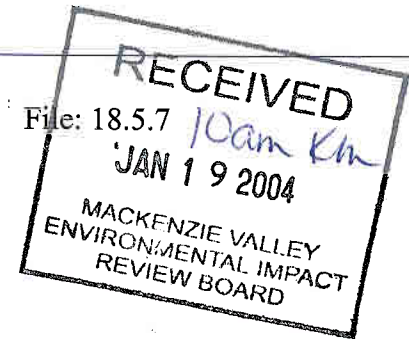


Friday, January 16, 2004

Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
5102-50th Avenue
Yellowknife, NT
X1A 2N7



Attention: Kimberley Cliffe-Phillips
Environmental Assessment Officer

Dear Ms. Cliffe-Phillips:

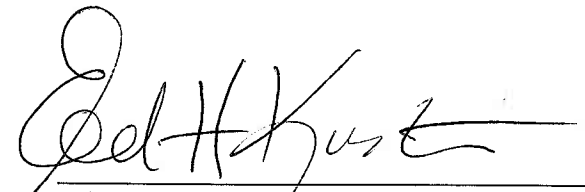
Re:
Environmental Assessment EA03-005
Cameron Hills Extension
Information Request Number 1.2.103

Pursuant to Information Request Number IR 1.2.103, attached is a copy of the Patching Associates Acoustical Engineering Ltd reports on noise monitoring:

- Cameron Hills, N.W.T. Gathering System and Facilities Ambient Noise Survey January 30, 2002
- Cameron Hills, N.W.T. Gathering System and Central Facility Noise Survey Following Production Operations Commencement April 19, 2002
- Cameron Hills, N.W.T. Gathering System and Central Facility Second Noise Survey Following Production Operations Commencement July 6, 2003

Should you have any questions, please contact the undersigned at (403) 206-3878.

Sincerely,
PARAMOUNT RESOURCES LTD.



Ed H. Kustan, Environmental Consultant
Corporate Compliance Department

c.c. Shirley Maaskant, Regulatory & Community Affairs Coordinator

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

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Sound Level Results at Measurement Site #2	Appendix C

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Purpose

Paramount Resources Ltd. retained the services of Patching Associates Acoustical Engineering Ltd. (PAAE Ltd.) to conduct an ambient noise survey at two locations situated 1500 metres to a proposed installation of a battery facility and a satellite site southwest of Hay River, Northwest Territories.

Glossary of Terms

The dBA noise level is an "A weighted" derivative of the measured dB noise level. The A weighting corrects for the non-linear response of the human ear.

The " L_{eq} " noise level is a logarithmic time averaged noise level which allows for variations over a given time period. For example, the L_{eq} may be quoted over a 1-minute period, 1-hour period, 9-hour period, etc. The L_{10} noise level is that exceeded 10 % of the time. Likewise, the L_{50} and L_{90} noise levels are those exceeded 50% and 90% of the time respectively.

Major Equipment

Paramount is proposing to construct an oil and gas gathering system, a satellite, a central compression and battery facility in the Cameron Hills region approximately 200 km NNW of High Level, Alberta. The proposed facilities are located in grid area 60° 10' N, 117° 30' W.

Noise Criteria

This survey was conducted according to the guidelines set forth by the Alberta Energy and Utilities Board (AEUB) Noise Control Directive ID 99-8. The National Energy Board (NEB) often allows for the application of the AEUB Directive to acoustical issues outside of Alberta as it is widely considered as the most stringent environmental noise guideline in Canada.

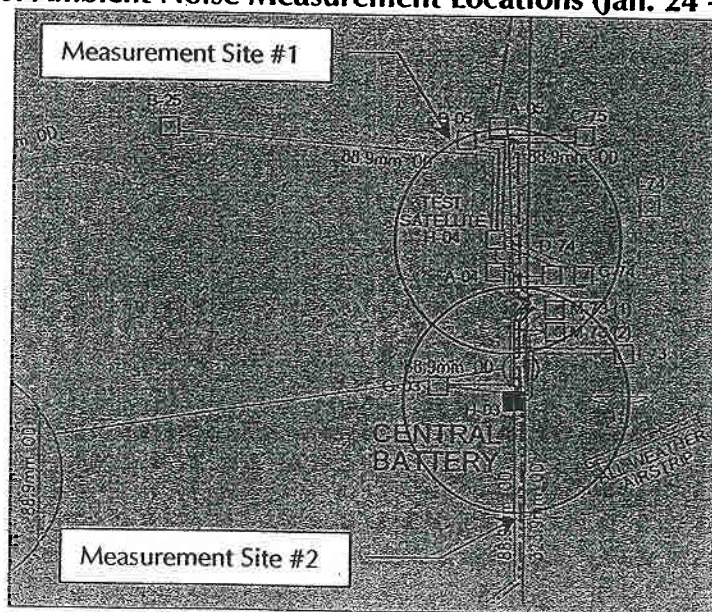
The AEUB Directive permits specified sound levels attributable to energy industry facilities at designated receptor points. These allowable limits are dependent on the population density, proximity to heavily traveled transportation routes (motor vehicles, rail and aircraft) and other specified adjustments. The AEUB Directive permits the daytime sound level to be as much as 10 dB above the nighttime sound level.

Consultants in Acoustics, Noise Control and Vibrations

Method

The ambient sound monitoring surveys were conducted with Brüel & Kjær Model 2236 Precision Integrating Sound Level Meters which were equipped with Brüel & Kjær 4188 microphones. Each microphone was mounted with Brüel & Kjær windscreen Model DS 0934 to reduce the potential for wind-induced noise at the microphone, as required by the Directive. The sound level meters were field calibrated at the start of the sound monitoring survey and then checked at the completion of the survey with a Brüel & Kjær Model 4231 Sound Level Calibrator. This equipment meets or exceeds the requirements of the Directive.

Figure 1.0: Ambient Noise Measurement Locations (Jan. 24 – 25, 2002)



Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Results

Tables 1.1 and 1.2 in Appendix B summarize the overall and hourly L_{eq} at Measurement Site #1.

Figures 1.1 to 1.4 in Appendix B depict the continuous monitoring at Measurement Site #1 from 11:26 am January 24/2002 to 11:23 am January 25/2002.

Figures 1.1i to 1.4i in Appendix B depict the isolated noise levels at Measurement Site #1 from 11:26 am January 24/2002 to 11:23 am January 25/2002.

Tables 2.1 and 2.2 in Appendix C summarize the overall and hourly L_{eq} at Measurement Site #2.

Figures 2.1 to 2.4 in Appendix C depict the continuous monitoring at Measurement Site #2 from 11:38 am January 24/2002 to 11:33 am January 25/2002.

Figures 2.1i to 2.4i in Appendix C depict the isolated noise levels at Measurement Site #2 from 11:38 am January 24/2002 to 11:33 am January 25/2002.

In each case, the difference between Figure 1.1 and 1.1i (1.2 and 1.2i; 1.3 and 1.3i; etc.) is that extraneous noise from the helicopter and crew during set-up and teardown have been removed in the "Residual" analysis.

The analysis reveals that the ambient noise level recorded at Measurement Site #1 had a 23.6-hour L_{eq} of 26.9 dBA when extraneous events had been removed. Measurement Site #2 had a 23.8-hour L_{eq} of 23.9 dBA when extraneous events had been removed.

As there are no residents within a 1500 metre radius of either facility, the AEUB Directive recommends that new facilities proposed for remote areas should be designed to meet a L_{eq} noise level of 40 dBA at a distance of 1500 metres from the facility. However, the AEUB Directive states that this target is not mandatory.

Conclusions

A survey of the ambient sound levels in the Cameron Hills area at two measurement locations 1500 metres from the proposed battery facility and satellite site was conducted from the 24 to 25 of January 2002. The overall L_{eq} at Measurement Site #1 and Site #2 were 26.9 dBA and 23.9 dBA respectively.

The AEUB Noise Control Directive ID 99-8 recommends that the plant should be designed to generate no more than 40 dBA L_{eq} at 1500 metres. Although the AEUB Directive states that this target is not mandatory, Paramount Resources Ltd. has expressed to the NEB that this is an agreeable target.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Appendix A

Permissible Sound Level Calculation

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

AEUB Noise Control Directive Permissible Sound Level Determination Cameron Hills Gathering System

Basic Nighttime Sound Level

Proximity to Transportation	Dwelling Unit Density per ¼ Section of Land		
	1 - 8 Dwellings	9 - 160 Dwellings	>160 Dwellings
Category 1	40	43	46
Category 2	45	48	51
Category 3	50	53	56

Daytime Adjustment Basic Sound Levels

Nighttime Daytime

40	40
N/A	10
40	50

Class A Adjustments

Class	Reason for Adjustment	Value (dBA L_{eq})
A1	Seasonal Adjustment (1 Nov - 31 Mar)	+5
A2	Absence of Both Tonal and Impulse/Impact Components	+5
A3	Ambient Monitoring Adjustment	-10 to +10
Class Adjustment = Sum of A1, A2 and A3 (as applicable), but not to exceed a maximum of 10 dBA L_{eq}		

Total Class A Adjustments

0	0
---	---

Class B Adjustments

Class	Duration of Activity	Value (dBA L_{eq})
B1	1 day	+15
B2	1 week	+10
B3	< or = to 2 months	+5
B4	> 2 months	0
Class B Adjustment = one only of B1, B2, B3 or B4		

Class B Adjustment

0	0
---	---

PERMISSIBLE SOUND LEVEL (dBA)

40	50
----	----

Notes:

A3 correction is not given for installation of new facilities in remote areas where nearest residence is beyond 1500 metres.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Appendix B

Sound Level Results at Measurement Site #1

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Monitoring Equipment Data

Project Name Paramount Resources Ltd.
Facility Location Cameron Hills N.W.T.
Facility LSD
File Number 2002-1270
Start Date 24-Jan-02
Consultant Measurements NM
Consultant Tape Review --
Computer File 2236-2 Paramount Site1.xls
Location/Residence Site 1 - 1500m NW of Satellite
GPS Coordinates (UTM) 6659021N / 11 470884E
Microphone Placement 1.5 m above ground

Sound Level Meter (Outdoor) Bruel & Kjaer 2236
Microphone Bruel & Kjaer 4188
Meter Calibration Date
Outdoor Microphone Kit Bruel & Kjaer UA1404
Sound Level Meter Bruel & Kjaer
Microphone Bruel & Kjaer 4188
Meter Calibration Date
Outdoor Microphone Kit Bruel & Kjaer UA1404

Calibrator Bruel & Kjaer 4231
Calibrator Calibration Date

1 - 2173781 2143086 Feb 13/01 Yes	2 - 2015449 2140862 Sept 05/01 Yes	3 - 1799377 189184 Mar 10/00 Yes	4 - 1799382 1803167 July 10/01 Yes	5 - 1911156 2121009 Jun 16/00 Yes
2236-2100873-D 1765148 Jul 31/00 No	2236-1764289-D 1795138 Oct 24/02 No	2260-2311741 4189-2305533 June 29/01 No	2260-2027582 1931041 Apr 20/01 No	2238-2163499 2143085 July 09/01 No

2122824 Aug 04/01	1800168 Oct 24/02	2052131 Nov 17/00	2175822 Sept 05/01
----------------------	----------------------	----------------------	-----------------------

B&K 4220
285153
Oct 4/00

Field Calibration Level Start **94.0** dBA Stop **94.0** dBA

VCR

Unit/Make	1 Mitsubishi	5 JVC	6 JVC	7 JVC
Model	HS-U55C	HR-DD840U	HR-DD840U	HR-DD840U
Serial No	5500271	122E0459	122E0468	122E0443
Unit/Make	10 JVC	11 JVC	12 JVC	13 JVC
Model	Optimus	HR-DD840U	HR-DD840U	HR-DD840U
Serial No	F8SK40354	153E0121	153E0126	153E0139
				14 JVC
				HR-DD840U
				153E0703

Temperature (Deg C) -32 **Humidity (%)** **Windspeed** 5-7 kph N

Clock Synchronization: GPS SLM

VCR Field Calibration Level dBA 20 - 100 **Battery Level (v)**

Tape / Time

Tape	Start Date	Start Time	Stop Time	Reading (dB)
1				
2				
3				
4				
5				
6				

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 1.1
Paramount Resources Ltd.
Site 1 - 1500m NW of Satellite
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Jan. 24, 2002	07:00 - 21:59	53.9	10.6	< 29.8	10.5
Jan. 24, 2002 - Jan. 25, 2002	22:00 - 06:59	< 20	9.0	< 20	9.0
Jan. 25, 2002	07:00 - 21:59	60.5	4.4	< 21.1	4.2
Jan 25, 2002 - Jan 26, 2002	22:00 - 06:59				
Jan. 26, 2002	07:00 - 21:59				
Overall Leq		54.9	24.0	< 26.9	23.6

Notes:

Due to the measurement range limitations of the sound level meter (between 20 and 100 dBA), all underrange entries were replaced with 19.9 dBA in order to calculate an approximate sound level for the environment.

The Residual Leq describes the sound level without the influence of equipment and crew. ie. helicopters and setup staff.

70.4% of the total measurement period was under 20 dBA. 27.8% of the measurement was between 20.0 and 24.9 dBA. 1.8% of the measurement period was above 25.0 dBA.

Error of the Overall Residual Leq is less than 1 dBA.

Error of the Overall Measured Leq is less than 0.1 dBA.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 1.2
Paramount Resources Ltd.
Site 1 - 1500m NW of Satellite
Hourly Leq Values

Date	24-Jan-02		25-Jan-02		26-Jan-02	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
0:00			19.9	19.9		
1:00			19.9	19.9		
2:00			19.9	19.9		
3:00			19.9	19.9		
4:00			19.9	19.9		
5:00			19.9	19.9		
6:00			19.9	19.9		
7:00			20.1	20.1		
8:00			20.0	20.0		
9:00			19.9	19.9		
10:00			22.4	22.4		
11:00	66.6	20.5	70.9	24.4		
12:00	20.9	20.9				
13:00	20.4	20.4				
14:00	39.6	39.6				
15:00	20.7	20.7				
16:00	20.0	20.0				
17:00	20.2	20.2				
18:00	20.0	20.0				
19:00	19.9	19.9				
20:00	19.9	19.9				
21:00	19.9	19.9				
22:00	20.5	20.5				
23:00	19.9	19.9				

Notes:

Due to the measurement range limitations of the sound level meter (between 20 and 100 dBA), all underrange entries were replaced with 19.9 dBA in order to calculate an approximate sound level for the environment.

Figure 1.1
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 24, 2002 07:00 - 14:29

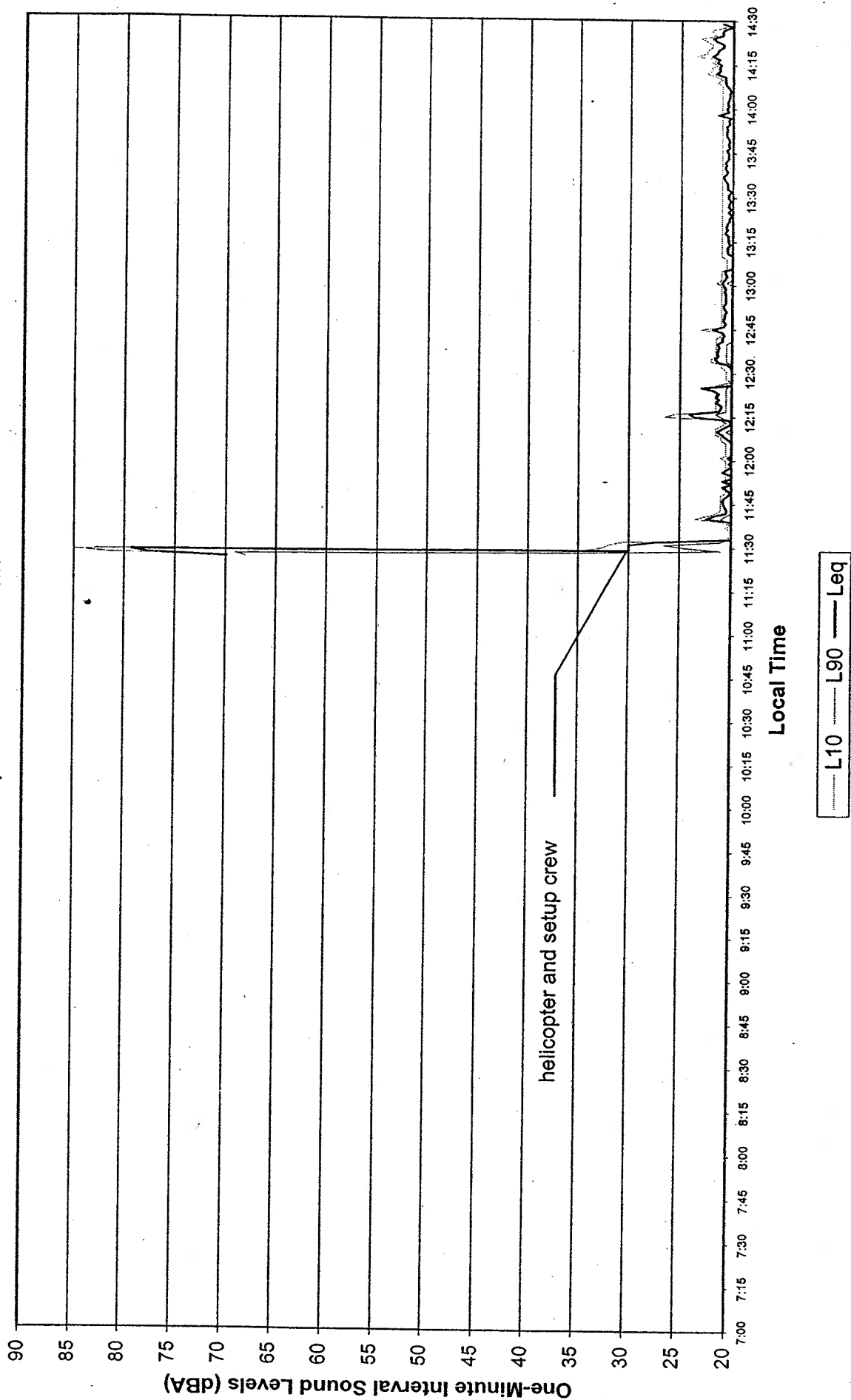


Figure 1.2
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 24, 2002 14:30 - 21:59

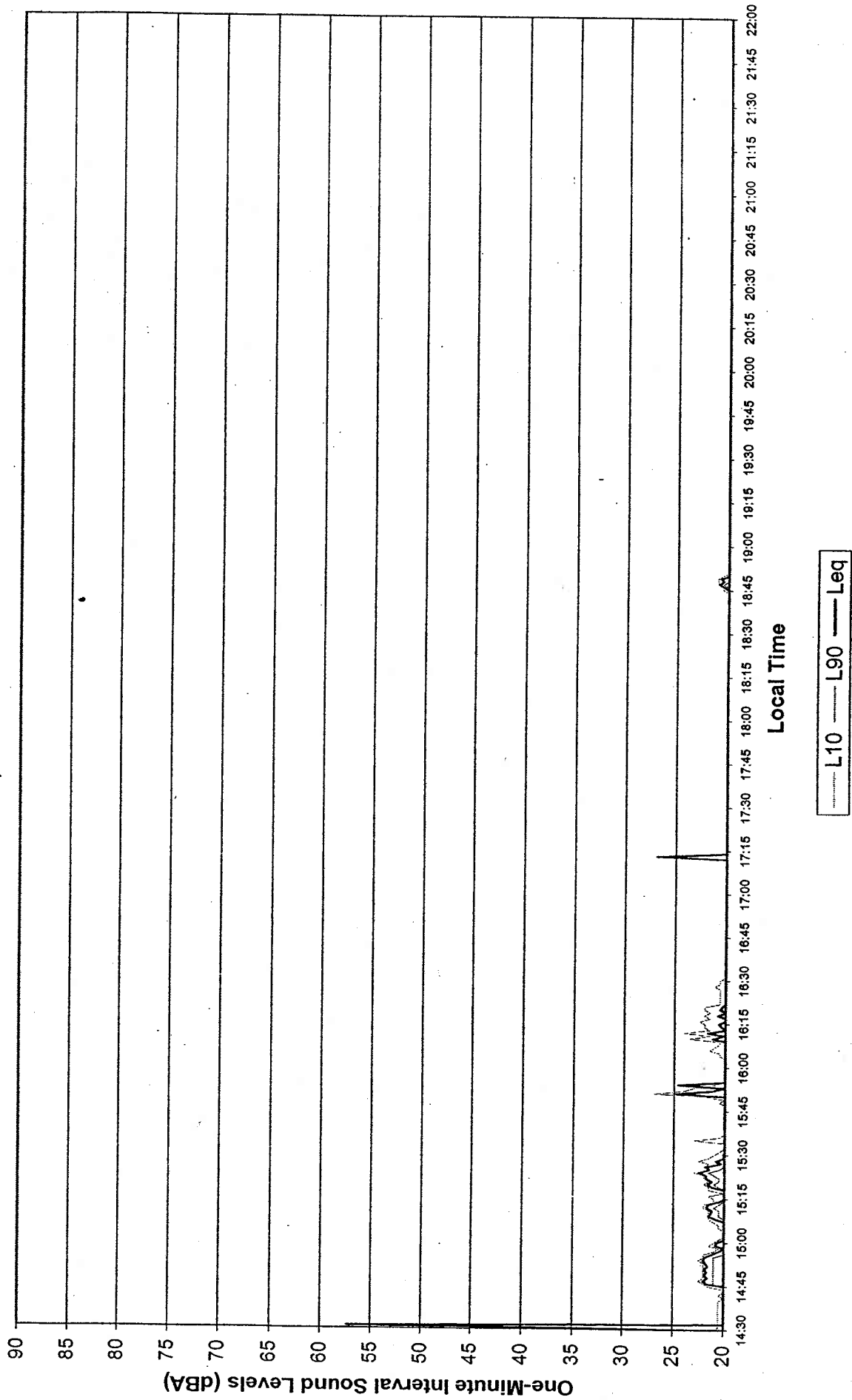


Figure 1.3
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 24, 2002 - Jan. 25, 2002 22:00 - 06:59

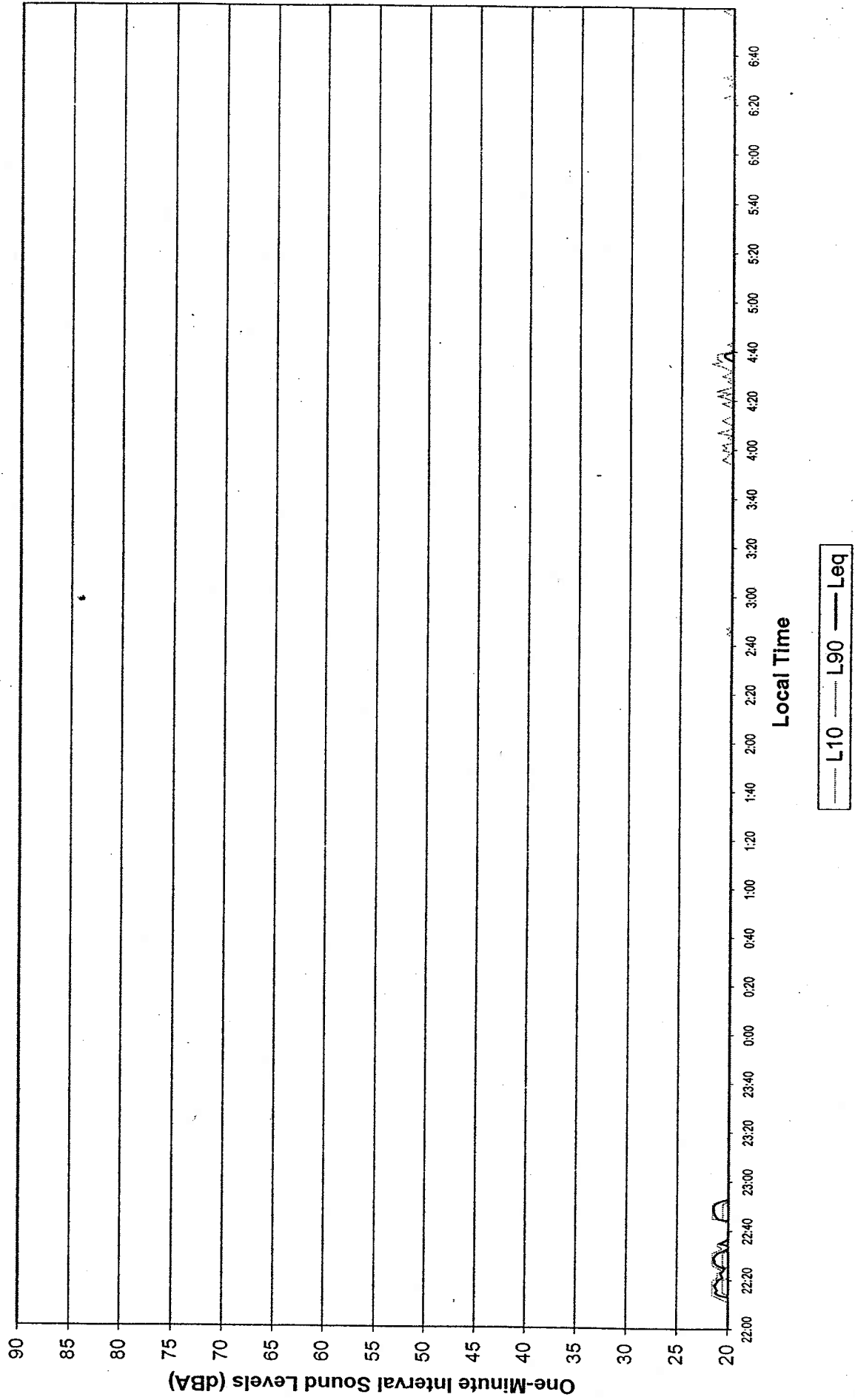


Figure 1.4
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 25, 2002 07:00 - 14:29

