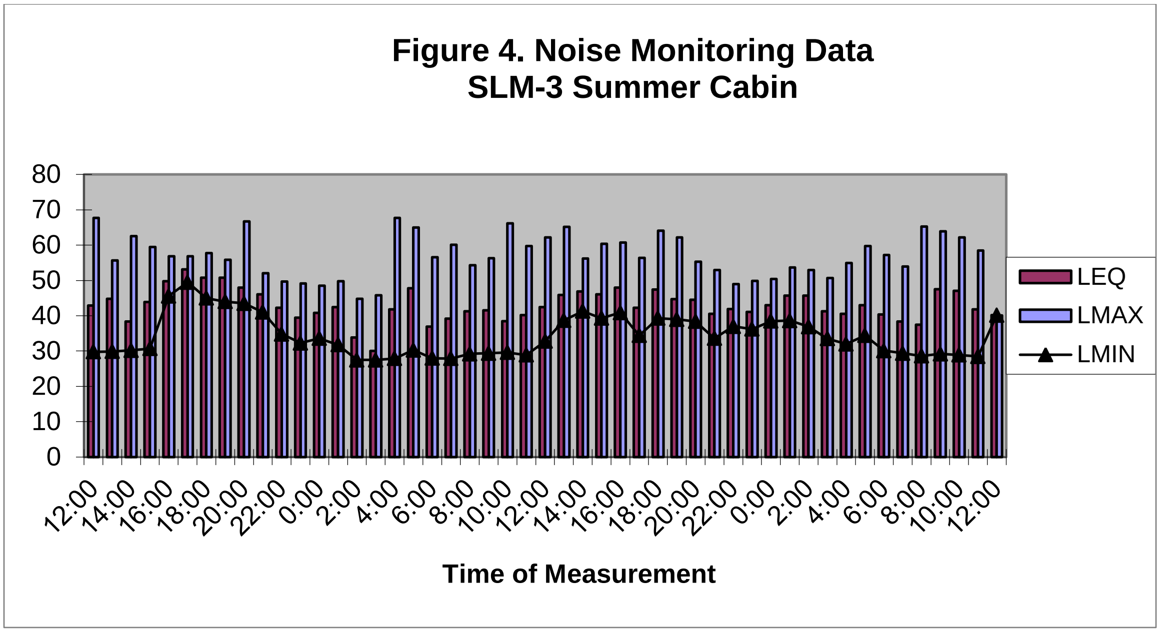
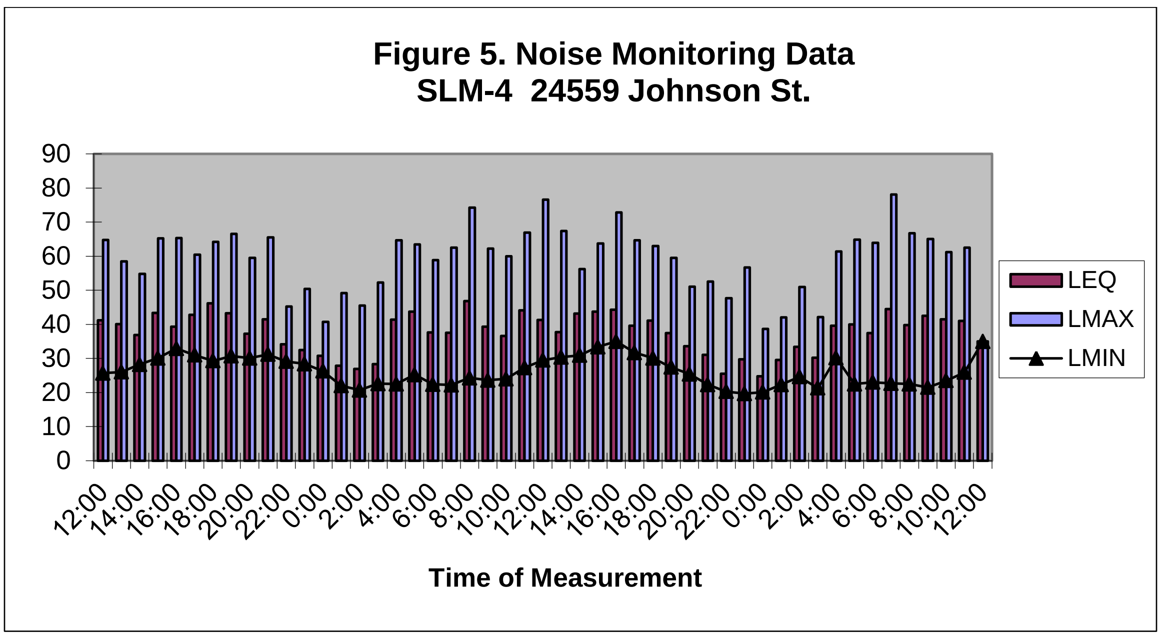