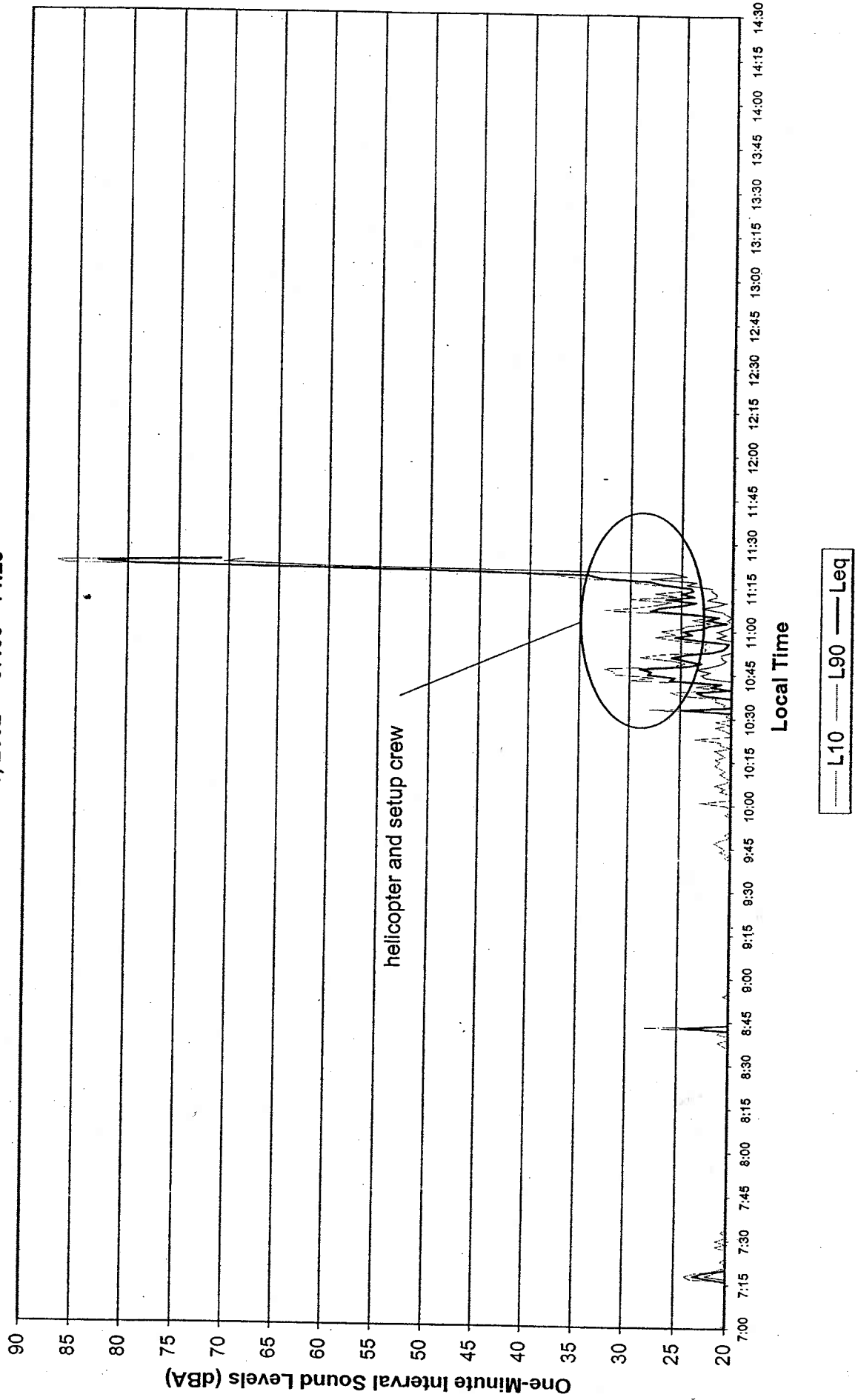


Figure 1.1i
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 24, 2002 07:00 - 14:29

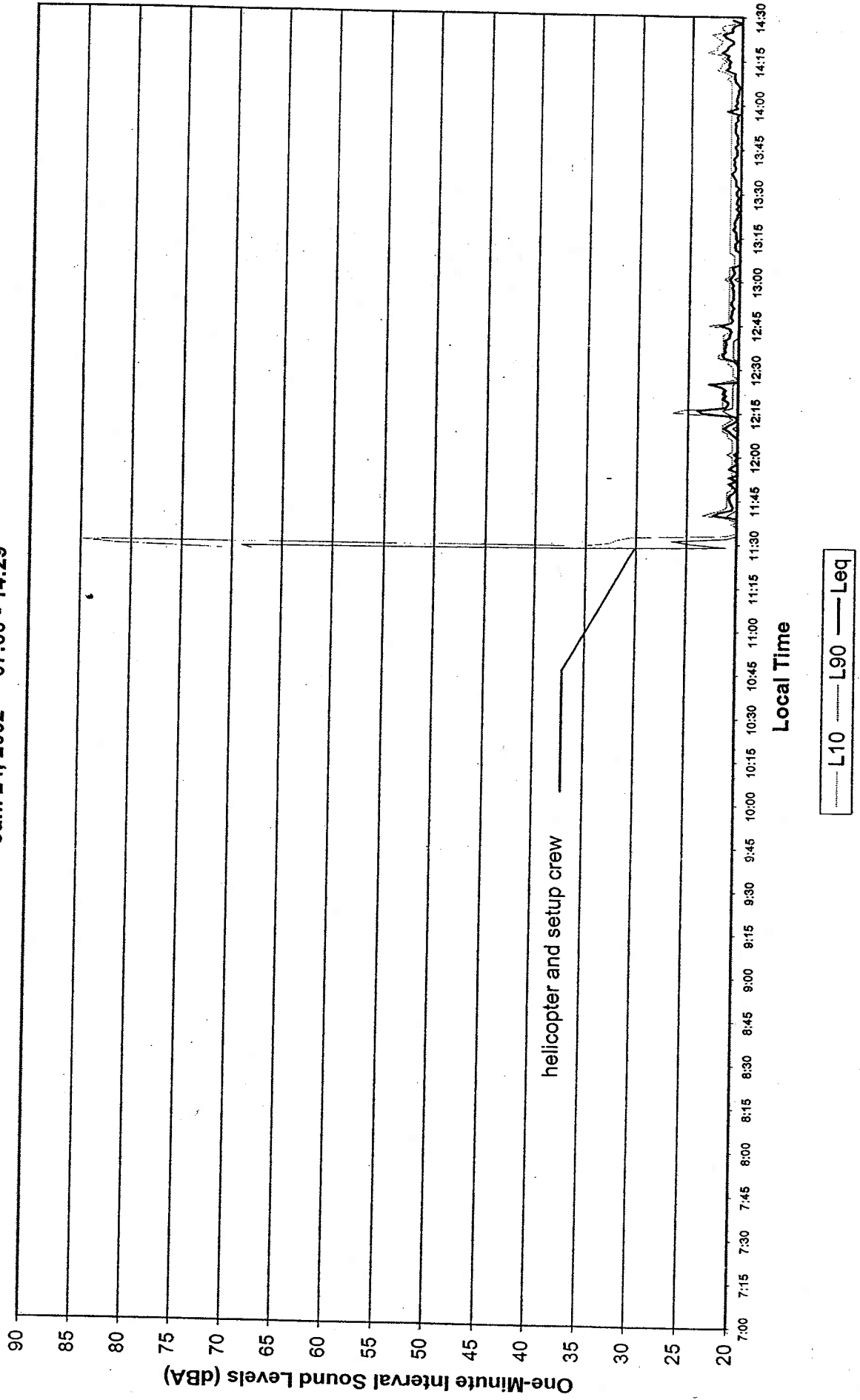
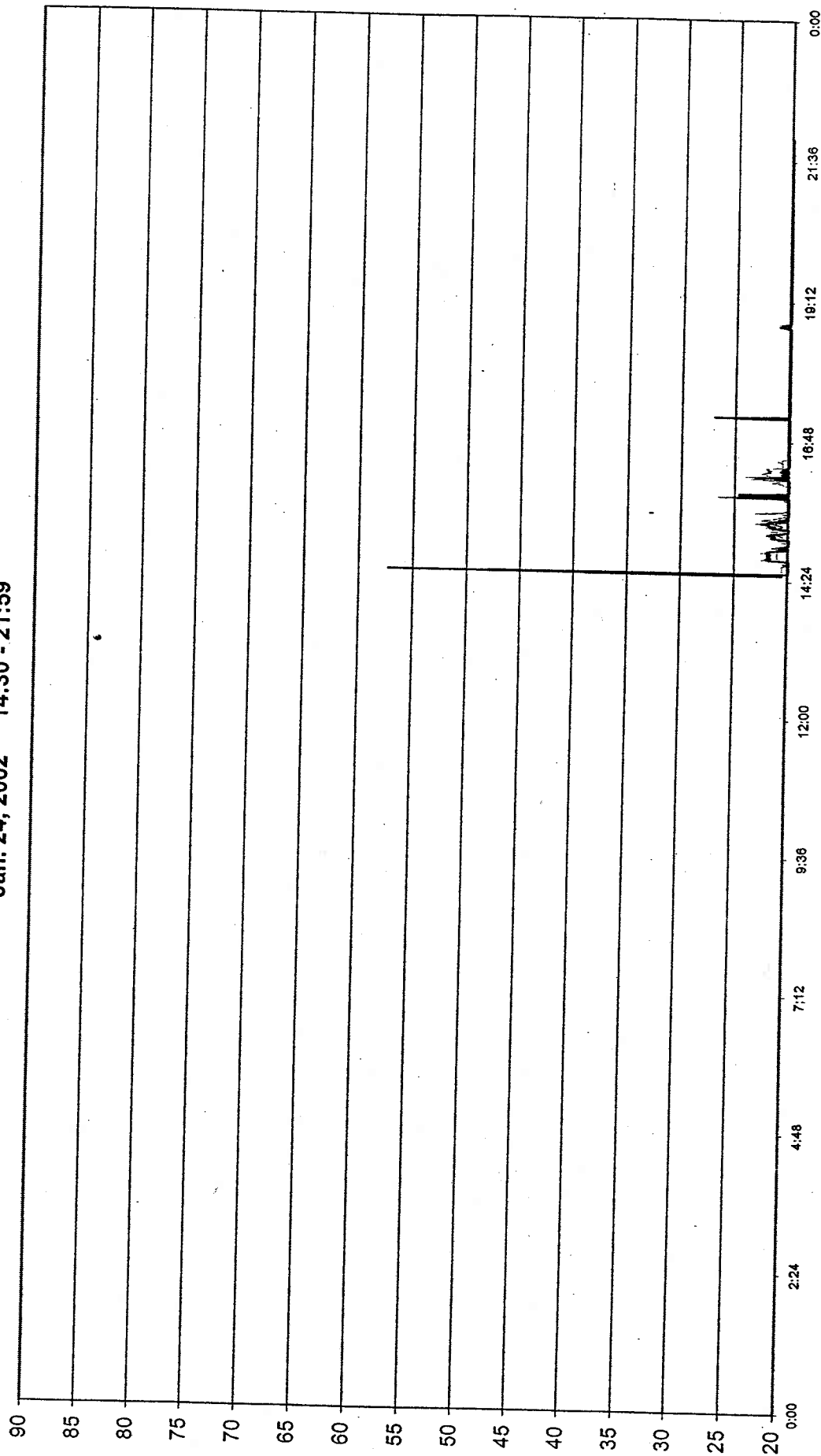


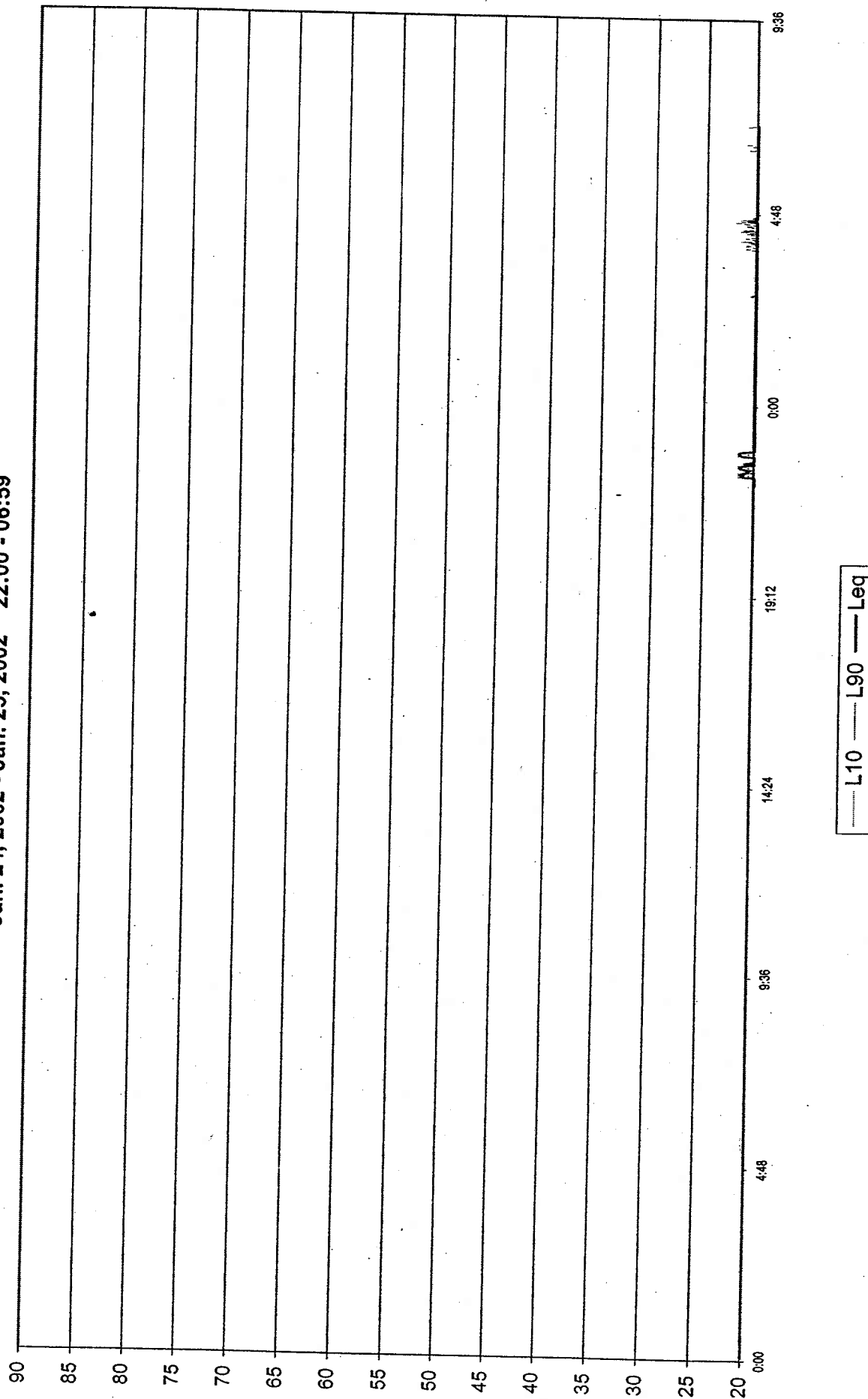
Figure 1.2i
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite

Jan. 24, 2002 14:30 - 21:59



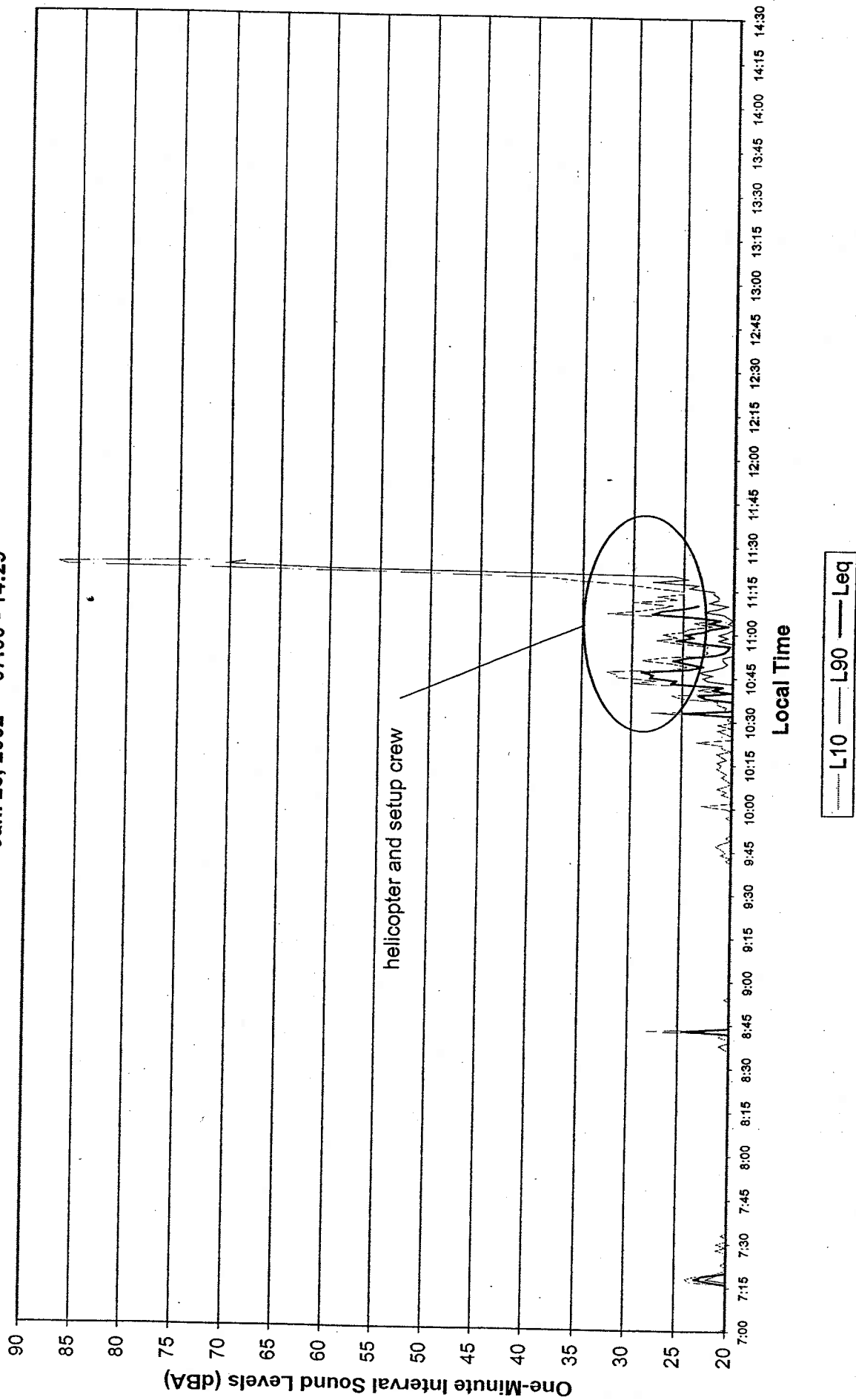
..... L10 — L90 — Leq

Figure 1.3i
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 24, 2002 - Jan. 25, 2002 22:00 - 06:59



2236-2

Figure 1.4i
Paramount Resources Ltd.
 Site 1 - 1500m NW of Satellite
 Jan. 25, 2002 07:00 - 14:29



Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Appendix C

Sound Level Results at Measurement Site #2

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Monitoring Equipment Data

Project Name Paramount Resources Ltd.
 Facility Location Cameron Hills N.W.T.
 Facility LSD
 File Number 2002-1270
 Start Date 24-Jan-02
 Consultant Measurements NM
 Consultant Tape Review -
 Computer File 2236-2 Paramount Site2.xls
 Location/Residence Site 2 - 1500m S of Battery
 GPS Coordinates (UTM) 6654227N / 11 472066E
 Microphone Placement 1.5 m above ground

Sound Level Meter (Outdoor) Bruel & Kjaer 2236
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404
 Sound Level Meter Bruel & Kjaer
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404

Calibrator Bruel & Kjaer 4231
 Calibrator Calibration Date

1 - 2173781 2143086 Feb 13/01 Yes	2 - 2015449 2140862 Sept 05/01 Yes	3 - 1799377 189184 Mar 10/00 Yes	4 - 1799382 1803167 July 10/01 Yes	5 - 1911156 2121009 Jun 16/00 Yes
2236-2100873-D 1765148 Jul 31/00 No	2236-1764289-D 1795138 Oct 24/02 No	2260-2311741 4189-2305533 June 29/01 No	2260-2027582 1931041 Apr 20/01 No	2238-2163499 2143085 July 09/01 No

2122824 Aug 04/01	1800168 Oct 24/02	2052131 Nov 17/00	2175822 Sept 05/01
----------------------	----------------------	----------------------	-----------------------

B&K 4220
285153
Oct 4/00

Field Calibration Level Start 94.0 dBA Stop 94.0 dBA

VCR

Unit/Make Model Serial No	1 Mitsubishi HS-U55C 5500271	5 JVC HR-DD840U 122E0459	6 JVC HR-DD840U 122E0468	7 JVC HR-DD840U 122E0443	
Unit/Make Model Serial No	10 JVC Optimus F8SK40354	11 JVC HR-DD840U 153E0121	12 JVC HR-DD840U 153E0126	13 JVC HR-DD840U 153E0139	14 JVC HR-DD840U 153E0703

Temperature (Deg C) -32 Humidity (%) Windspeed 5-7 kph N

Clock Synchronization: GPS SLM

VCR Field Calibration Level dBA 20 - 100 Battery Level (v)
 Tape / Time

Tape	Start Date	Start Time	Stop Time	Reading (dB)
1				
2				
3				
4				
5				
6				

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 2.1
Paramount Resources Ltd.
Site 2 - 1500m S of Battery
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Jan. 24, 2002	07:00 - 21:59	59.0	10.4	< 24.5	10.3
Jan. 24, 2002 - Jan. 25, 2002	22:00 - 06:59	< 19.9	9.0	< 19.9	9.0
Jan. 25, 2002	07:00 - 21:59	62.2	4.6	< 26.5	4.5
Jan 25, 2002 - Jan 26, 2002	22:00 - 06:59				
Jan. 26, 2002	07:00 - 21:59				
Overall Leq		58.2	23.9	< 23.9	23.8

Notes:

Due to the measurement range limitations of the sound level meter (between 20 and 100 dBA), all underrange entries were replaced with 19.9 dBA in order to calculate an approximate sound level for the environment.

The Residual Leq describes the sound level without the influence of equipment and crew. ie. helicopters and setup staff.

94.0% of the total measurement period was under 20 dBA. 2.3% of the measurement was between 20.0 and 24.9 dBA. 3.7% of the measurement period was above 25.0 dBA.

Error of the Overall Residual Leq is less than 2.1 dBA.

Error of the Overall Measured Leq is less than 0.1 dBA.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 2.2
Paramount Resources Ltd.
Site 2 - 1500m S of Battery
Hourly Leq Values

Date	24-Jan-02		25-Jan-02		26-Jan-02	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
0:00			19.9	19.9		
1:00			19.9	19.9		
2:00			19.9	19.9		
3:00			19.9	19.9		
4:00			19.9	19.9		
5:00			19.9	19.9		
6:00			20.1	20.1		
7:00			19.9	19.9		
8:00			19.9	19.9		
9:00			19.9	19.9		
10:00			21.7	21.7		
11:00	73.5	26.5	71.3	34.9		
12:00	32.7	32.7				
13:00	20.6	20.6				
14:00	19.9	19.9				
15:00	20.0	20.0				
16:00	19.9	19.9				
17:00	19.9	19.9				
18:00	19.9	19.9				
19:00	19.9	19.9				
20:00	19.9	19.9				
21:00	19.9	19.9				
22:00	19.9	19.9				
23:00	19.9	19.9				

Notes:

Due to the measurement range limitations of the sound level meter (between 20 and 100 dBA), all underrange entries were replaced with 19.9 dBA in order to calculate an approximate sound level for the environment.

Figure 2.1

Paramount Resources Ltd.

Site 2 - 1500m S of Battery

Jan. 24, 2002 07:00 - 14:29

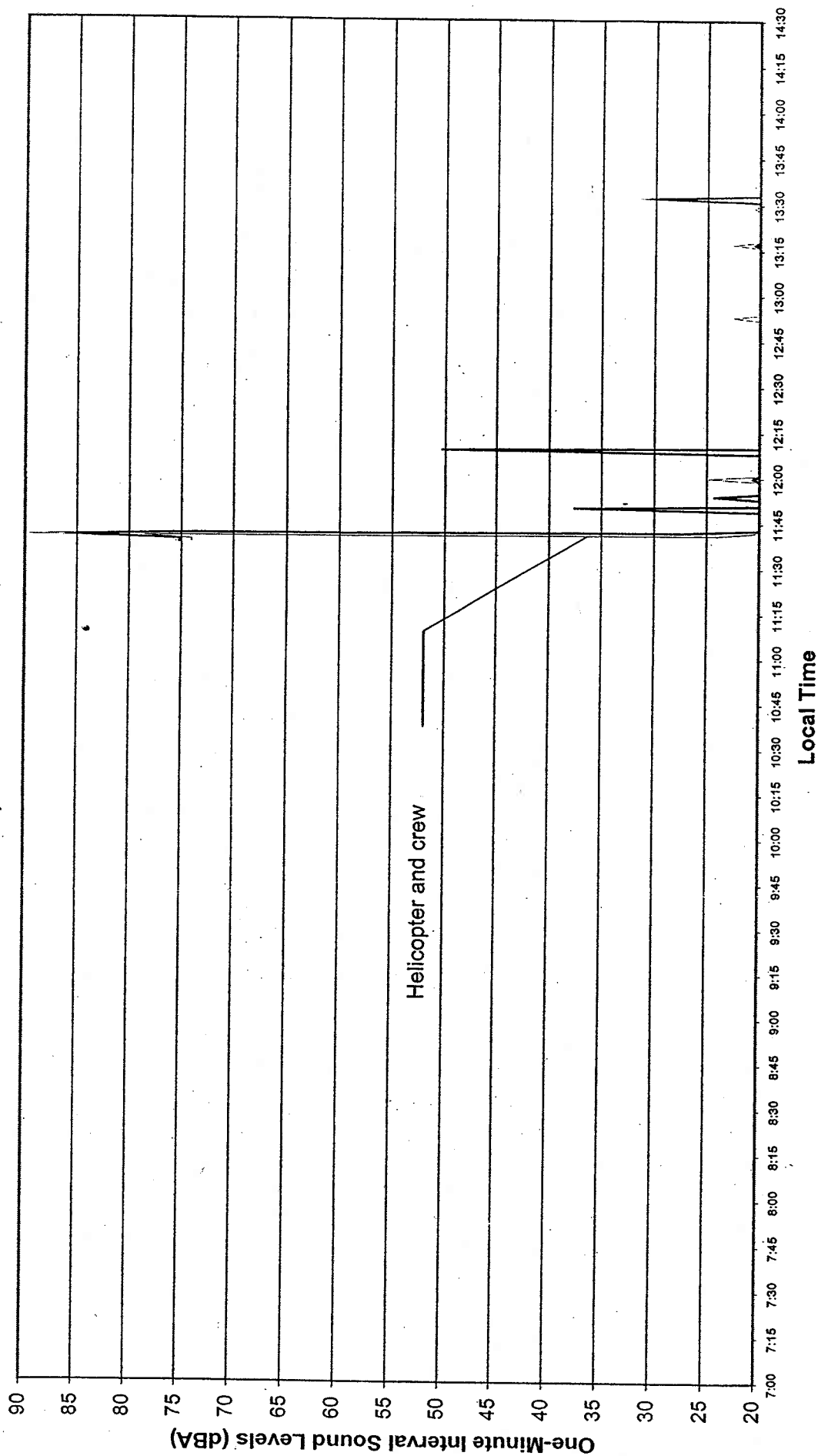


Figure 2.2
Paramount Resources Ltd.
 Site 2 - 1500m S of Battery
 Jan. 24, 2002 14:30 - 21:59

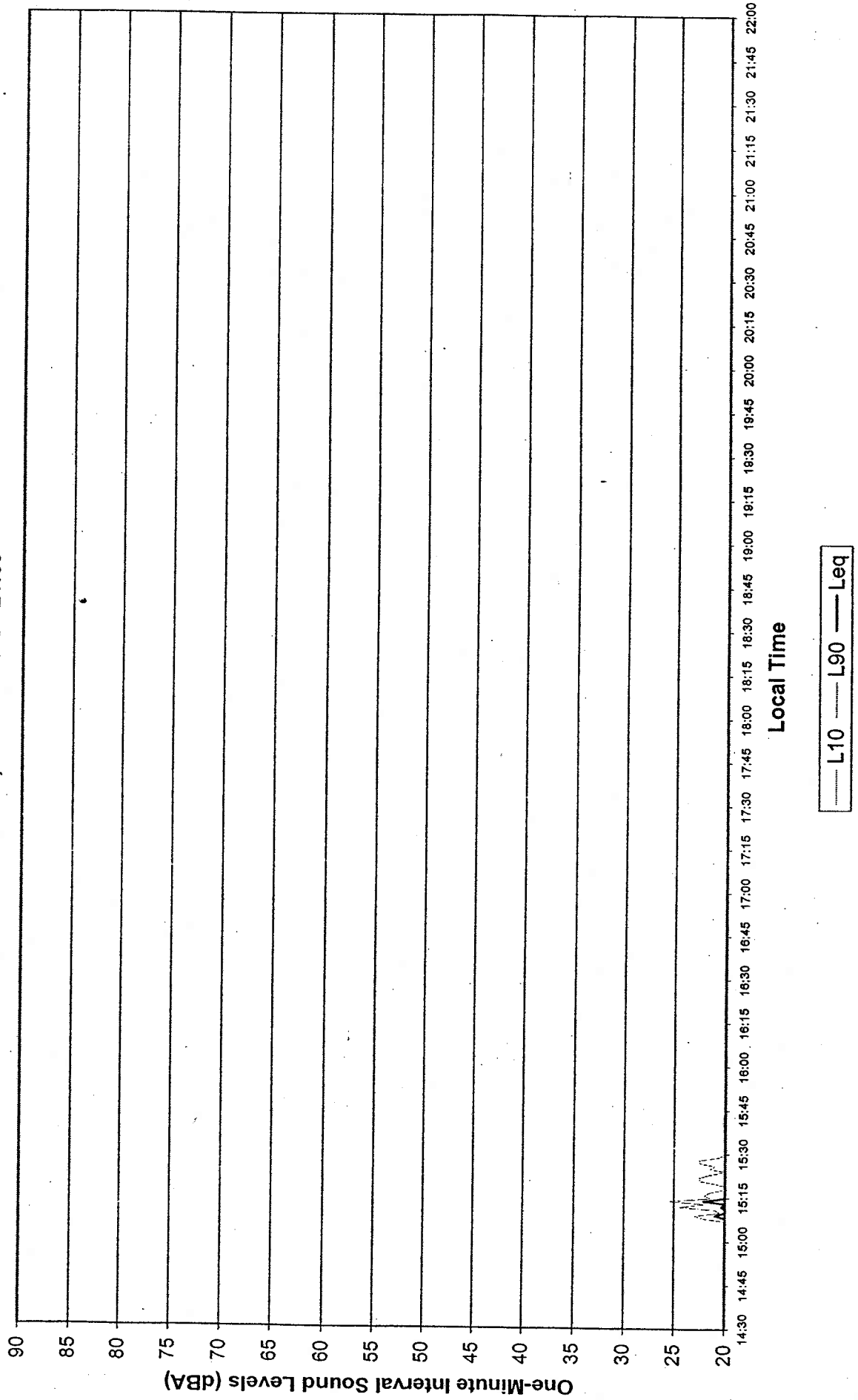


Figure 2.3
Paramount Resources Ltd.
 Site 2 - 1500m S of Battery
 Jan. 24, 2002 - Jan. 25, 2002 22:00 - 06:59

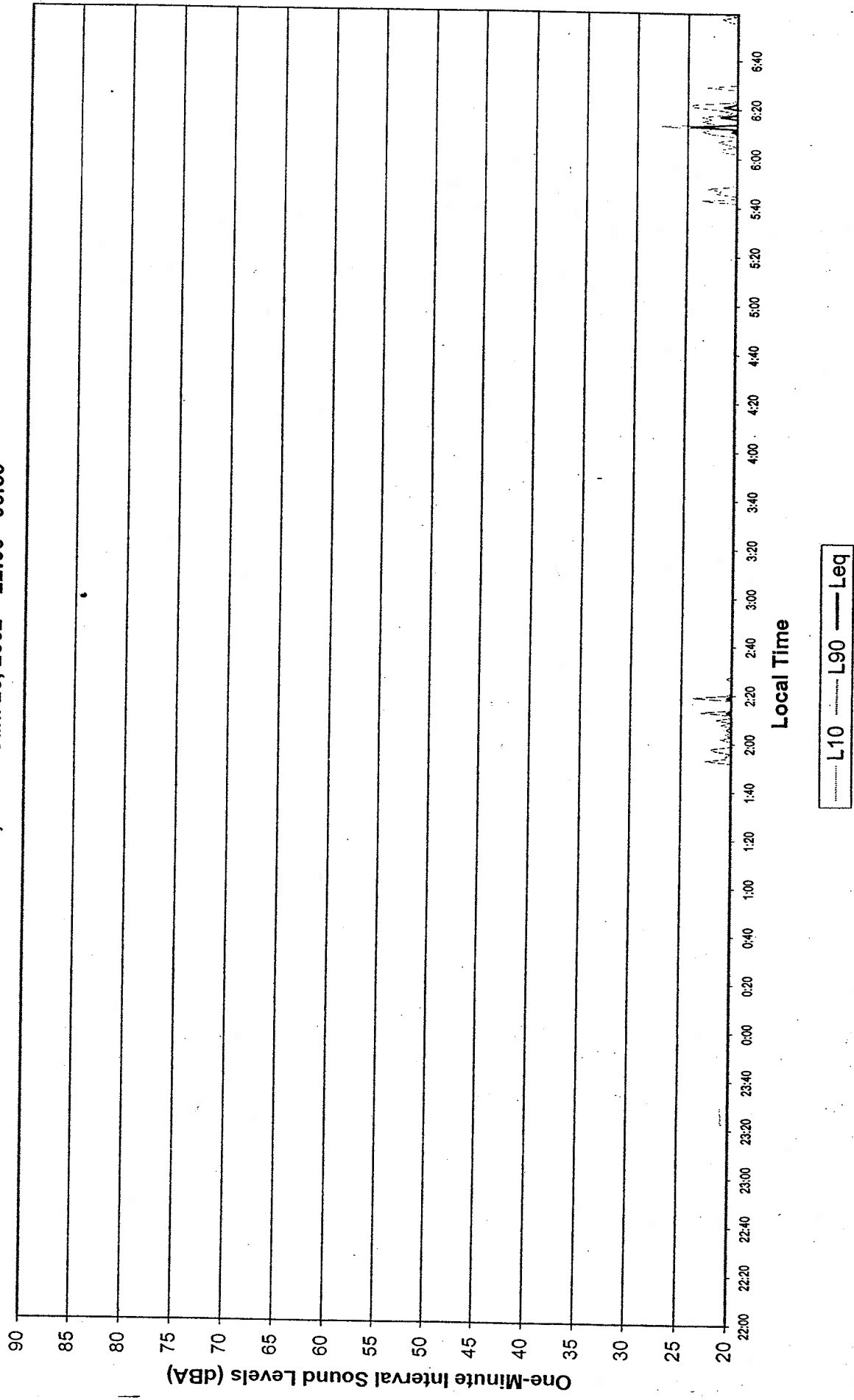


Figure 2.4 Paramount Resources Ltd.

Site 2 - 1500m S of Battery

Jan. 25, 2002 07:00 - 14:29

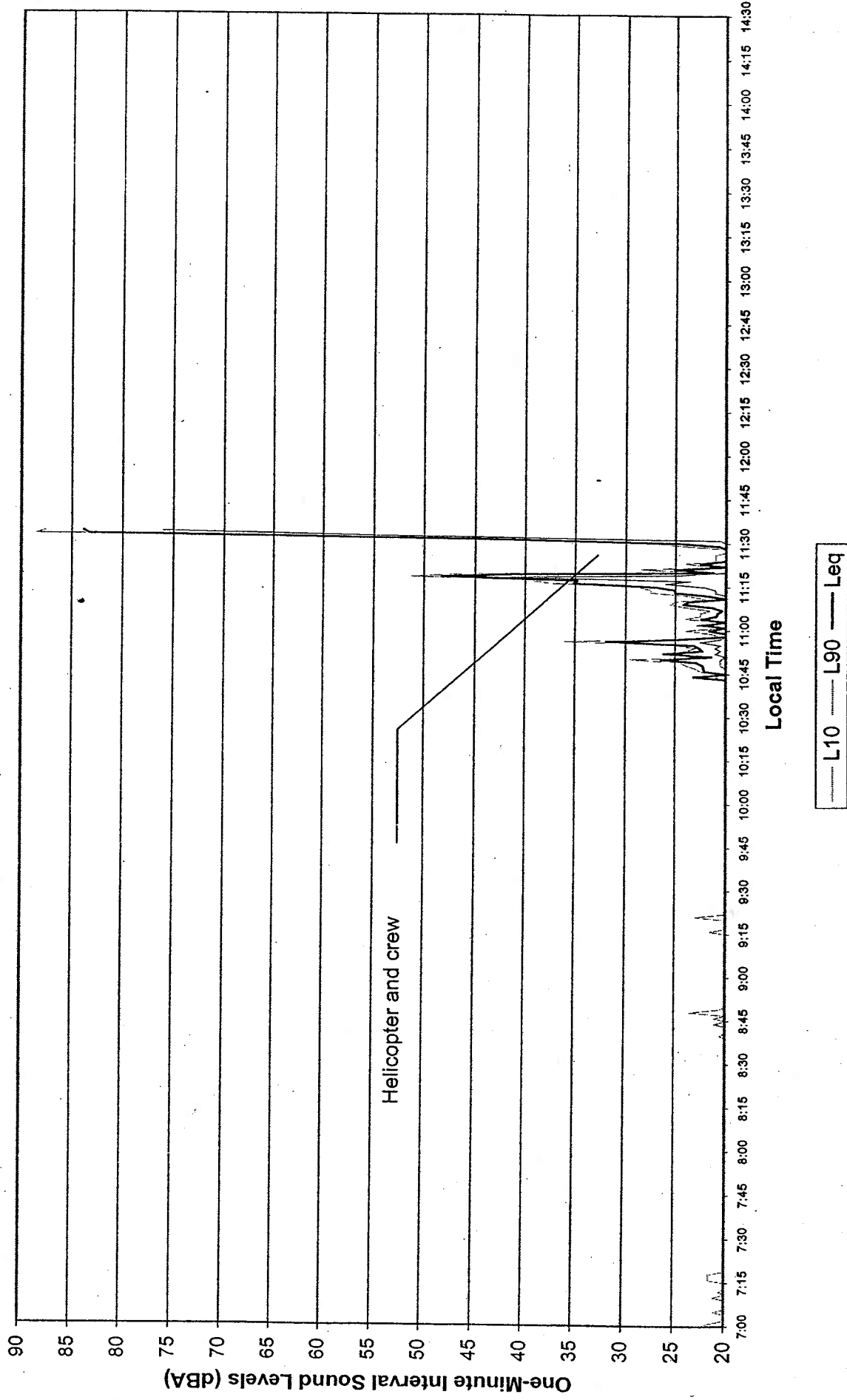


Figure 2.1i

Paramount Resources Ltd.

Site 2 - 1500m S of Battery

Jan. 24, 2002 07:00 - 14:29

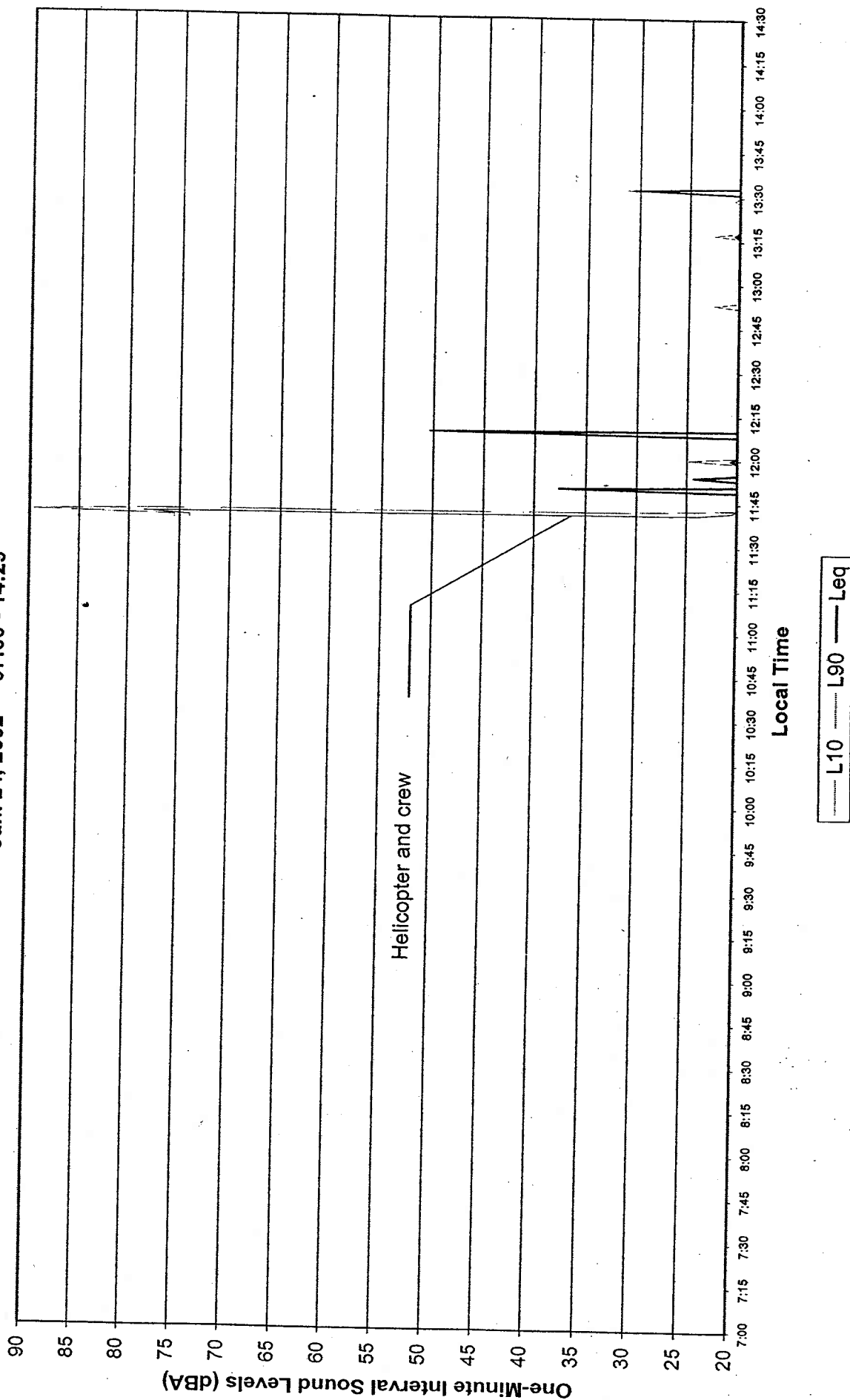
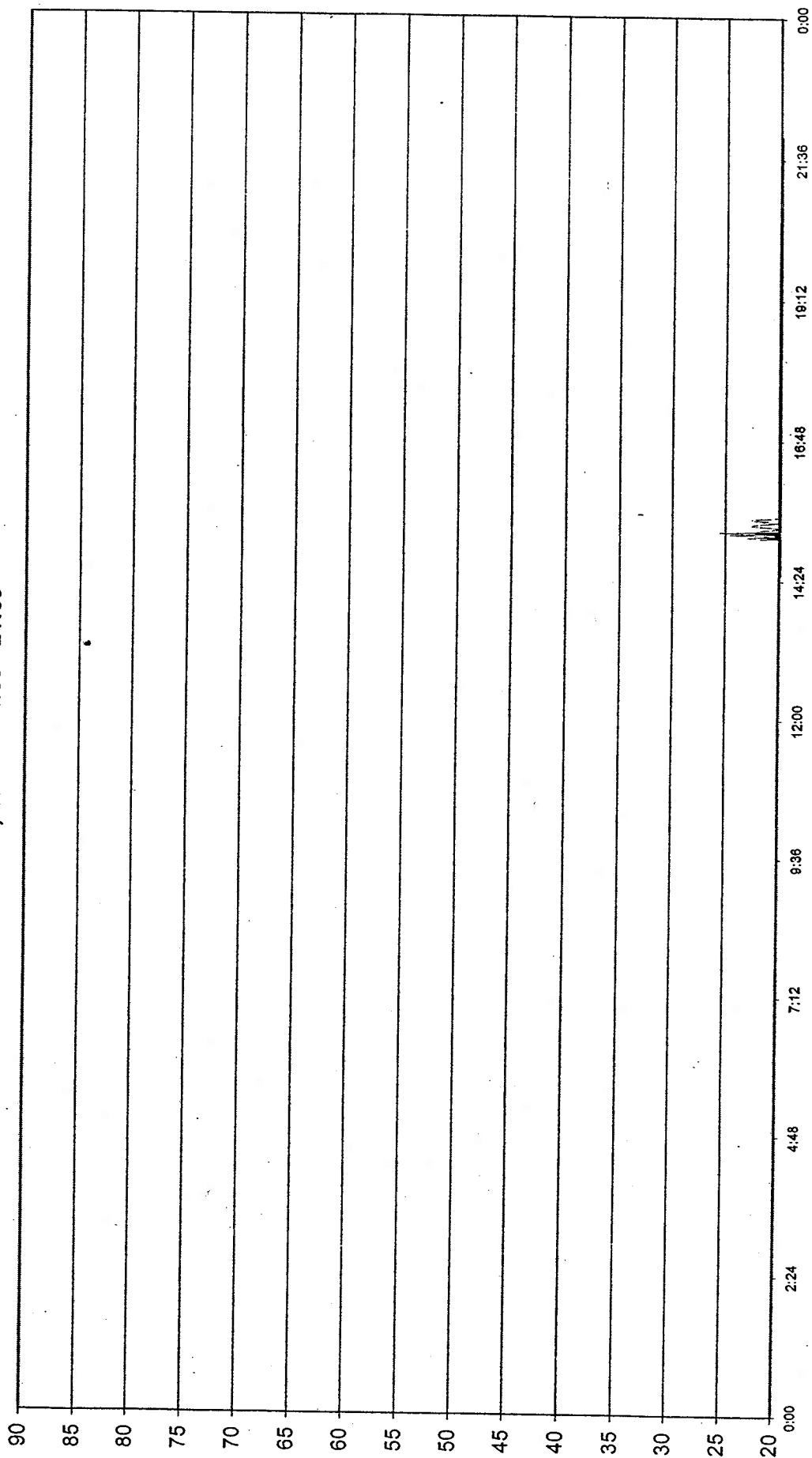
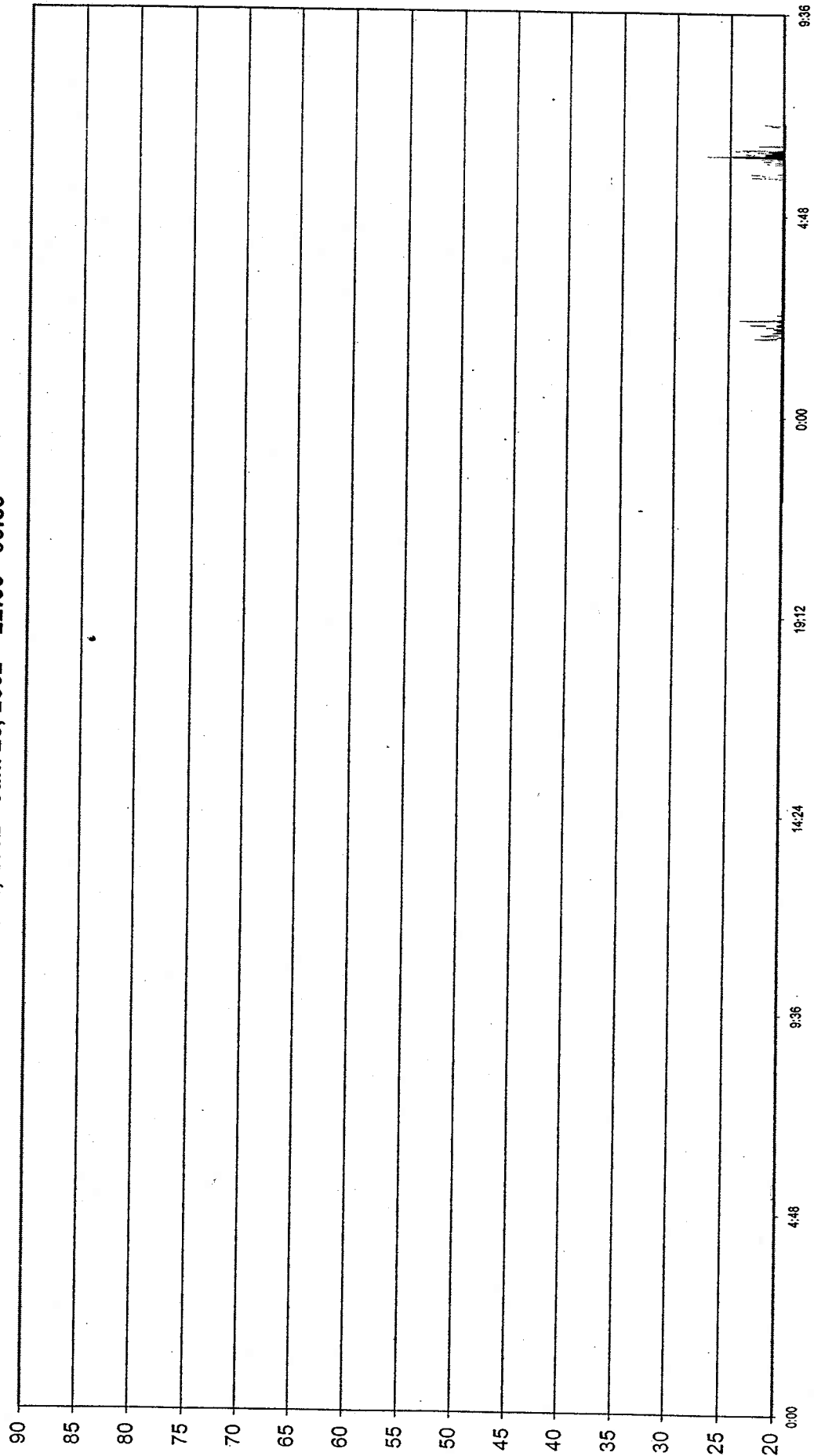