Figure 3. Noise Monitoring Data
SLM-2 184 Groves Way







The information in Table 2 and Figures 2 to 5 illustrates how quiet the existing noise environment is on the average, with extremely low minimum noise levels.

Project Impacts

Measurements were made of construction machinery and conveyor systems similar or identical to what is being proposed. Measurements of the equipment, rounded to nearest whole decibel are shown in Table 3.

Table 3. Sound Levels of Machinery

Process and Equipment	Sound Pressure Level at 100' from Equipment
Facility Operations	
Conveyor belt	49
Conveyor transfer points	60
Gravel loading into steel ship	69
Ship Arrival/Departure with Tug Assisting	61
Pier Facility Construction	
Tugboat	61
Pile Driver (impact)	86-100
Pile Driver (vibratory)	60
Barge mounted cranes	69-79
Conveyor Construction	
D-8 Crawler Tractor	76-86
D9 Crawler Tractor	80
Cat 988 Frontend Loader	77
Cat 966 Frontend loader	79 (FHWA)
Grader	66-86 (FHWA)
631 Scraper	77-84
Crawler Crane	69-79
Mobile 50 ton crane	69-79
Dump trucks-10 yard	76-88
Boom trucks	76-88
Semi-trucks 40 foot	76-88
Welders	75-80
Crew Pickups	65-70

Table 4. Distance of Receivers from Construction Activity and Maximum Construction Noise

Construction of Pier		
Receiver	**Distance to Closest Part of Pier in Feet**	**Maximum Construction Noise**
SLM-1 Soaring Eagle Road	3950	54-68
SLM-2 Groves Way	1250	64-78
SLM-3 Summer Cabin	1140	65-79
Construction of Conveyor		
Receiver	**Distance to Closest Part of Conveyor in Feet**	**Maximum Construction Noise**
SLM-1 Soaring Eagle Road	4020	54-62
SLM-2 Groves Way	1140	65-73
SLM-3 Summer Cabin	840	68-76

Discussion of Table 4.

Table 4 presents a "worst-case" picture of potential construction noise as if all the equipment needed to build either the pier of the conveyor was operating at once and there were no attenuation due to inventing topography or vegetation. The actual noise impacts of construction will be substantially lower but will be audible at times on adjacent residential properties.