Figure 2.2i
Paramount Resources Ltd.
 Site 2 - 1500m S of Battery
 Jan. 24, 2002 14:30 - 21:59



— L10 — L90 — Leq

Figure 2.3i
Paramount Resources Ltd.
 Site 2 - 1500m S of Battery
 Jan. 24, 2002 - Jan. 25, 2002 22:00 - 06:59



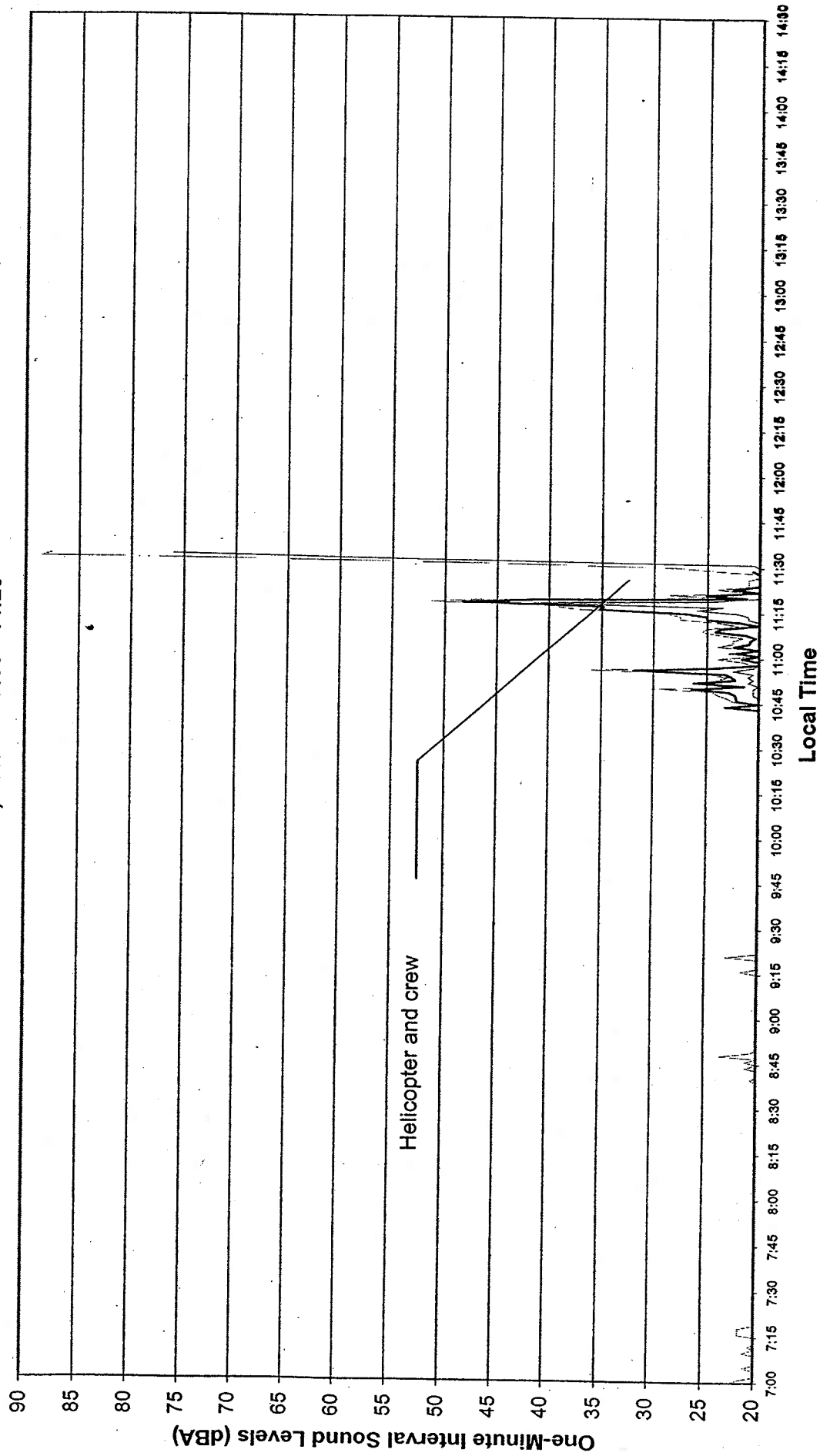
— L10 — L90 — Leq

Figure 2.4i

Paramount Resources Ltd.

Site 2 - 1500m S of Battery

Jan. 25, 2002 07:00 - 14:29



Legend: L10 (dotted line), L90 (dashed line), Leq (solid line)

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

**Cameron Hills, N.W.T.
Gathering System and Central Facility
Noise Survey Following
Production Operations Commencement**

Prepared for:

Paramount Resources Ltd.
Calgary, Alberta

Prepared by:

Richard Patching, M. Eng., P. Eng.
Neil Morozumi, EIT

of

Patching Associates Acoustical Engineering Ltd.
Consultants in Acoustics, Noise Control and Vibrations

19 -04- 2001

April 19, 2002

File: 2002 – 1270B

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibration

Executive Summary

Patching Associates Acoustical Engineering Ltd. (PAAE) was requested by Paramount Resources Ltd. (Paramount) to perform a noise survey following the start-up of production operations at a facility southwest of Hay River, Northwest Territories. The results of this survey will be used to determine the noise contribution of only the facilities at Paramount's operations in the Cameron Hills region after the construction of an oil and gas gathering system and central facility. Measurements were taken over a one-day period at two locations 1500 metres from the central facility and future satellite site.

The survey results contained short-term higher-level sound events that were not indicative of noise generated by the facility and are attributed to helicopters, facility operators on all-terrain vehicles and visits by PAAE technical staff. The non-facility short-term sounds were verified and isolated from comprehensive sound level data using activity logs from the plant operators and are presented in the table below.

Noise Measurements at Two Receivers Located at 1500 metres

Date (2002)	Daytime/ Nighttime	Measured Sound Level*		Residual Sound Level**	
		Leq (dBA)	Hours	Leq (dBA)	Hours
Site 1 – 1500 NNW of Future Satellite Site					
Apr. 13	07:00 – 21:59	31.0	10.5	20.3	10.3
Apr. 13 – 14	22:00 – 06:59	21.0	9.0	21.0	9.0
Apr. 14	07:00 – 21:59	31.9	4.2	23.6	4.1
Overall		29.5	23.7	21.4	23.4
Site 2 – 1500 S of Central Facility					
Apr. 13	07:00 – 21:59	40.0	10.4	24.9	10.1
Apr. 13 – 14	22:00 – 06:59	24.6	9.0	24.6	9.0
Apr. 14	07:00 – 21:59	37.9	4.3	26.4	4.0
Overall		37.5	23.7	25.1	23.2

* The Measured Leq describes the sound level without the influence of PAAE set-up staff only (i.e. PAAE support helicopter).

** The Residual Leq describes the sound level without the influence of helicopters and all-terrain vehicles used by Paramount and PAAE set-up staff.

The results of this assessment indicate that the current post-construction noise levels at 1500 metres from the central facility and future satellite site are well within the nighttime Leq target of 40 dBA made by Paramount Resources Ltd.

Patching Associates Acoustical Engineering Ltd.

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Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibration

Introduction

Patching Associates Acoustical Engineering Ltd. (PAAE) was requested by Paramount Resources Ltd. (Paramount) to perform a noise survey following the start-up of production operations at a facility southwest of Hay River, Northwest Territories. The results of this survey will be used to determine the noise contribution of only the facilities at Paramount's operations in the Cameron Hills region after the construction of an oil and gas gathering system and central facility. Measurements were taken over a one-day period at two locations 1500 metres from the central facility and future satellite site.

Noise Criteria

Paramount has targeted a nighttime L_{eq} noise level of 40 dBA from the facility. PAAE has assumed that the nighttime period to be the same as the nighttime period specified by the Alberta Energy and Utilities Board (AEUB). The AEUB defines daytime as between 7:00 and 21:59, and nighttime as between 22:00 and 6:59.

The L_{eq} is the A-weighted equivalent-continuous sound level. This index is an energy average of the varying sound levels over a specified period. The use of this index permits the description of a varying sound level environment as a single number. As the L_{eq} is an "average" level, the measured sound level may exceed the criterion level for a short period, provided that the duration is limited. The L_{eq} value considers both the sound level and the length of time that the sound level occurs. Appendix A provides a detailed explanation of the L_{eq} index.

Methodology

The sound monitoring survey was conducted with Brüel & Kjær Model 2236 Precision Integrating Sound Level Meter which was equipped with a Brüel & Kjær 4188 microphone. The sound level meter was configured to continuously record the one-minute L_{eq} , L_{10} and L_{90} values. The microphone was mounted with a Brüel & Kjær windscreen Model DS 0934 to reduce the potential for wind-induced noise at the microphone, as required by the Directive.

The sound level meter was field calibrated at the start of the comprehensive sound monitoring survey and then checked at the completion of the survey with a Brüel & Kjær Model 4231 Sound Level Calibrator.

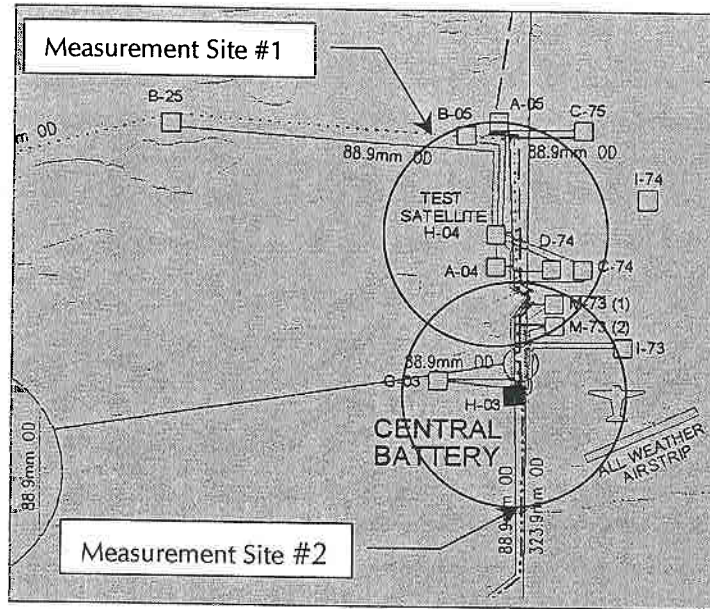
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Monitoring Locations

Measurement Site #1 was located 1500 metres NNW of the future satellite site at UTM 6659021 N / 11 470884 E and Measurement Site #2 was located 1500 metres S of the central facility at UTM 6654227 N / 11 472066 E. Figure 1.0 depicts the locations of the comprehensive noise measurements for the study.

Figure 1.0: Comprehensive Noise Measurement Locations (Apr. 13 - 14, 2002)



The microphone was mounted on a tripod at a height of approximately 1.5 m above the ground.

Facility Operating Conditions

Observations from field staff and conversations with the facility operator indicate that the Paramount facility was operating normally during the study period.

It is the understanding of PAAE that local helicopter and all-terrain vehicle activities were due to troubleshooting work at the wellsites. Paramount has indicated that once the initial start-up phase of the production operation is streamlined, this activity will be substantially reduced.

Environmental Conditions

Wind induced noise can often be a problem in environmental measurements. The AEUB Noise Control Directive ID 99-8 (Directive) requires that for environmental noise surveys, the wind speed is no greater than 20 kph for facilities upwind or crosswind of the receiver and 15 kph for facilities downwind of the receiver. This survey has also adopted this method to ensure a valid and meaningful measurement result.

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The hourly observation record of wind velocity and direction measured at the Hay River weather station is presented in Table 1.

**Table 1 – Weather Conditions for Hay River, Northwest Territories
April 13, 2002 – April 14, 2002**

Date	Time	Temperature (°C)	Wind Speed (kph)	Wind Direction
April 13, 2002	11:00	-8	13	NNW
	12:00	-7	13	NNW
	13:00	-6	11	NW
	14:00	Not Available		
	15:00	-4	13	NNW
	16:00	-3	11	NW
	17:00	-3	11	NW
	18:00	-2	13	NW
	19:00	-2	15	WNW
	20:00	-3	9	WNW
	21:00	-5	9	WNW
	22:00	-6	0	-
	23:00	-9	0	-
April 14, 2002	00:00	-10	11	E
	01:00	-9	13	E
	02:00	-11	11	E
	03:00	-11	7	E
	04:00	-11	6	ESE
	05:00	-13	11	E
	06:00	-16	7	E
	07:00	-16	4	ESE
	08:00	-15	9	E
	09:00	-14	7	E
	10:00	-12	15	ENE
	11:00	-11	15	ENE

It should be noted that the weather conditions at the weather station might not correspond with those at the measurement sites but should serve as an adequate indicator of the conditions in the general study area.

The topography of the area may be described as flat muskeg with small brush and trees.

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Results

The recorded values for the monitored one-minute L_{eq} , L_{10} and L_{90} sound levels for Site #1 and Site #2 are presented graphically in a time history format in Figures 1.1 to 1.4 and Figures 2.1 to 2.4 in Appendix B. The one-minute L_{eq} values were used to calculate daytime, nighttime and overall L_{eq} values for each measurement location. The daytime and nighttime periods are the same as those specified by the AEUB.

The measured noise levels for each measurement location are presented in Table 2.

Table 2 – Noise Measurements at Two Receivers Located at 1500 metres

Date (2002)	Daytime/ Nighttime	Measured Sound Level		Residual Sound Level	
		Leq (dBA)	Hours	Leq (dBA)	Hours
Site 1 – 1500 NNW of Future Satellite Site					
Apr. 13	07:00 – 21:59	31.0	10.5	20.3	10.3
Apr. 13 – 14	22:00 – 06:59	21.0	9.0	21.0	9.0
Apr. 14	07:00 – 21:59	31.9	4.2	23.6	4.1
Overall		29.5	23.7	21.4	23.4
Site 2 – 1500 S of Central Facility					
Apr. 13	07:00 – 21:59	40.0	10.4	24.9	10.1
Apr. 13 – 14	22:00 – 06:59	24.6	9.0	24.6	9.0
Apr. 14	07:00 – 21:59	37.9	4.3	26.4	4.0
Overall		37.5	23.7	25.1	23.2

Table 2 shows that Paramount's current post-construction facility operation sound levels at 1500 metres from the future satellite site and central facility are well within the target nighttime L_{eq} of 40 dBA.

Discussion of Results

Through the use of activity logs provided by Paramount, many of the noise spikes were found to be sounds generated by helicopters, facility operators on all-terrain vehicles and visits from PAAE staff. The Measured Sound Levels in Table 2 are the resulting sound levels after noise generated by PAAE staff have been removed. The Residual Sound Levels listed in Table 2 are the resulting sound levels after noise from helicopters, all-terrain vehicles and PAAE staff have been removed and are more indicative of the sound produced by only the facility. Figures 1.1 Isolated to 1.4 Isolated and Figures 2.1 Isolated to 2.4 Isolated in Appendix B present the time history for the measurement with extraneous events removed.

Comparing the comprehensive noise level with the ambient noise level measured in a previous study (PAAE file 2002-1270), the current noise level is approximately 1.0 dBA and 1.2 dBA greater than the ambient pre-construction noise level at Site #1 and Site #2 respectively. (Note: a change of 3 dB is barely perceptible by a human with normal hearing under field conditions)

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Conclusion

The results of this assessment indicate that the current post-construction noise levels at 1500 metres from the central facility and future satellite site are well within the nighttime L_{eq} target set by Paramount Resources Ltd. of 40 dBA.

APPENDIX A

Explanation of Technical Details Regarding Sound Measurement and Analysis

Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at $2.0 \times 10^{-5} \text{ N/m}^2$ (also written $20 \mu\text{Pa}$), which corresponds to a sound intensity of $10^{-12} \text{ Watts/m}^2$ (or 1 piconWatt per square metre, written 1 pW/m^2).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 KHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

When sound is measured using the A-weighting scale, the reading is often called the "Noise level", to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in Table A1.

When the A-weighting scale is not used, the measurement is said to have a "linear" weighting, or to be unweighted, and may be called a "linear" level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term "Sound Pressure Level", or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as "unwanted sound", which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). An alternate definition of noise is "sound made by somebody else", which emphasizes that the ability to control the level of the sound alters the perception of noise.

Table A1- Noise Levels of Familiar Sources

Source Or Environment	Noise Level (dBA)
High Pressure Steam Venting To Atmosphere (3m)	121
Steam Boiler (2m)	90-95
Drilling Rig (10m)	80-90
Pneumatic Drill (15m)	85
Pump Jack (10m)	68-72
Truck (15m)	65-70
Business Office	65
Conversational Speech (1m)	60
Light Auto Traffic (30m)	50
Living Room	40
Library	35
Soft Whisper (5m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the centre frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq} , which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, nighttime (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to an existing environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10%-ile level, written L_{10} , is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90} , is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.

One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90} , greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

APPENDIX B

Measurement Results

Graphs of 1-Minute L_{eq} , L_{10} and L_{90} Data

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Monitoring Equipment Data

Project Name Paramount Resources Ltd.
 Facility Location Cameron Hills N.W.T.
 Facility LSD
 File Number 2002-1270B
 Start Date 13-Apr-02
 Consultant Measurements NM
 Consultant Tape Review --
 Computer File 2236-2 Paramount Site1.xls
 Location/Residence Site #1 - 1500m NNW of Future Satellite Site
 GPS Coordinates (UTM) 6659021N / 11 470884E
 Microphone Placement 1.5 m above ground

Sound Level Meter (Outdoor) Bruel & Kjaer 2236
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404
 Sound Level Meter Bruel & Kjaer
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404

Calibrator Bruel & Kjaer 4231
 Calibrator Calibration Date

1 - 2173781 2143086 February 22/02 Yes	2 - 2015449 2140862 Sept 05/01 Yes	3 - 1799377 189184 Mar 10/00 Yes	4 - 1799382 1803167 July 10/01 Yes	5 - 1911156 2121009 Jun 16/00 Yes
2236-2100873-D 1765148 Jul 31/00 No	2236-1764289-D 1795138 Oct 24/02 No	2260-2311741 4189-2305533 June 29/01 No	2260-2027582 1931041 Apr 20/01 No	2238-2163499 2143085 July 09/01 No

2122824 Aug 04/01	1800168 Oct 24/01	2052131 Jan 17/02	2175822 Sept 05/01
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B&K 4220
285153
Oct 4/00

Field Calibration Level Start **93.7** dBA Stop **93.7** dBA

VCR	Unit/Make	1 Mitsubishi	5 JVC	6 JVC	7 JVC	
	Model	HS-U55C	HR-DD840U	HR-DD840U	HR-DD840U	
	Serial No	5500271	122E0459	122E0468	122E0443	
	Unit/Make	10 JVC	11 JVC	12 JVC	13 JVC	14 JVC
	Model	Optimus	HR-DD840U	HR-DD840U	HR-DD840U	HR-DD840U
	Serial No	F8SK40354	153E0121	153E0126	153E0139	153E0703

Temperature (Deg C) Humidity (%) Windspeed

Clock Synchronization: GPS SLM

VCR Field Calibration Level dBA 20 - 100 Battery Level (v)
 Tape / Time

Tape	Start Date	Start Time	Stop Time	Reading (dB)
1				
2				
3				
4				
5				
6				

Notes:

Equipment used in this survey have been bolded and shaded above.

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Table 1.1
Paramount Resources Ltd.
Site #1 - 1500m NNW of Future Satellite Site
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Apr. 13, 2002	07:00 - 21:59	31.0	10.5	20.3	10.3
Apr. 13, 2002 - Apr. 14, 2002	22:00 - 06:59	21.0	9.0	21.0	9.0
Apr. 14, 2002	07:00 - 21:59	31.9	4.2	23.6	4.1
Apr 14, 2002 - Apr 15, 2002	22:00 - 06:59				
Apr. 15, 2002	07:00 - 21:59				
Overall Leq		29.5	23.7	21.4	23.4

Notes:

Due to the measurement range limitations of the sound level meter (between 20 and 100 dBA), all underrange entries were replaced with 19.9 dBA in order to calculate an approximate sound level for the environment.

The Measured Leq describes the sound level without the influence of PAAE setup staff only (i.e. PAAE support helicopter).

The Residual Leq describes the sound level without the influence of helicopters and all-terrain vehicles used by Paramount and PAAE setup staff.