Operational Impacts

Modeling of Noise Impacts

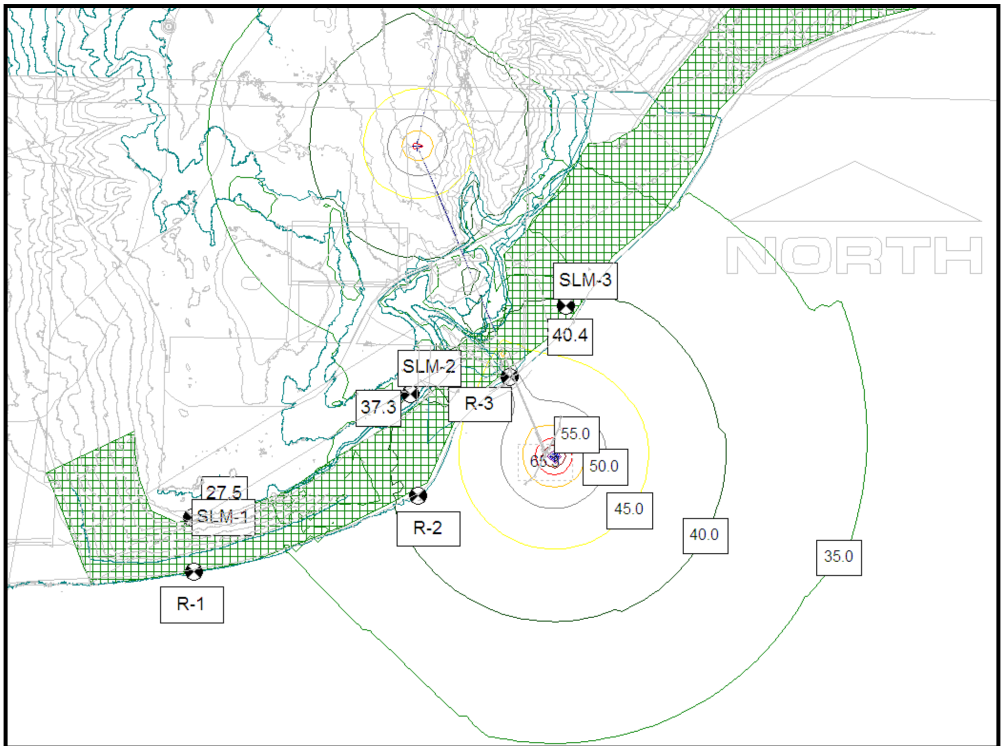
The CadnaA™ noise model was used for the analysis of potential noise impacts from the Central Conveyor and Pier project. The model inputs reflect the current thinking on the numbers and types of machinery that would be used. This analysis conservatively assumes that gravel loading could be a 7-day a week, 24-hours at day operation. The CadnaA™ model follows the methodology specified by the International Standards Organization (ISO 9613), which propagates noise as if there were a wind blowing from each source towards each receiver. Table 4 summarizes the results of the noise modeling and the results are shown graphically in Figure 6.

Table 4. Modeled Sound Pressure Levels $dBA_{HourlyLEQ}$

Receiver	Address of Receiver	Range of Background Noise Levels	Sound Levels Generated by Project	Cumulative Sound Levels Background + Project	Increase due to Project
SLM-1	62 Soaring Eagle Road	26-52	28	30-52	0-4
SLM-2	184 Groves Way	25-49	37	37-49	0-12
SLM-3	Near a Summer Cabin	30-53	40	40-53	0-10
SLM-4	24559 Johnson St.	25-47	0 (Too far from project)	25-47	0
R-1	Beach front at 62 Soaring Eagle Road	Assume 30-55	27	32-55	0-2
R-2	Beach front at 184 Groves Way	Assume 30-55	41	40-55	0-10
R-3	Portion of Aquatic Lands 100 Feet from Conveyor	Assume 30-55	49	49-56	1-19

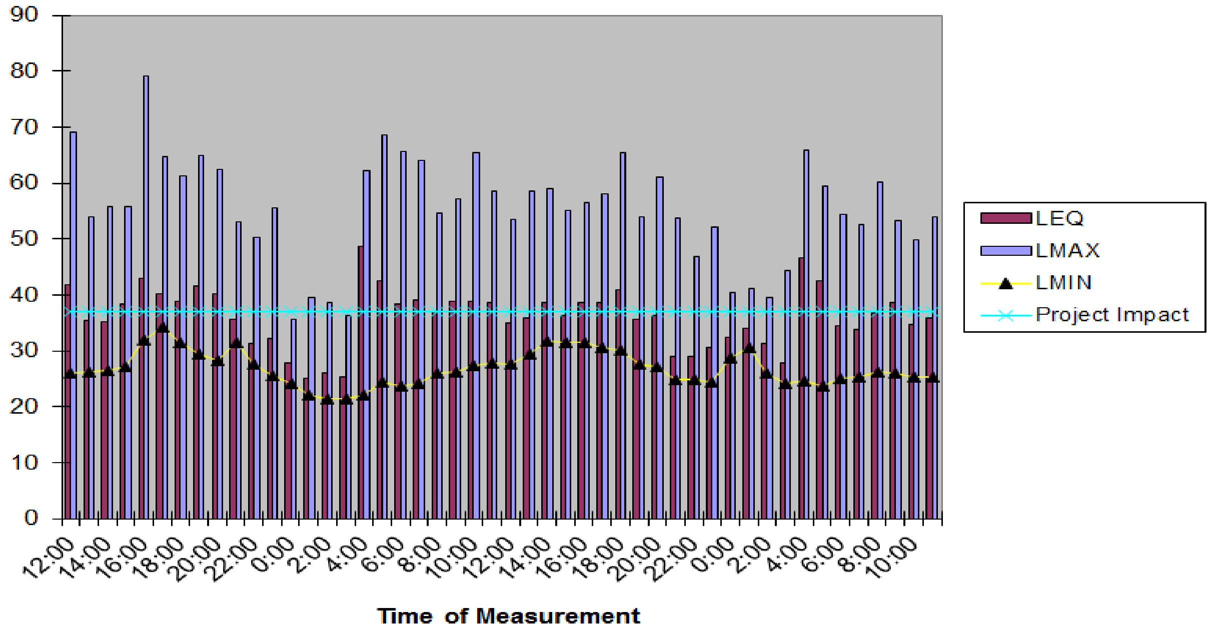
Note: During periods of higher ambient noise the overall decibel level of the project is low enough that it would not be heard at SLM-4. The project will be clearly audible during moments of very low background noise. Also certain sounds from the project may be clearly audible because the project's decibel levels at those frequencies are greater than the background decibel level at the same frequencies.