69.3% of the total measurement period was under 20 dBA. 24.6% of the measurement was between 20.0 and 24.9 dBA. 6.1% of the measurement period was above 25.0 dBA.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 1.2
Paramount Resources Ltd.
Site #1 - 1500m NNW of Future Satellite Site
Hourly Leq Values

Date	13-Apr-02		14-Apr-02		15-Apr-02	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
0:00			19.9	19.9		
1:00			19.9	19.9		
2:00			19.9	19.9		
3:00			19.9	19.9		
4:00			19.9	19.9		
5:00			21.6	21.6		
6:00			24.4	24.4		
7:00			24.1	24.1		
8:00			24.3	24.3		
9:00			26.7	23.3		
10:00			37.3	21.2		
11:00	22.2	20.2	25.7	25.7		
12:00	32.1	21.5				
13:00	37.1	19.9				
14:00	20.0	20.0				
15:00	19.9	19.9				
16:00	20.1	20.1				
17:00	20.2	20.2				
18:00	37.6	19.9				
19:00	19.9	19.9				
20:00	20.5	20.5				
21:00	20.7	20.7				
22:00	20.7	20.7				
23:00	20.0	20.0				

Figure 1.1
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 07:00 - 14:29

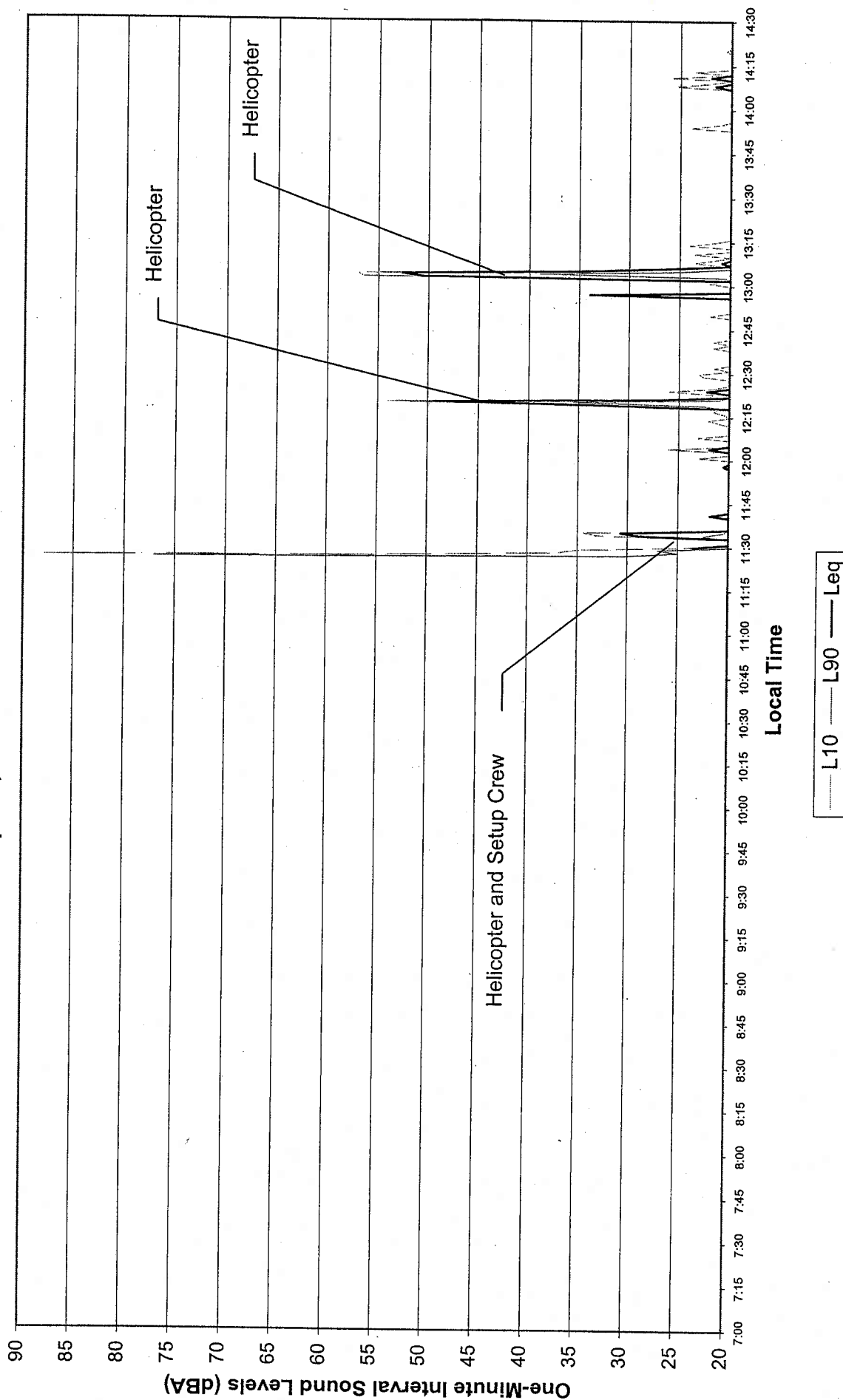


Figure 1.2
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 14:30 - 21:59

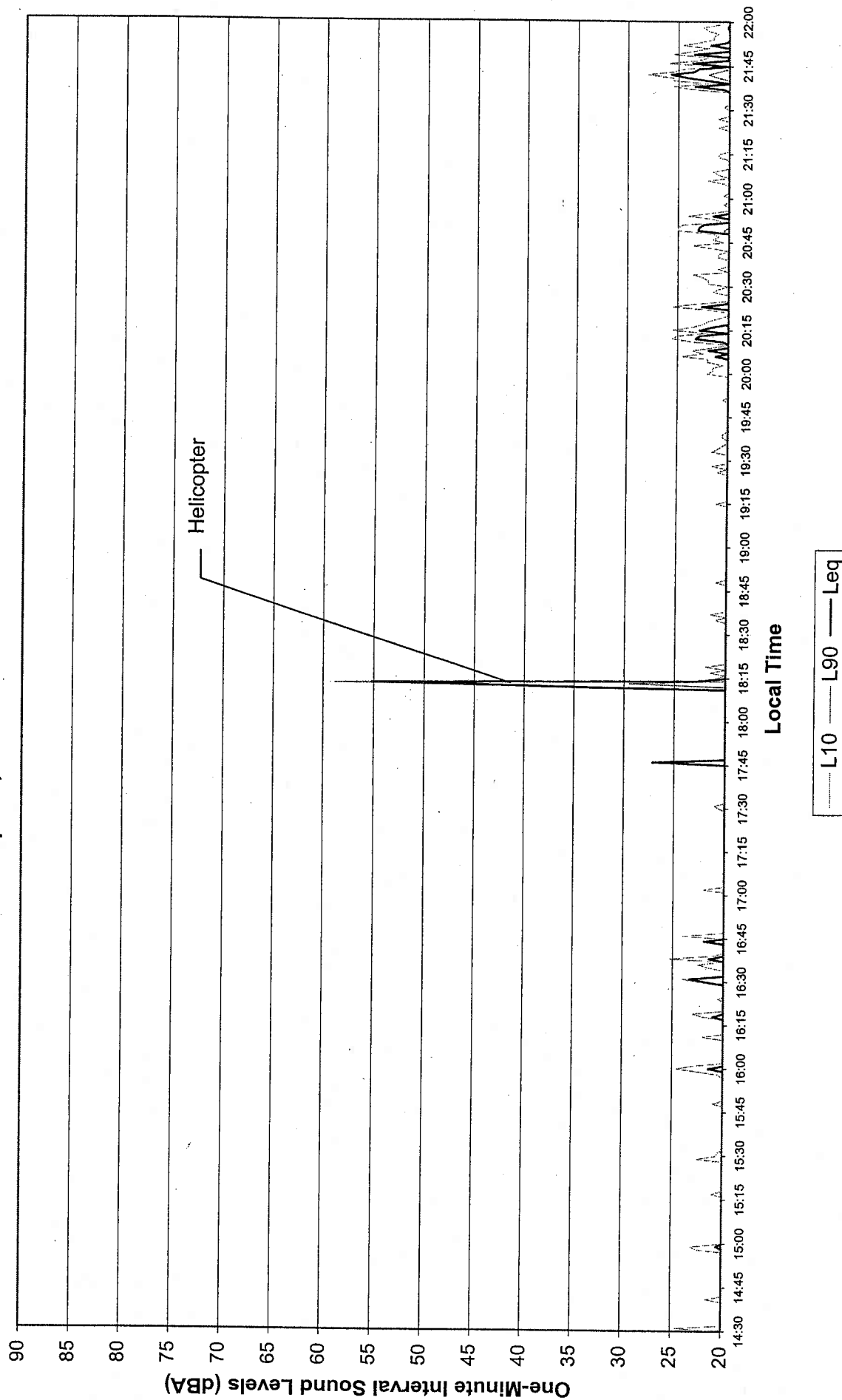


Figure 1.3
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 - Apr. 14, 2002 22:00 - 06:59

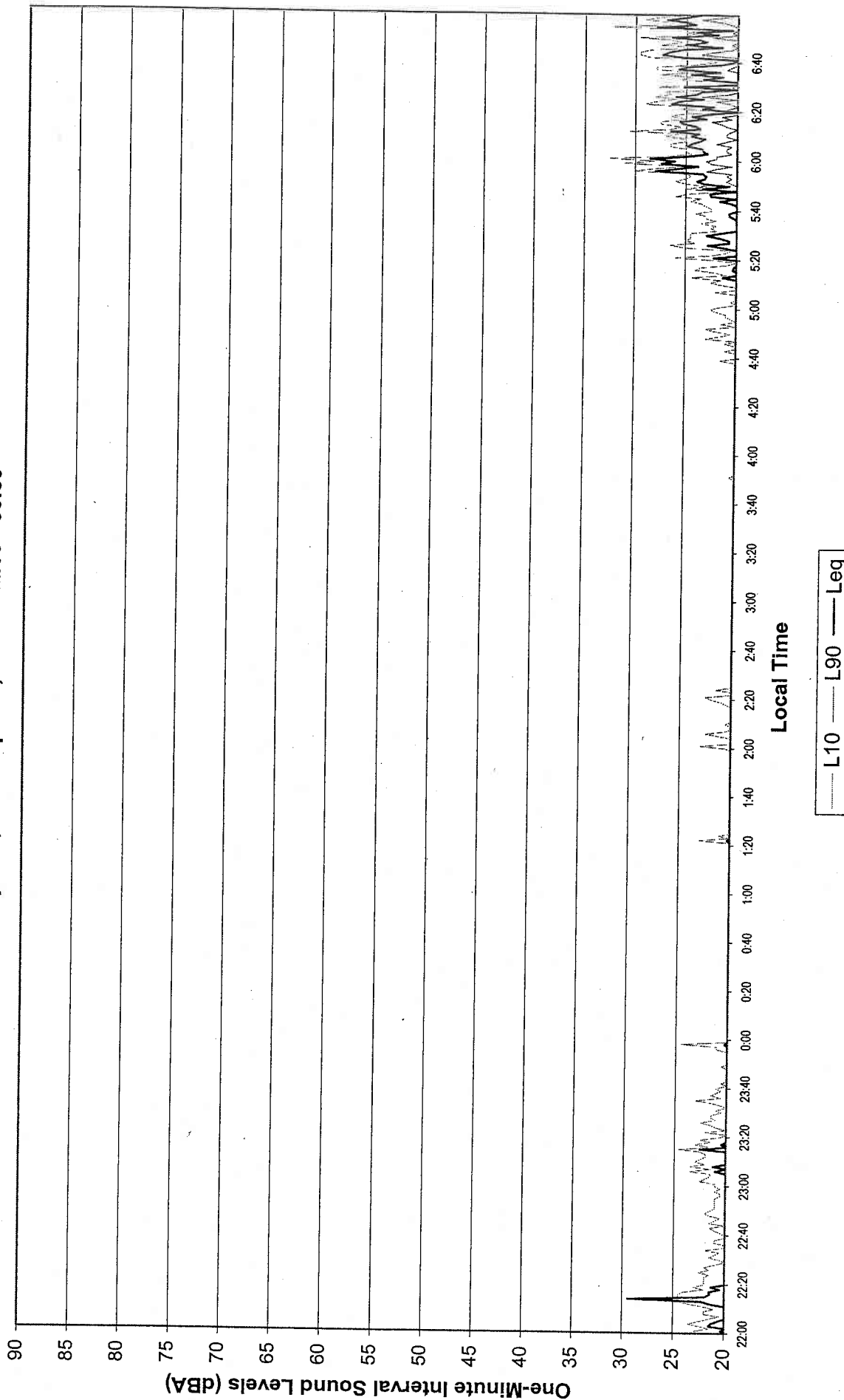


Figure 1.4
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 14, 2002 07:00 - 14:29

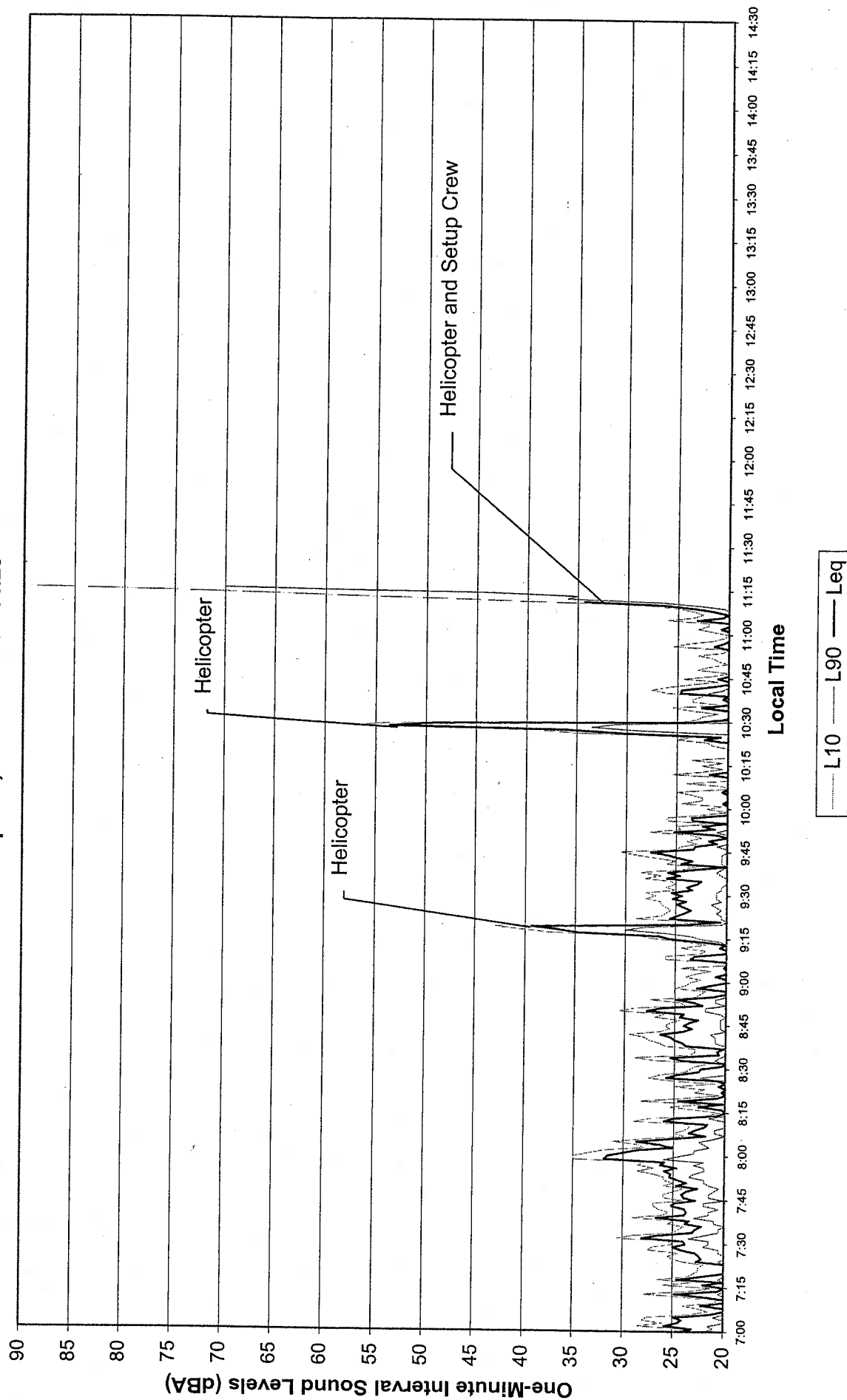


Figure 1.1 Isolated
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 07:00 - 14:29

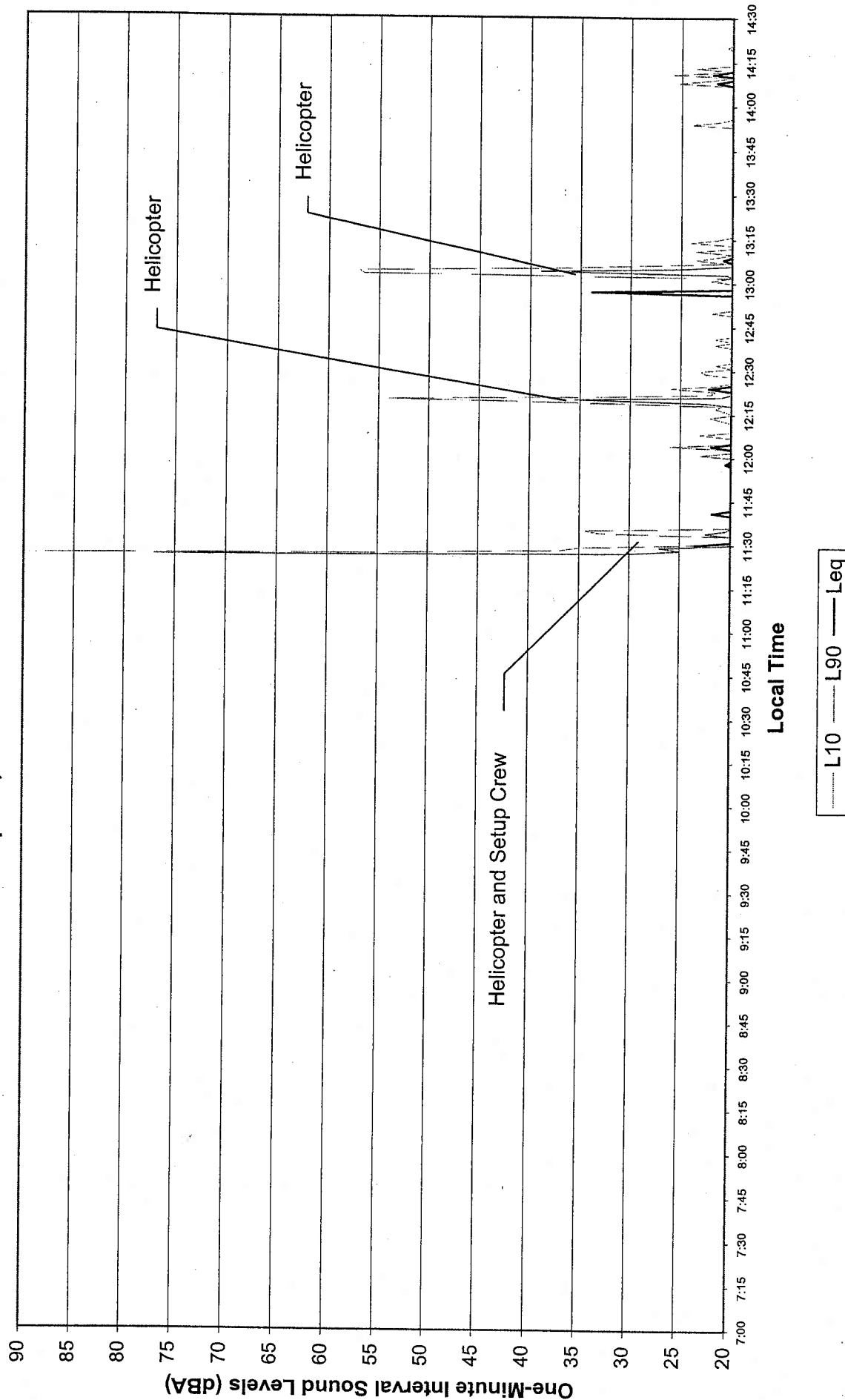


Figure 1.2 Isolated
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 14:30 - 21:59

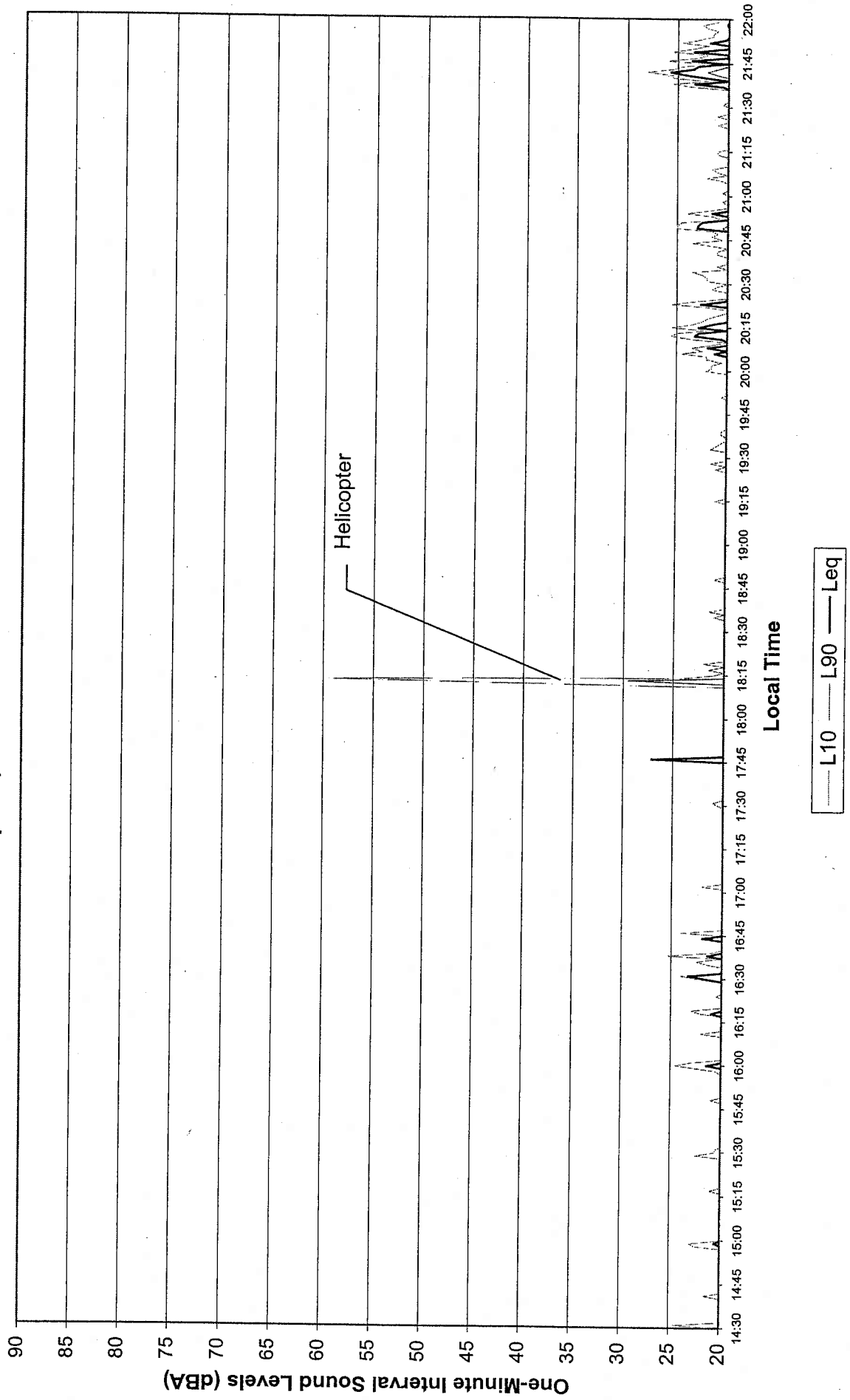


Figure 1.3 Isolated
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 13, 2002 - Apr. 14, 2002 22:00 - 06:59

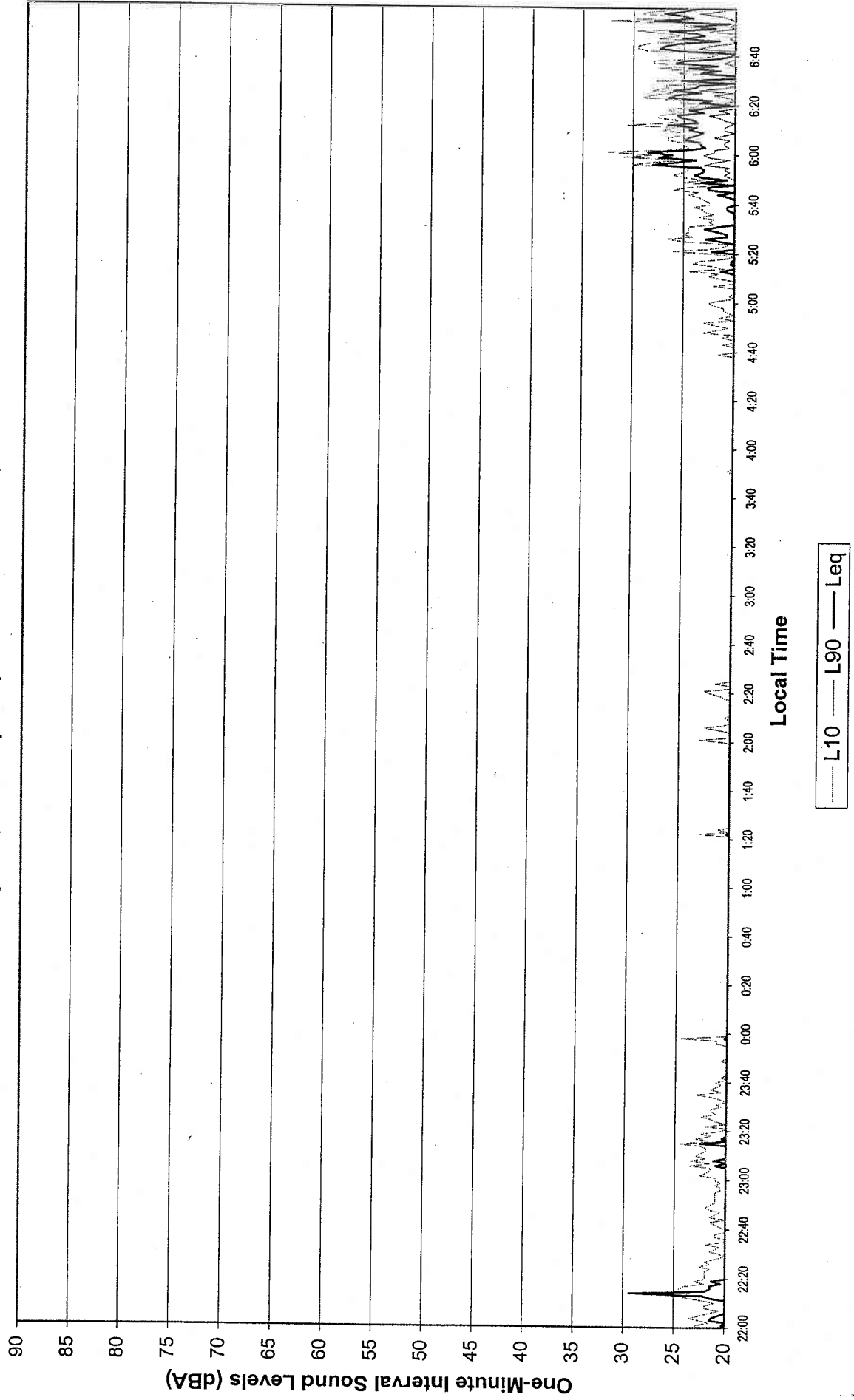
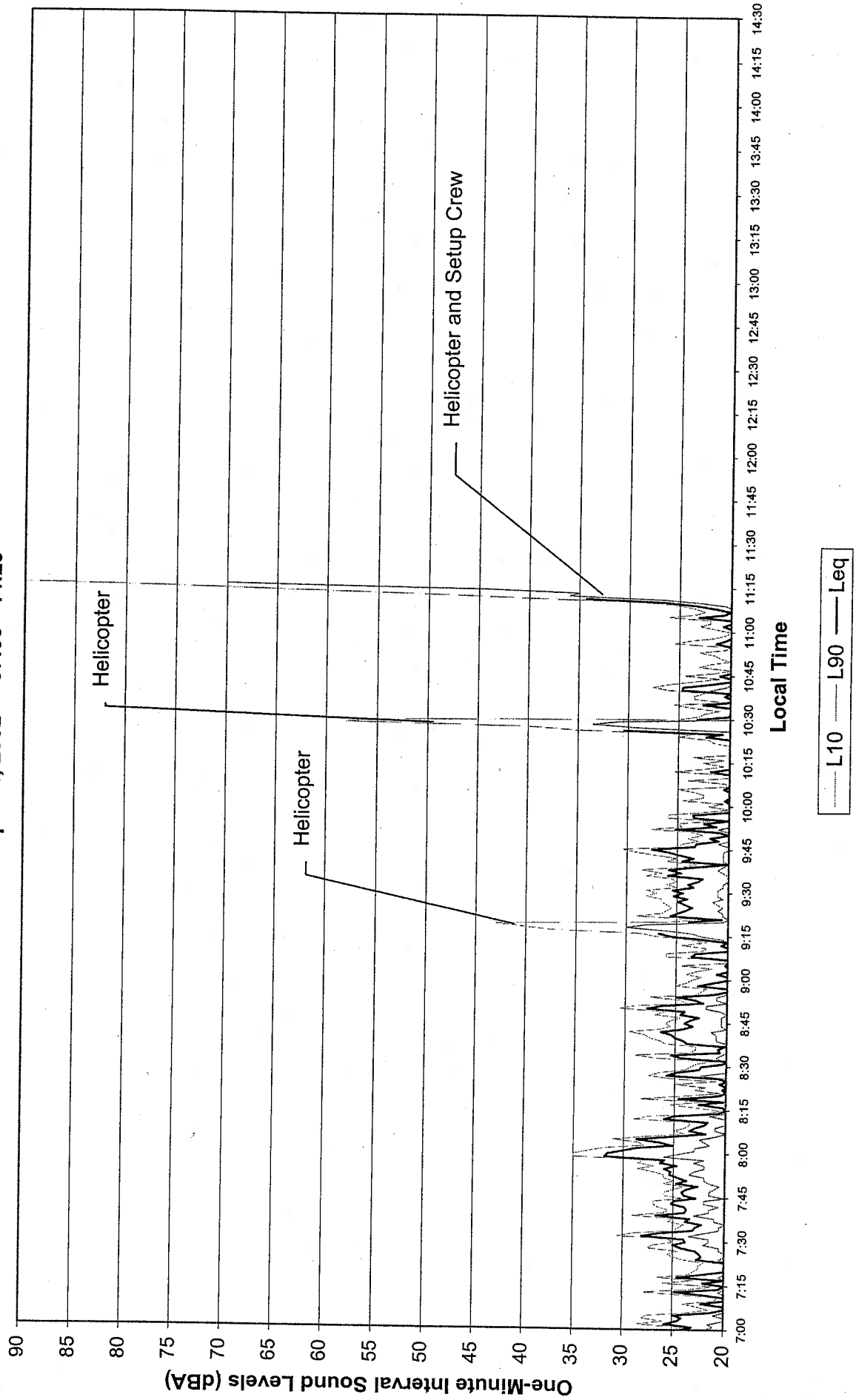


Figure 1.4 Isolated
Paramount Resources Ltd.
 Site #1 - 1500m NNW of Future Satellite Site
 Apr. 14, 2002 07:00 - 14:29



Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Monitoring Equipment Data

Project Name Paramount Resources Ltd.
 Facility Location Cameron Hills N.W.T.
 Facility LSD
 File Number 2002-1270B
 Start Date 13-Apr-02
 Consultant Measurements NM
 Consultant Tape Review --
 Computer File 2236-2 Paramount Site2.xls
 Location/Residence Site #2 - 1500m S of Central Facility
 GPS Coordinates (UTM) 6654227N / 11 472066E
 Microphone Placement 1.5 m above ground

Sound Level Meter (Outdoor) Bruel & Kjaer 2236
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404
 Sound Level Meter Bruel & Kjaer
 Microphone Bruel & Kjaer 4188
 Meter Calibration Date
 Outdoor Microphone Kit Bruel & Kjaer UA1404

Calibrator Bruel & Kjaer 4231
 Calibrator Calibration Date

1 - 2173781 2143086 February 22/02 Yes	2 - 2015449 2140862 Sept 05/01 Yes	3 - 1799377 189184 Mar 10/00 Yes	4 - 1799382 1803167 July 10/01 Yes	5 - 1911156 2121009 Jun 16/00 Yes
2236-2100873-D 1765148 Jul 31/00 No	2236-1764289-D 1795138 Oct 24/02 No	2260-2311741 4189-2305533 June 29/01 No	2260-2027582 1931041 Apr 20/01 No	2238-2163499 2143085 July 09/01 No

2122824 Aug 04/01	1800168 Oct 24/01	2052131 Jan 17/02	2175822 Sept 05/01
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B&K 4220
285153
Oct 4/00

Field Calibration Level Start 93.8 dBA Stop 93.8 dBA

VCR

Unit/Make	1 Mitsubishi	5 JVC	6 JVC	7 JVC
Model	HS-U55C	HR-DD840U	HR-DD840U	HR-DD840U
Serial No	5500271	122E0459	122E0468	122E0443
Unit/Make	10 JVC	11 JVC	12 JVC	13 JVC
Model	Optimus	HR-DD840U	HR-DD840U	HR-DD840U
Serial No	F8SK40354	153E0121	153E0126	153E0139
				14 JVC
				HR-DD840U
				153E0703

Temperature (Deg C)

Humidity (%)

Windspeed

Clock Synchronization:

GPS

SLM

VCR Field Calibration Level
Tape / Time

dBA 20 - 100

Battery Level (v)

Tape	Start Date	Start Time	Stop Time	Reading (dB)
1				
2				
3				
4				
5				
6				

Notes:

Equipment used in this survey have been bolded and shaded above.

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Table 2.1
Paramount Resources Ltd.
Site #2 - 1500m S of Central Facility
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Apr. 13, 2002	07:00 - 21:59	40.0	10.4	24.9	10.1
Apr. 13, 2002 - Apr. 14, 2002	22:00 - 06:59	24.6	9.0	24.6	9.0
Apr. 14, 2002	07:00 - 21:59	37.9	4.3	26.4	4.0
Apr 14, 2002 - Apr 15, 2002	22:00 - 06:59				
Apr. 15, 2002	07:00 - 21:59				
Overall Leq		37.5	23.7	25.1	23.2

Note:

The Measured Leq describes the sound level without the influence of PAAE setup staff only (i.e. PAAE support helicopter).

The Residual Leq describes the sound level without the influence of helicopters and all-terrain vehicles used by Paramount and PAAE setup staff.

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Table 2.2
Paramount Resources Ltd.
Site #2 - 1500m S of Central Facility
Hourly Leq Values

Date	13-Apr-02		14-Apr-02		15-Apr-02	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
0:00			24.0	24.0		
1:00			23.5	23.5		
2:00			23.7	23.7		
3:00			23.1	23.1		
4:00			23.9	23.9		
5:00			25.0	25.0		
6:00			28.0	28.0		
7:00			27.4	26.7		
8:00			26.3	26.3		
9:00			29.7	26.9		
10:00			43.8	25.7		
11:00	25.4	25.4	31.6	26.2		
12:00	44.4	25.9				
13:00	46.5	24.5				
14:00	27.8	27.8				
15:00	42.3	26.0				
16:00	24.4	24.4				
17:00	41.1	22.9				
18:00	26.4	22.4				
19:00	23.8	23.8				
20:00	23.9	23.9				
21:00	23.9	23.9				
22:00	23.1	23.1				
23:00	24.2	24.2				

Figure 2.1
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 07:00 - 14:29

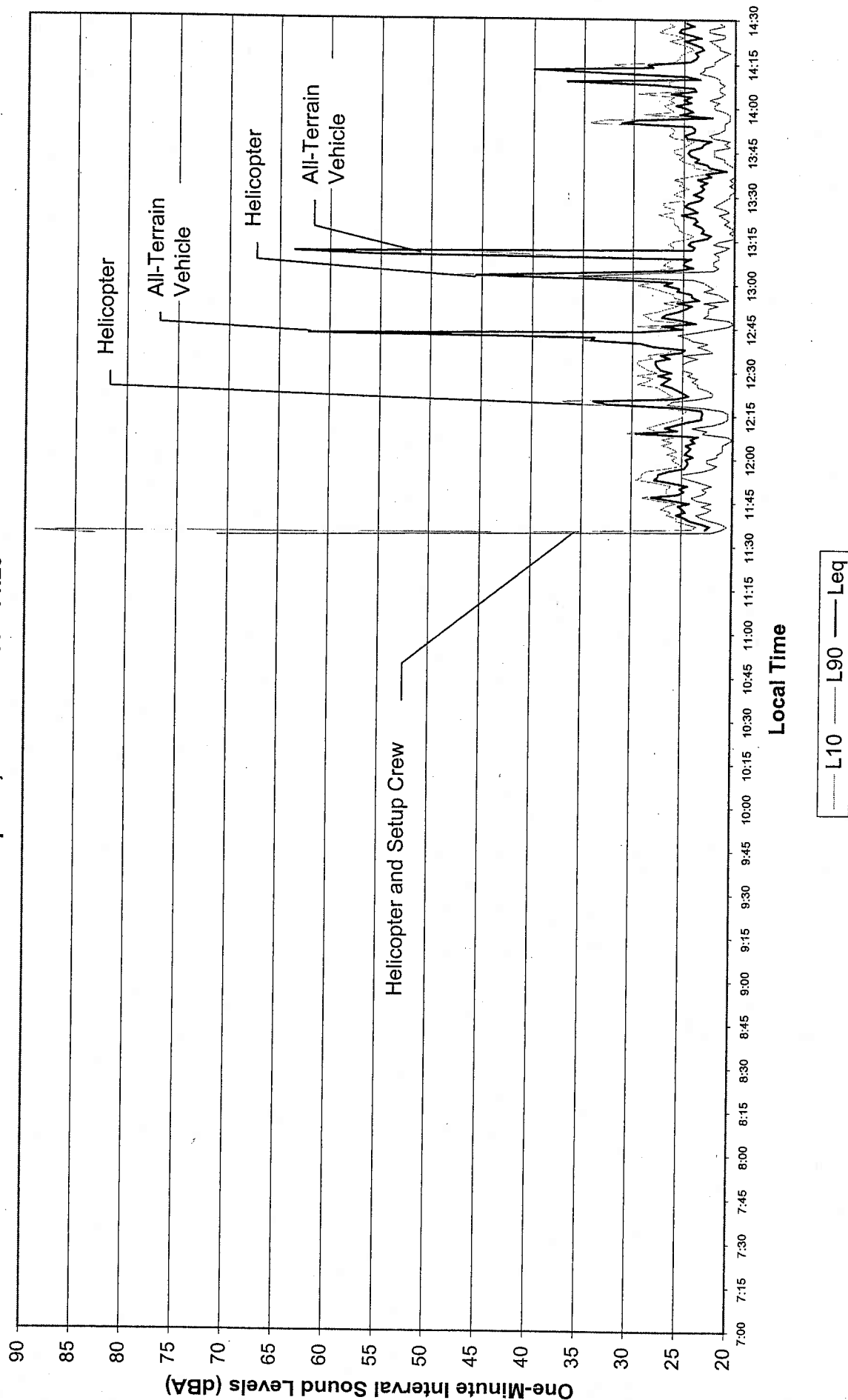


Figure 2.2
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 14:30 - 21:59

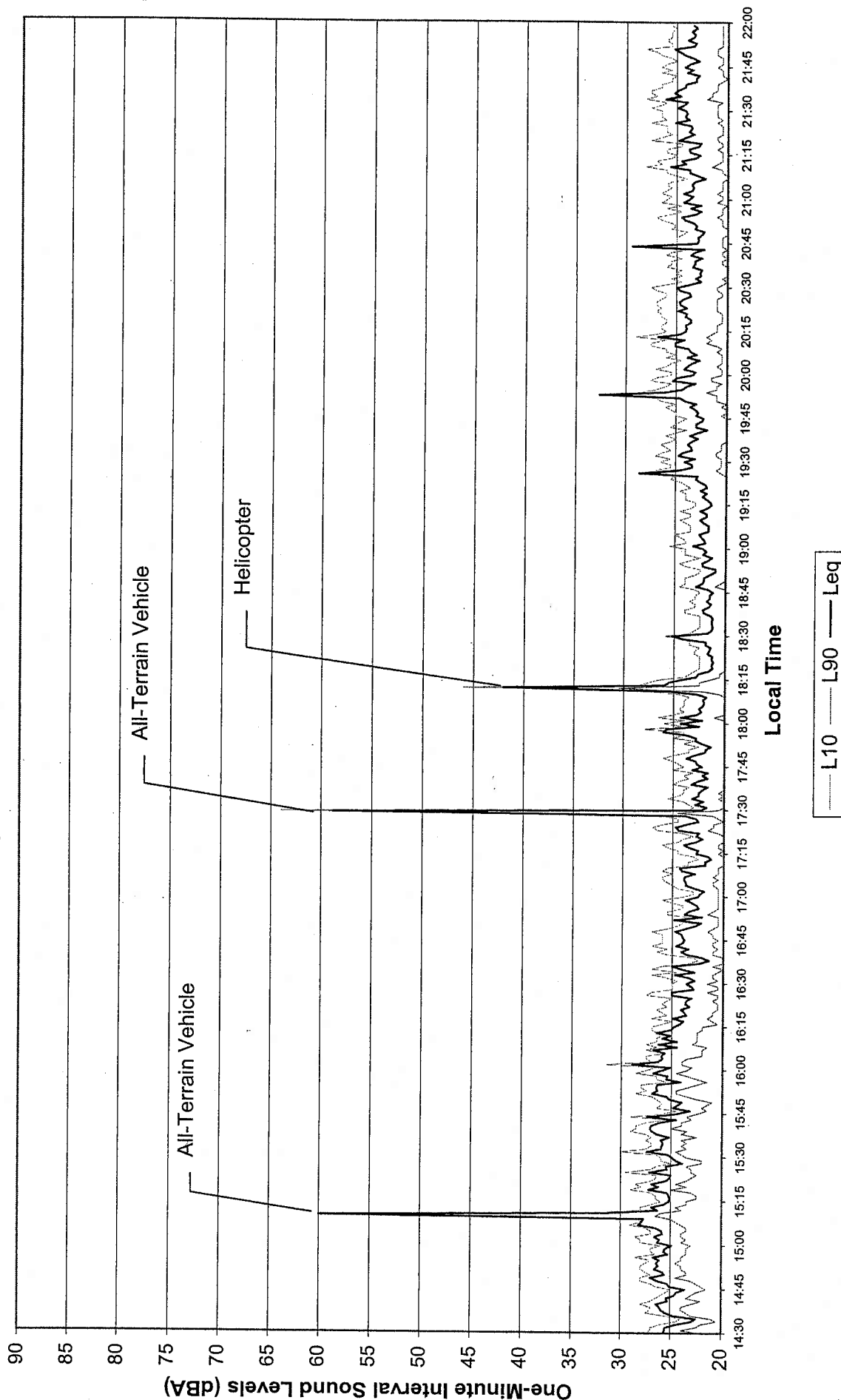


Figure 2.3
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 - Apr. 14, 2002 22:00 - 06:59

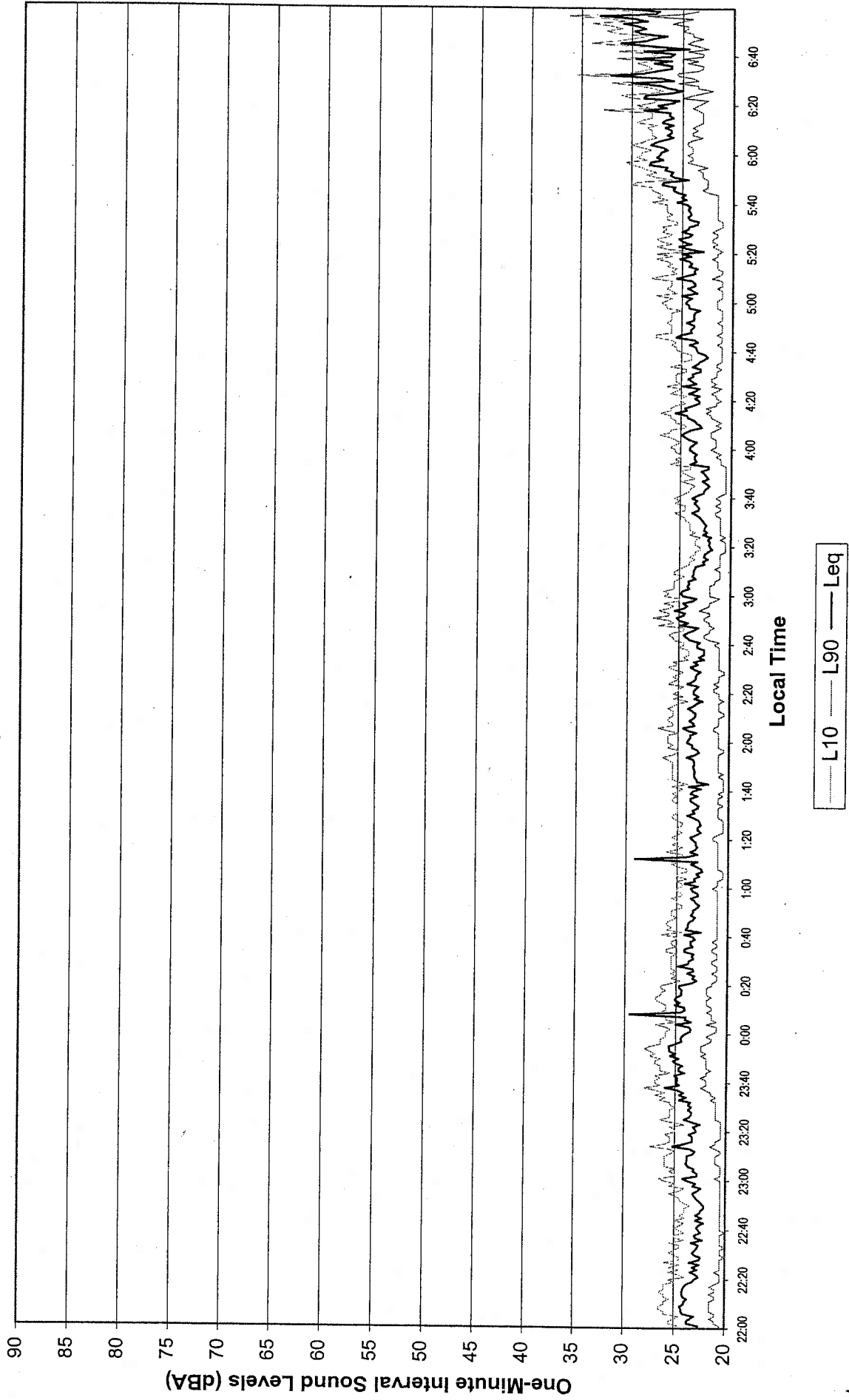


Figure 2.4
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 14, 2002 07:00 - 14:29

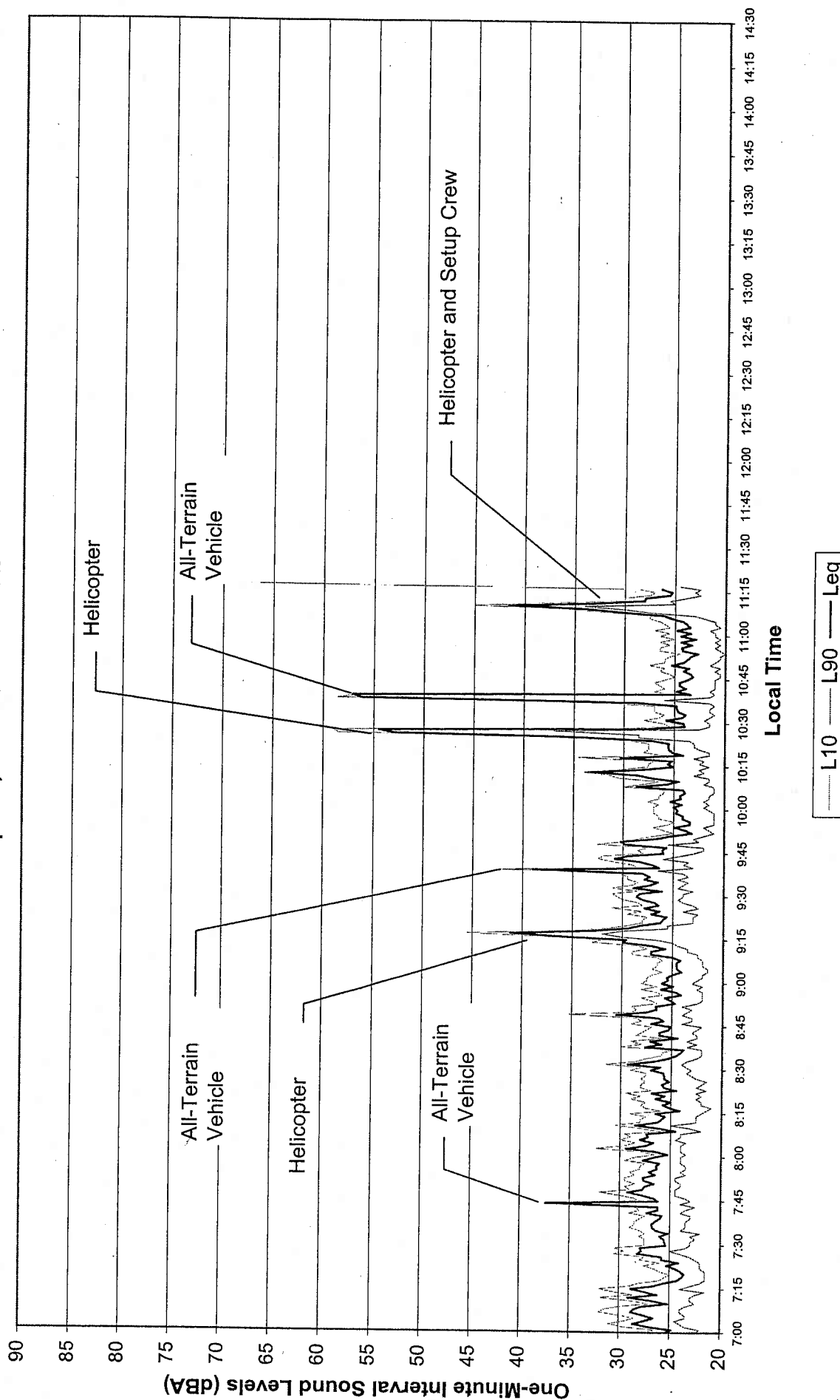


Figure 2.1 Isolated
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 07:00 - 14:29