Figure 6. Noise Impacts of Gravel Loading



The residential measurement site showing the highest project noise impacts is SLM-2 (184 Groves Way). Figure 7 overlays the project's modeled noise level of 37 dBA upon the hourly measurement data.

Figure 7. Project Noise Impacts
SLM-2 184 Groves Way



Summary of the Project's Impacts

The T-ROC Central Conveyor and Pier project meets the Jefferson County Noise Criteria of 60 dBA or 50 dBA nighttime. However for much of the time, (38 hours out of the 48-hour measurement period) the project's noise could be audible (i.e. at least 3 dBA above hourly background levels). For 1-3 hours in the middle of the night the project would generate noise up to 10-12 decibels louder than the ambient sound environment. However only rarely would the project's noise exceed the highest background sound levels (2-3 hours per day). The CadnaA™ modeling likely overstates the project's impacts because the noise measurements of the ship loading system and conveyor belt are of older designs. For example the conveyor on the pier will be covered thus attenuating its noise emissions. In order to pinpoint the specific sources of project noise the contribution of each noise source to the project's total each at each receiver is `shown in Table 5.

Table 5. Noise Impacts from Each Component of the Project

Receiver	Address of Receiver	Conveyor Belt	Gravel Loading Nose	Belt Transfer Point
SLM-1	62 Soaring Eagle Road	12.1	26.7	18.8
SLM-2	184 Groves Way	23.4	36.9	23.5
SLM-3	Near a Summer Cabin	26.4	40.2	21.9
SLM-4	24559 Johnson St.	0	0	0
R-1	Beach front at 62 Soaring Eagle Road	11.6	26.4	16.2
R-2	Beach front at 184 Groves Way	29.7	40.7	19.7
R-3	Aquatic Shoreline 100 Feet from Pier	47.4	43.1	14.9

Note: During periods of higher ambient noise the overall decibel level of the project is low enough that it would not be heard at SLM-4. The project will be clearly audible during moments of very low background noise. Also certain sounds from the project may be clearly audible because the project's decibel levels at those frequencies are greater than the background decibel level at the same frequencies.

As can be seen from Table 5 the gravel-loading nose is the predominant source of the project's noise impacts, except at site R-3, which is only 100 feet from the conveyor.

Mitigation Measures

No mitigation measures would be required for the T-ROC Central Convey and Pier project in order to meet the County's noise standards, as no exceedances are predicted. However, the operations will be clearly audible when the background noise is low and complaints from neighbors may occur. The requirement that noise sources within aquatic shorelines generate less than 50 dBA when measured at a distance of 100 feet can be met under the assumptions used in the noise modeling. A variety of mitigation measures should be considered as summarized in Table 5.

Table 5. Noise Mitigation Measures

Type of Mitigation	Effectiveness	Cost/ Difficulty
Engineering Improvements		
Engineer a quieter gravel loading System, for example: Longer "nose" so gravel hits barge/ship hull with less force	Could significantly reduce noise impacts	Unknown
Use a quieter (covered) conveyor system	Could significantly reduce noise impacts	This is to be the design for the conveyor on the pier.
Insulate the buildings housing the belt transfer points	Could reduce noise impacts	Not difficult or expensive to do
Changes in operational Practices		
Line the bottom of ships with sand before loading gravel		Might be unacceptable to buyers of product
Other Changes		
Perform periodic noise monitoring	Could establish a baseline of normal ship loading noise levels	