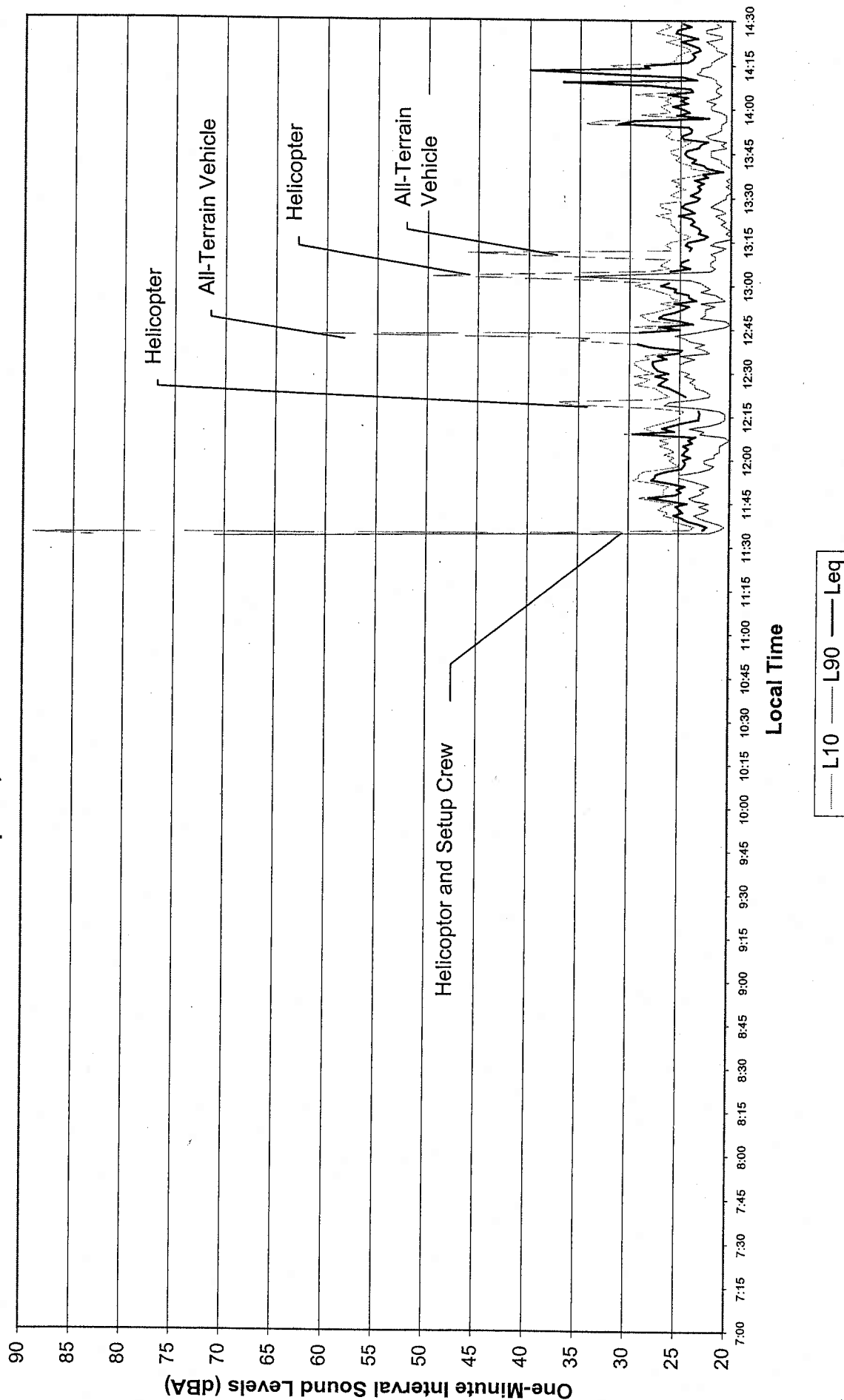


Figure 2.2 Isolated
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 14:30 - 21:59

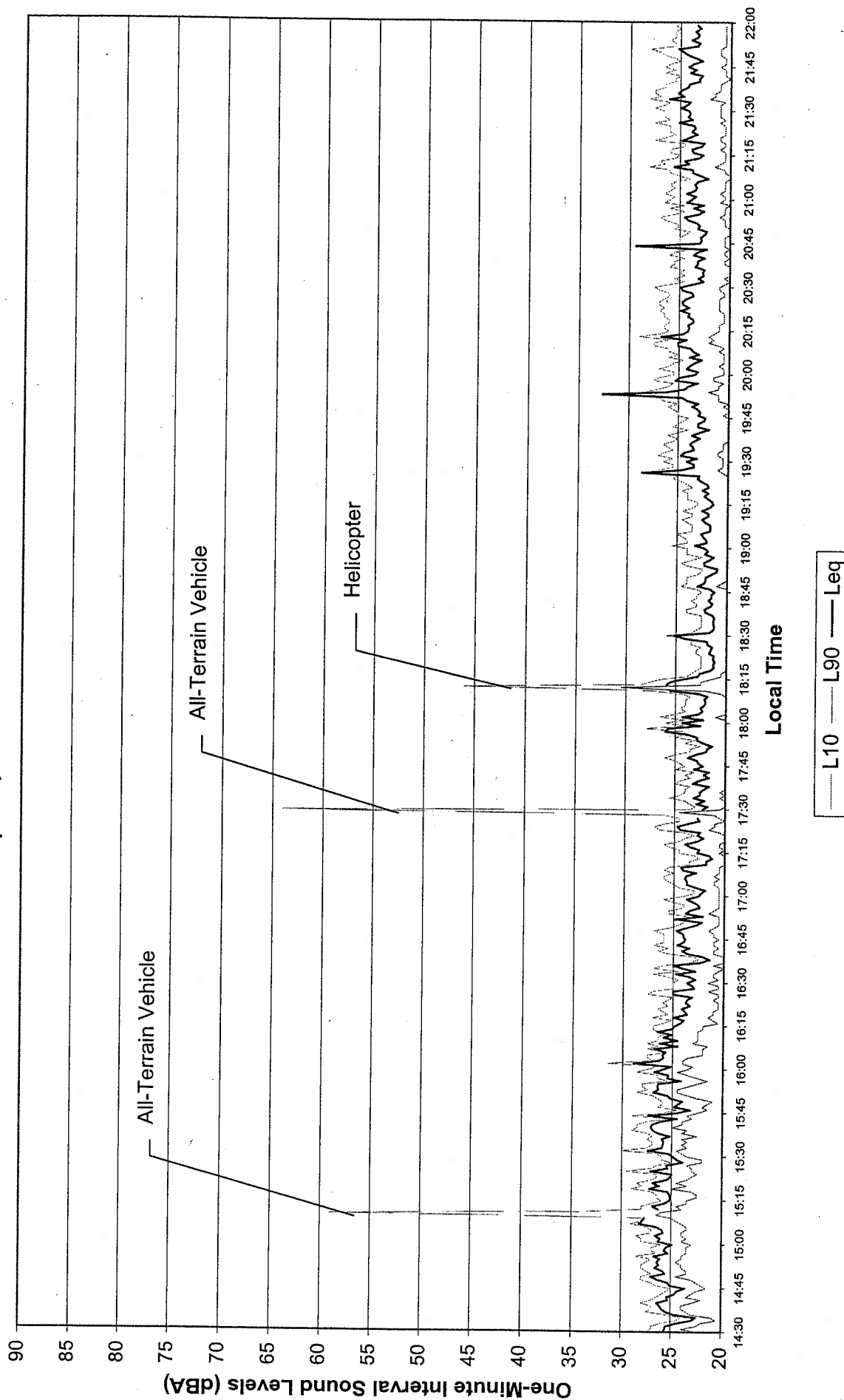


Figure 2.3 Isolated
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 13, 2002 - Apr. 14, 2002 22:00 - 06:59

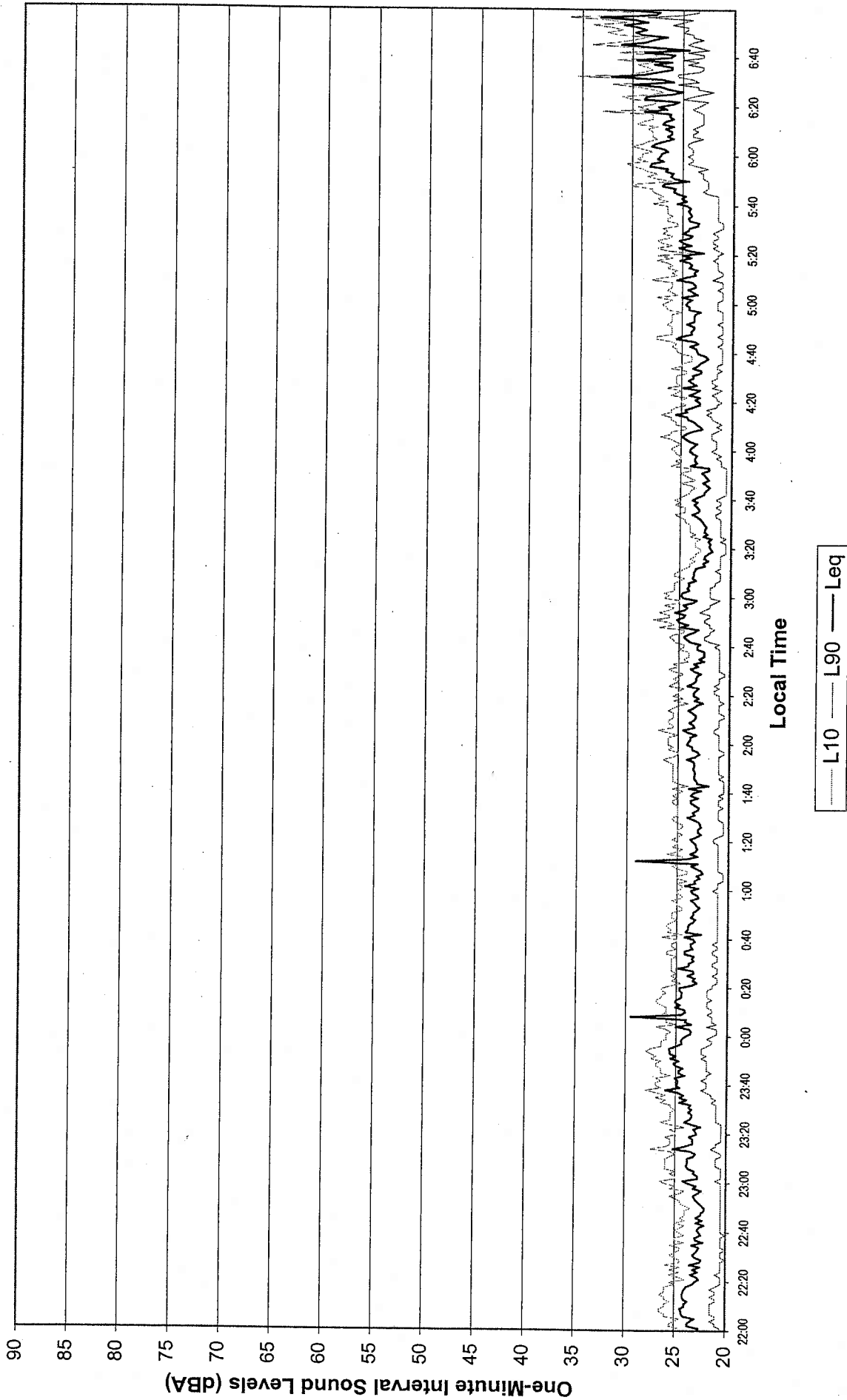
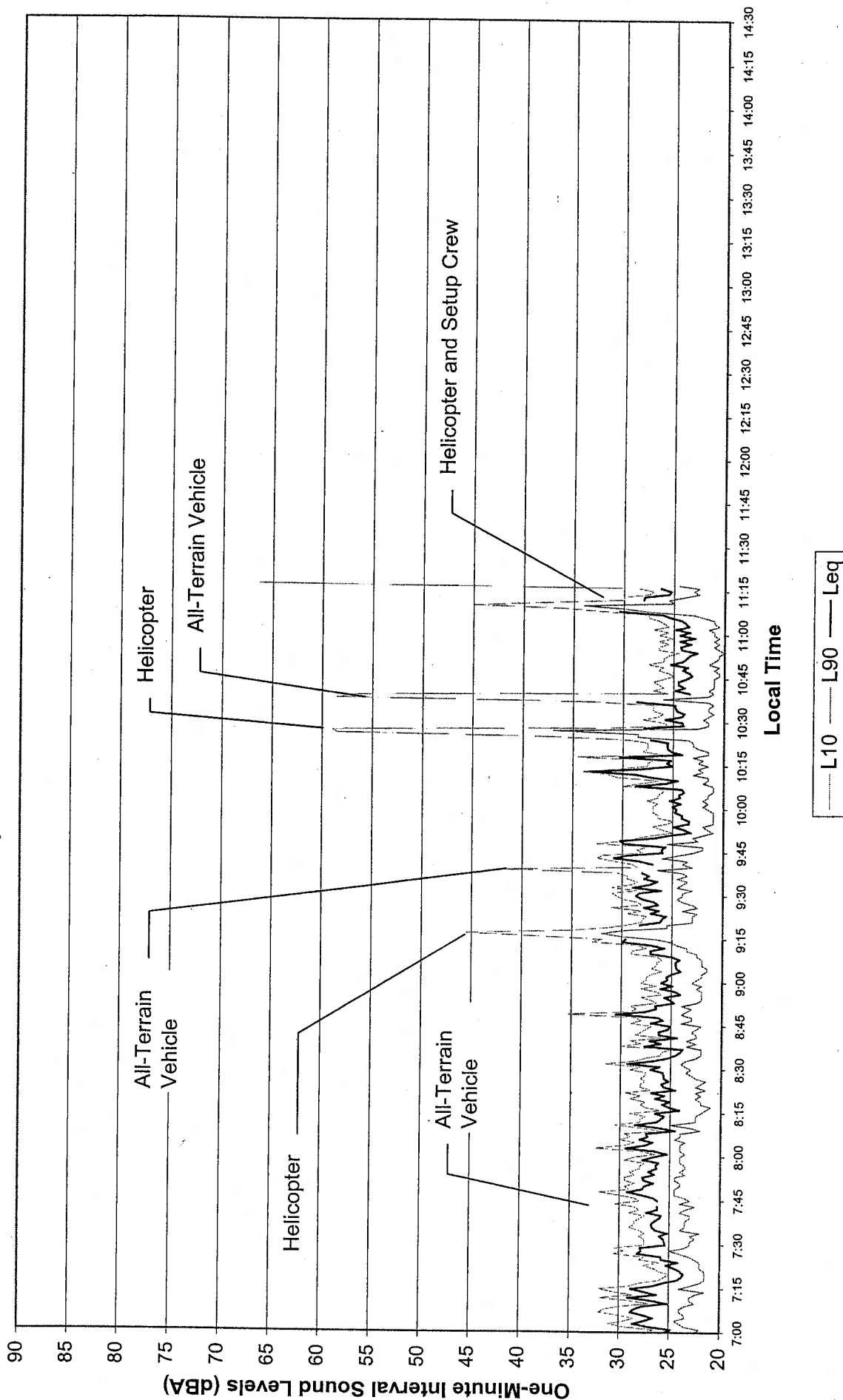


Figure 2.4 Isolated
Paramount Resources Ltd.
 Site #2 - 1500m S of Central Facility
 Apr. 14, 2002 07:00 - 14:29



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Consultants in Acoustics, Noise Control and Vibrations

**Cameron Hills, N.W.T.
Gathering System and Central Facility
Second Noise Survey Following
Production Operations Commencement**

Prepared for:

Paramount Resources Ltd.
Calgary, Alberta

Prepared by:

Richard Patching, M. Eng., P. Eng.
Neil Morozumi, EIT

of

Patching Associates Acoustical Engineering Ltd.
Consultants in Acoustics, Noise Control and Vibrations

July 6, 2003

File: 2002 - 1270C

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibration

Executive Summary

Patching Associates Acoustical Engineering Ltd. (PAAE) was requested by Paramount Resources Ltd. (Paramount) to perform a noise survey following the start-up of production operations at a facility southwest of Hay River, Northwest Territories. The results of this survey will be used to determine the noise contribution of the facilities at Paramount's operations in the Cameron Hills region after the construction of an oil and gas gathering system and central facility. Measurements were taken over a nominal one-day period at two locations, one at 1500 metres from the future satellite site and the other at 1300 metres south from the central facility.

In previous studies, the measurement site south of the central facility was located at 1500 metres, but this site is located in the bottom of a muskeg-filled creek bed well with a large ridge between it and the facility – a site which allowed for a secure positioning of the microphone on less swampy ground was selected on a secondary ridge 200 metres north. Neglecting the increased effect of the ridge at the original site, the levels at 1500 km should be 1.2 dBA less than those at the 1300 metres distance.

The survey results contained short-term higher-level sound events that were not indicative of noise generated by the facility and are attributed to helicopters, visits by PAAE technical staff and facility operators on all-terrain vehicles. The non-facility short-term sounds were verified and isolated from comprehensive sound level data using activity logs from the plant operators and are presented in the table below.

Noise Measurements at Two Monitoring Sites

Date (2002)	Daytime/ Nighttime	Measured Sound Level*		Residual Sound Level**	
		Leq (dBA)	Hours	Leq (dBA)	Hours
Site 1 – 1500 NNW of Future Satellite Site					
June 12	07:00 – 21:59	38.4	7.6	24.6	7.4
June 12 – 13	22:00 – 06:59	34.9	9.0	24.8	8.9
June 13	07:00 – 21:59	43.7	1.1	29.6	1.1
Overall		37.8	17.8	25.3	17.4
Site 2 – 1300 S of Central Facility					
June 12	07:00 – 21:59	37.8	7.1	32.5	6.8
June 12 – 13	22:00 – 06:59	28.4	9.0	28.4	9.0
June 13	07:00 – 21:59	29.7	1.6	29.7	1.6
Overall		34.6	17.7	30.6	17.4

* The Measured Leq describes the sound level without the influence of PAAE set-up staff only (i.e. PAAE support helicopter).

** The Residual Leq describes the sound level without the influence PAAE set-up staff, of helicopters and all-terrain vehicles used by Paramount staff, and the sporadic birdsongs of the "dawn chorus" between 03:00 and 06:45.

The results of this assessment indicate that the current post-construction noise levels at 1500 metres from future satellite site and at 1300 metres from the central facility are well within the nighttime Leq target of 40 dBA made by Paramount Resources Ltd.

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Measurement Results Graphs of 1 Minute L_{eq} , L_{10} and L_{90} Data	Appendix B

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibration

Introduction

Patching Associates Acoustical Engineering Ltd. (PAAE) was requested by Paramount Resources Ltd. (Paramount) to perform a second noise survey following the start-up of production operations at a facility southwest of Hay River, Northwest Territories. The results of this survey will be used to determine the noise contribution of only the facilities at Paramount's operations in the Cameron Hills region after the construction of an oil and gas gathering system and central facility. Measurements were taken over a nominal one-day period (complete nighttime plus at least three hours of daytime) at two locations, one at 1500 metres from the future satellite site and one at 1300 metres from the central facility.

During earlier studies in January and April of 2002, the site to the south of the central facilities was located at 1500 metres south of the central facility. At the time the ground was frozen with significant snow cover. At the time of these measurements, this site was found to be at the bottom of a muskeg-filled creekbed – this site was also well behind a large ridge. A more suitable site was selected, along the cut-line 200 metres north of the original site on the top of a secondary ridge, where the microphone could be mounted in a more accessible location, and secured to a survey marker to prevent being blown or knocked over.

Noise Criteria

Paramount has specified a nighttime L_{eq} noise level target of 40 dBA from the facility. PAAE has assumed that the nighttime period to be the same as the nighttime period specified by the Alberta Energy and Utilities Board (AEUB). The AEUB defines daytime as between 7:00 and 21:59, and nighttime as between 22:00 and 6:59.

The L_{eq} is the A-weighted equivalent-continuous sound level. This index is an energy average of the varying sound levels over a specified period. The use of this index permits the description of a varying sound level environment as a single number. As the L_{eq} is an "average" level, the measured sound level may exceed the criterion level for a short period, provided that the duration is limited. The L_{eq} value considers both the sound level and the length of time that the sound level occurs. Appendix A provides a detailed explanation of the L_{eq} index.

Methodology

The sound monitoring survey was conducted with Brüel & Kjær Model 2236 Precision Integrating Sound Level Meter which was equipped with a Brüel & Kjær 4188 microphone. The sound level meter was configured to continuously record the one-minute L_{eq} , L_{10} and L_{90} values. The microphone was mounted at a height of 1.5 metres above the ground, with a Brüel & Kjær windscreen Model DS 0934 to reduce the potential for wind-induced noise at the microphone, as required by the Directive.

The sound level meter was field calibrated at the start of the comprehensive sound monitoring survey and then checked at the completion of the survey with a Brüel & Kjær Model 4231 Sound Level Calibrator.

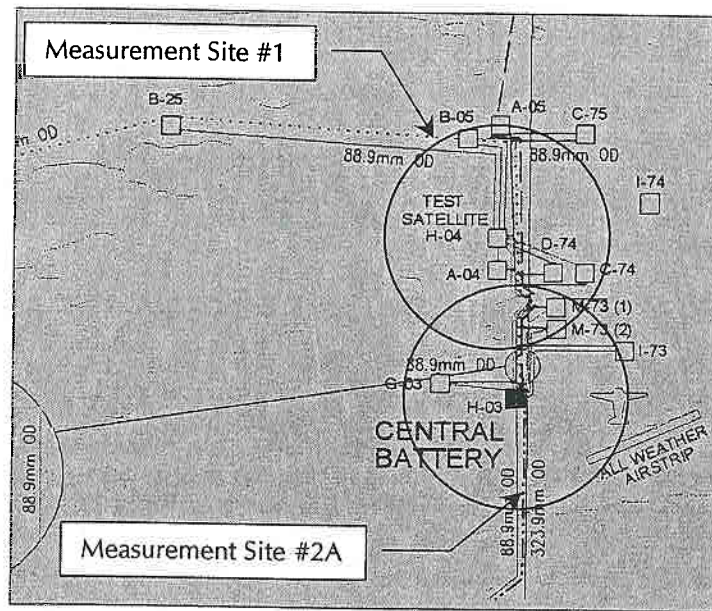
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Monitoring Locations

Measurement Site #1 was located 1500 metres NNW of the future satellite site at UTM 6659019 N / 11 470889 E and Measurement Site #2A was located 1300 metres S of the central facility at UTM 6654420 N / 11 472125 E. Figure 1.0 depicts the locations of the comprehensive noise measurements for the study.

Figure 1.0: Comprehensive Noise Measurement Locations (June 12 - 13, 2003)



The microphone was mounted on a tripod at a height of 1.5 m above the ground.

Facility Operating Conditions

Observations from field staff and conversations with the facility operators indicated that the Paramount facility was operating normally during the study period.

It is the understanding of PAAE that most of the local helicopter and all-terrain vehicle activities in the area were due to troubleshooting work at the wellsites, as well as repairs to a bridge north of Site #1. Paramount had indicated that once the initial start-up phase of the production operation was streamlined, this activity would be substantially reduced.

Environmental Conditions

Wind-induced noise can often be a problem in environmental measurements. The AEUB Noise Control Directive ID 99-8 (Directive) requires that for environmental noise surveys, the wind speed is no greater than 20 kph for facilities upwind or crosswind of the receiver and 15 kph for facilities downwind of the receiver. This survey has also adopted this method to ensure a valid and meaningful measurement result.

The hourly observation record of wind velocity and direction measured at the Hay River weather station is presented in Table 1.

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**Table 1 – Weather Conditions for Hay River, Northwest Territories
June 12, 2003 – June 13, 2003**

Date	Time	Temperature (°C)	Wind Speed (kph)	Wind Direction
June 12, 2003	12:00	3	11	N
	13:00	4	13	NNW
	14:00	4	16	NW
	15:00	4	14	NW
	16:00	4	7	NW
	17:00	5	13	NW
	18:00	5	3	NNW
	19:00	4	11	NNE
	20:00	4	5	NE
	21:00	4	3	ENE
	22:00	3	1	ENE
	23:00	1	0	-
June 13, 2003	00:00	-1	0	-
	01:00	-1	0	-
	02:00	1	1	SSE
	03:00	0	0	-
	04:00	0	5	SE
	05:00	-1	7	SE
	06:00	0	7	SSE
	07:00	2	3	ESE
	08:00	4	9	ESE
	09:00	4	7	SE
	10:00	6	3	E
	11:00	6	18	ENE

It should be noted that the weather conditions at the weather station might not correspond with those at the measurement sites but should serve as an adequate indicator of the conditions in the general study area.

The topography of the area to the north of the plant may be described as flat muskeg with small brush and trees. To the south of the plant, there are a number of ridges aligned roughly WSW to ENE, with a creek at 1500 metres from the plant also running parallel to the ridges – the direction of flow of this creek was not determined.

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Results

The recorded values for the monitored one-minute L_{eq} , L_{10} and L_{90} sound levels for Site #1 and Site #2A are presented graphically in a time history format in Figures 1.1 to 1.4 and Figures 2.1 to 2.4 in Appendix B. The one-minute L_{eq} values were used to calculate daytime, nighttime and overall L_{eq} values for each measurement location. The daytime and nighttime periods are the same as those specified by the AEUB.

The measured noise levels for each measurement location are presented in Table 2.

Table 2 – Noise Measurements at Two Monitoring Sites

Date (2002)	Daytime/ Nighttime	Measured Sound Level*		Residual Sound Level**	
		Leq (dBA)	Hours	Leq (dBA)	Hours
Site 1 – 1500 NNW of Future Satellite Site					
June 12	07:00 – 21:59	38.4	7.6	24.6	7.4
June 12 – 13	22:00 – 06:59	34.9	9.0	24.8	8.9
June 13	07:00 – 21:59	43.7	1.1	29.6	1.1
Overall		37.8	17.8	25.3	17.4
Site 2 – 1300 S of Central Facility					
June 12	07:00 – 21:59	37.8	7.1	32.5	6.8
June 12 – 13	22:00 – 06:59	28.4	9.0	28.4	9.0
June 13	07:00 – 21:59	29.7	1.6	29.7	1.6
Overall		34.6	17.7	30.6	17.4

* The Measured L_{eq} describes the sound level without the influence of PAAE set-up staff only (i.e. PAAE support helicopter).

** The Residual L_{eq} describes the sound level without the influence PAAE set-up staff, of helicopters and all-terrain vehicles used by Paramount staff, and the sporadic birdsongs of the "dawn chorus" between 03:00 and 06:45.

Table 2 shows that Paramount's current post-construction facility operation sound levels at 1500 metres from the future satellite site and central facility are well within the target nighttime L_{eq} of 40 dBA.

Discussion of Results

Many of the noise spikes were determined, from discussions with Paramount staff, to be sounds generated by helicopters, facility operators on all-terrain vehicles and visits from PAAE staff. The Measured Sound Levels in Table 2 are the resulting sound levels after noise generated by PAAE staff have been removed. The Residual Sound Levels listed in Table 2 are the resulting sound levels after noise from helicopters, all-terrain vehicles and PAAE staff have been removed and are more indicative of the sound produced by only the facility. Figures 1.1 Isolated to 1.4 Isolated and Figures 2.1 Isolated to 2.4 Isolated in Appendix B present the time history for the measurement with extraneous events removed.

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Comparing these nighttime comprehensive noise levels with the noise levels measured in a previous study (PAAE file 2002-1270B), the current noise level is approximately 3.8 dBA and 0.3 dBA greater than the first post-construction noise level at Site #1 and Site #2 respectively. (Note: a change of 3 dB is barely perceptible by a human with normal hearing under field conditions).

At Site #1, the measured noise levels were below the lower limit of the measuring equipment (20 dBA) for a good deal of the time. In the calculation of the L_{eq} noise levels, under-range data were replaced by a value of 15 dBA, in order to calculate the overall noise levels by having the calculations of time functions work properly. As the L_{eq} level is dominated by the higher-level noise events, any error introduced would be an increase of less than one deciBel.

Conclusion

The results of this assessment indicate that the current post-construction noise levels at 1500 metres from the future satellite site and 1300 metres from central facility are well within the nighttime L_{eq} target set by Paramount Resources Ltd. of 40 dBA.

APPENDIX A

Explanation of Technical Details Regarding Sound Measurement and Analysis

Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at $2.0 \times 10^{-5} \text{ N/m}^2$ (also written $20 \text{ } \mu\text{Pa}$), which corresponds to a sound intensity of $10^{-12} \text{ Watts/m}^2$ (or 1 piconWatt per square metre, written 1 pW/m^2).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 KHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

When sound is measured using the A-weighting scale, the reading is often called the "Noise level", to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in Table A1.

When the A-weighting scale is not used, the measurement is said to have a "linear" weighting, or to be unweighted, and may be called a "linear" level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term "Sound Pressure Level", or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as "unwanted sound", which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). An alternate definition of noise is "sound made by somebody else", which emphasizes that the ability to control the level of the sound alters the perception of noise.

Table A1- Noise Levels of Familiar Sources

Source Or Environment	Noise Level (dBA)
High Pressure Steam Venting To Atmosphere (3m)	121
Steam Boiler (2m)	90-95
Drilling Rig (10m)	80-90
Pneumatic Drill (15m)	85
Pump Jack (10m)	68-72
Truck (15m)	65-70
Business Office	65
Conversational Speech (1m)	60
Light Auto Traffic (30m)	50
Living Room	40
Library	35
Soft Whisper (5m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the centre frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq} , which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, nighttime (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to an existing environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10%-ile level, written L_{10} , is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90} , is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.

One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90} , greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

APPENDIX B

Measurement Results

Graphs of 1-Minute L_{eq} , L_{10} and L_{90} Data

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 1.1
Paramount Cameron Hills
1.5 km northwest of Satellite
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Jun. 12, 2003	07:00 - 21:59	38.4	7.6	24.6	7.4
Jun. 12, 2003 - Jun. 13, 2003	22:00 - 06:59	34.9	9.0	24.8	8.9
Jun. 13, 2003	07:00 - 21:59	43.7	1.1	29.6	1.1
Jun 13, 2003 - Jun 14, 2003	22:00 - 06:59				
Jun. 14, 2003	07:00 - 21:59				
Overall Leq		37.8	17.7	25.3	17.4

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 1.2
Paramount Cameron Hills
1.5 km northwest of Satellite
Hourly Leq Values

Date	12-Jun-03		13-Jun-03		14-Jun-03	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
00:00			27.6	22.4		
01:00			27.7	27.7		
02:00			30.9	28.0		
03:00			39.4	25.3		
04:00			37.4	24.2		
05:00			37.9	24.5		
06:00			36.9	23.8		
07:00			39.6	29.7		
08:00			51.2	27.7		
09:00						
10:00						
11:00						
12:00						
13:00						
14:00	38.2	27.4				
15:00	42.3	28.9				
16:00	40.4	25.4				
17:00	32.0	26.3				
18:00	21.9	21.9				
19:00	42.8	18.7				
20:00	19.4	19.4				
21:00	16.9	16.9				
22:00	19.0	19.0				
23:00	19.5	19.5				

Figure 1.1

Paramount Cameron Hills

1.5 km northwest of Satellite

Jun. 12, 2003 07:00 - 14:29

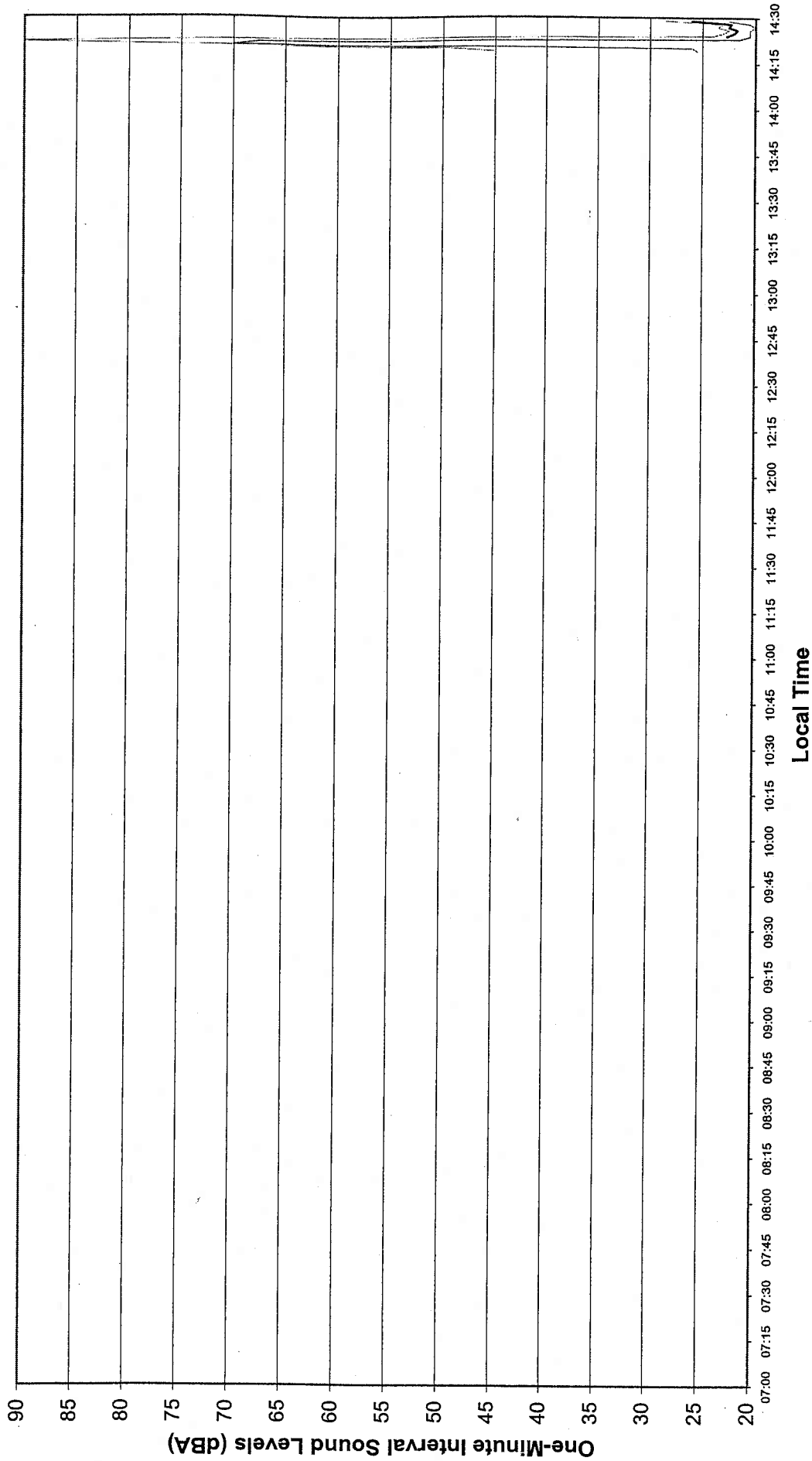


Figure 1.1 - Isolated
Paramount Cameron Hills
 1.5 km northwest of Satellite
 Jun. 12, 2003 07:00 - 14:29

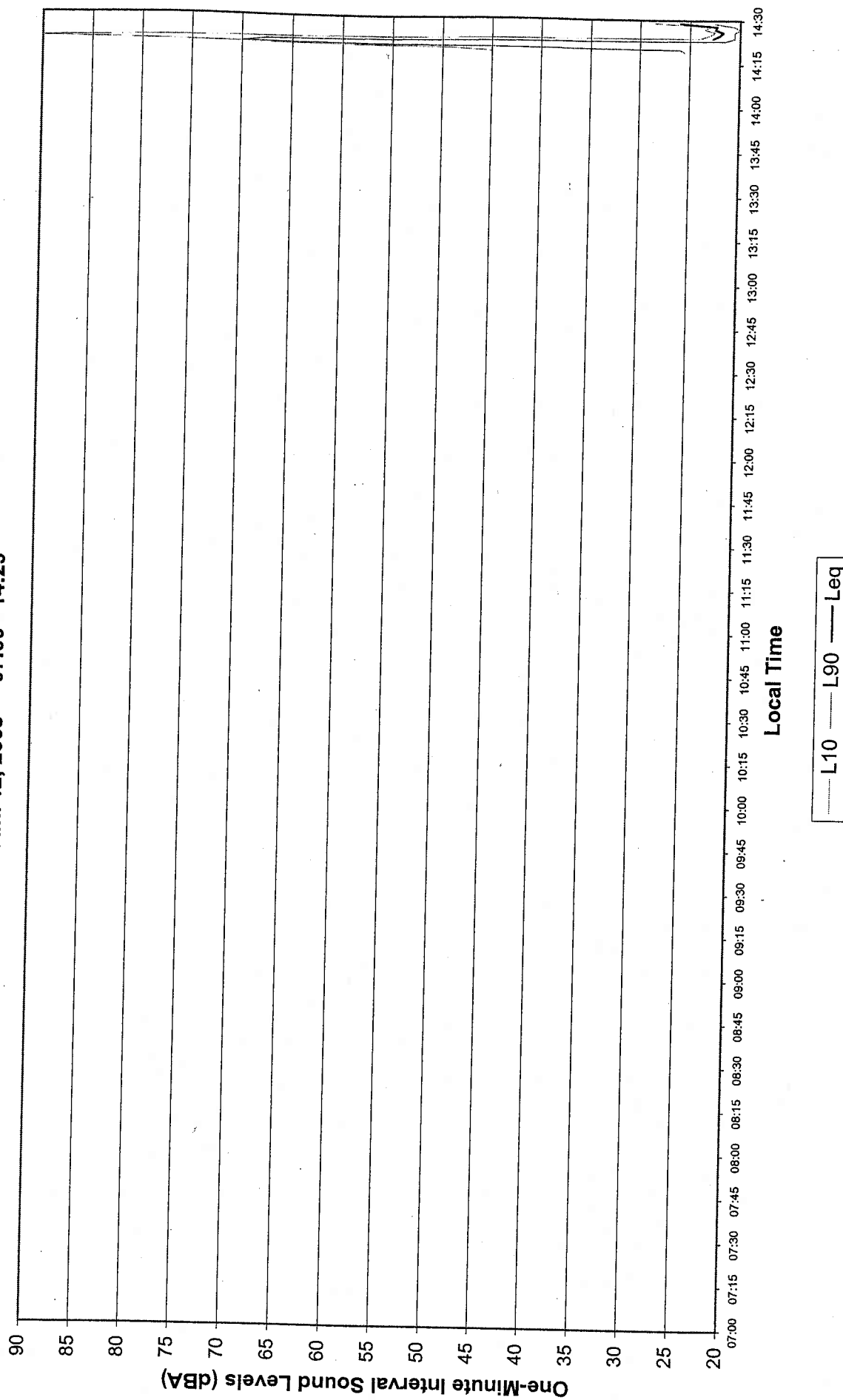


Figure 1.2
Paramount Cameron Hills
 1.5 km northwest of Satellite
 Jun. 12, 2003 14:30 - 21:59

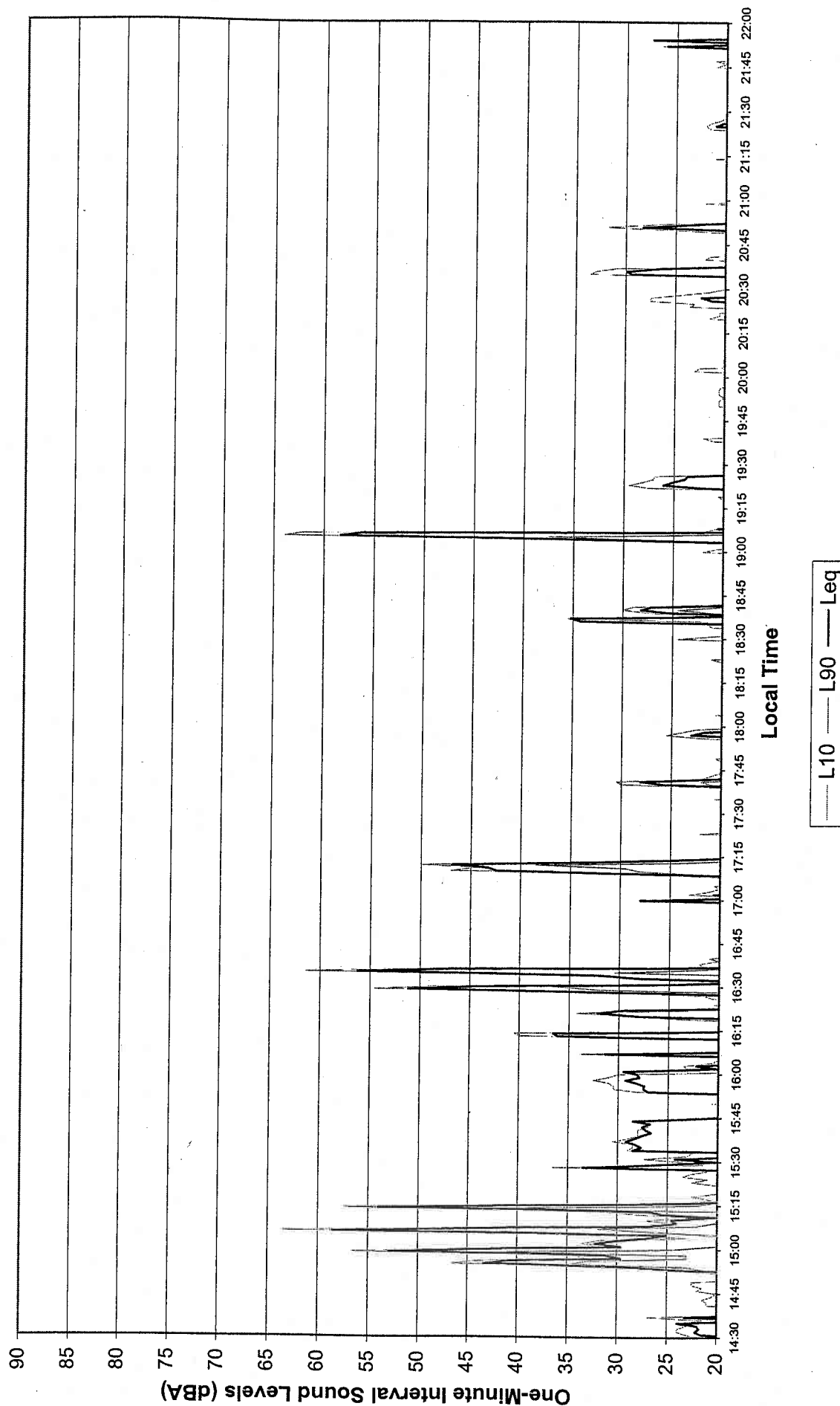


Figure 1.2 - Isolated
Paramount Cameron Hills
 1.5 km northwest of Satellite
 Jun. 12, 2003 14:30 - 21:59

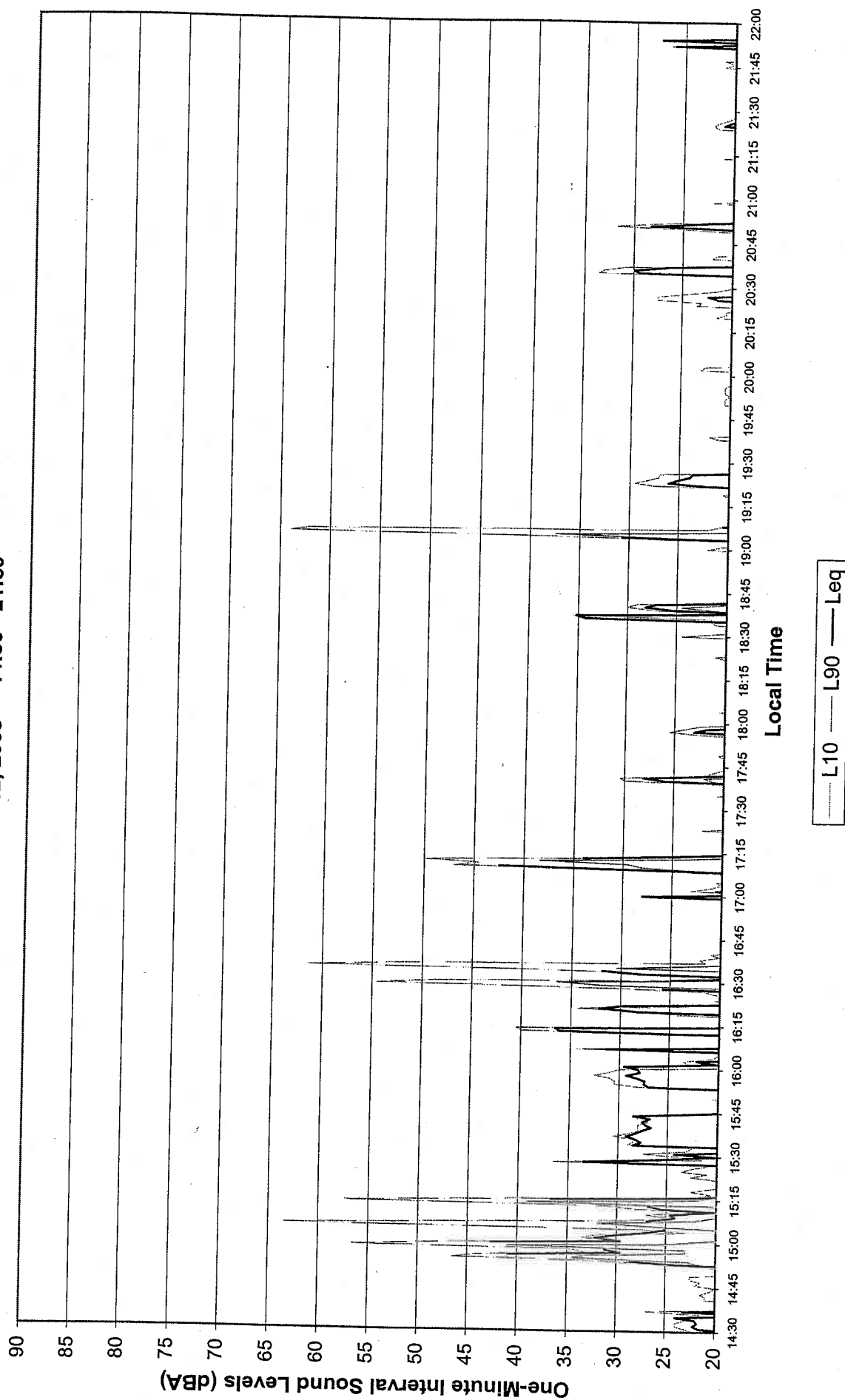


Figure 1.3
Paramount Cameron Hills
 1.5 km northwest of Satellite
 Jun. 12, 2003 - Jun. 13, 2003 22:00 - 06:59

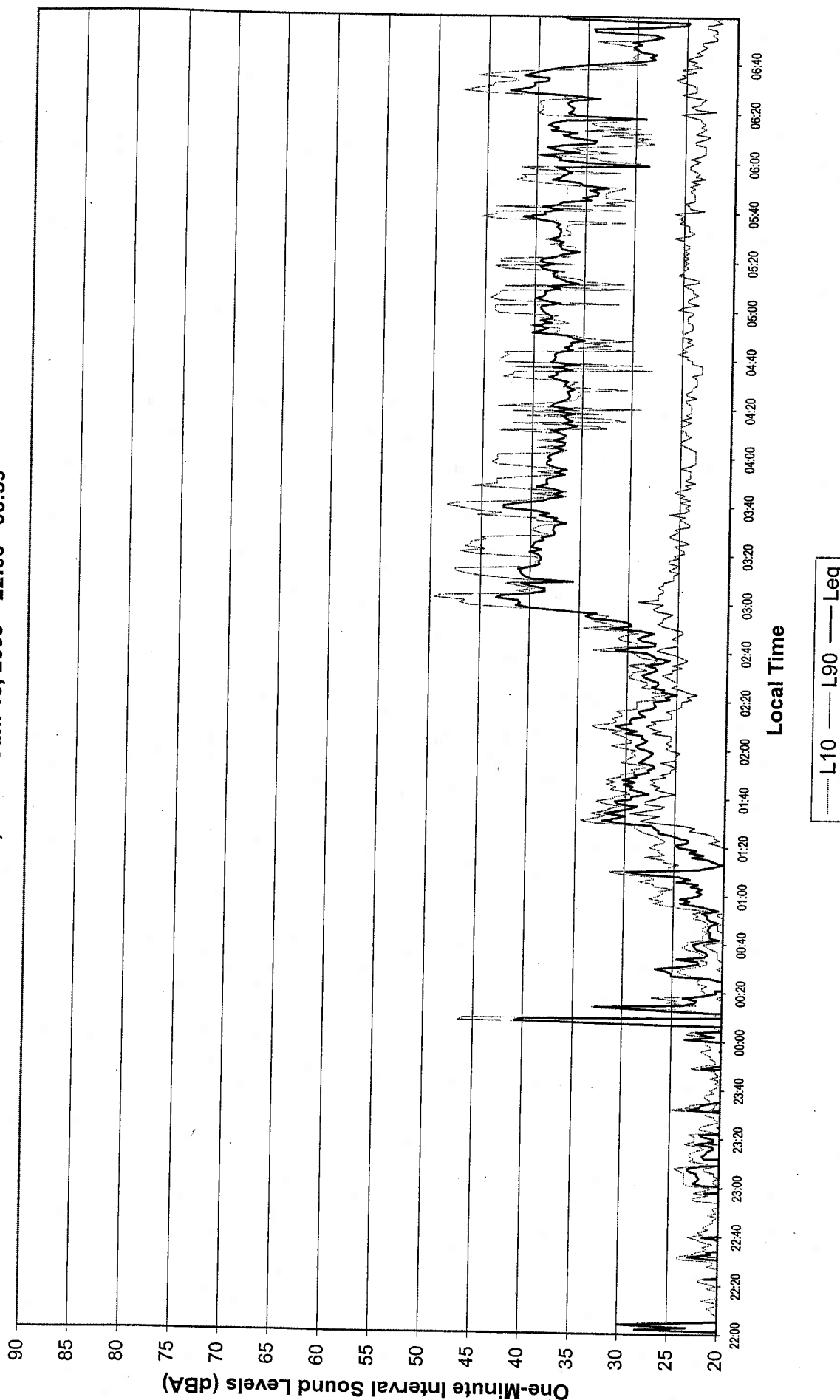


Figure 1.3 - Isolated
Paramount Cameron Hills
 1.5 km northwest of Satellite
 Jun. 12, 2003 - Jun. 13, 2003 22:00 - 06:59

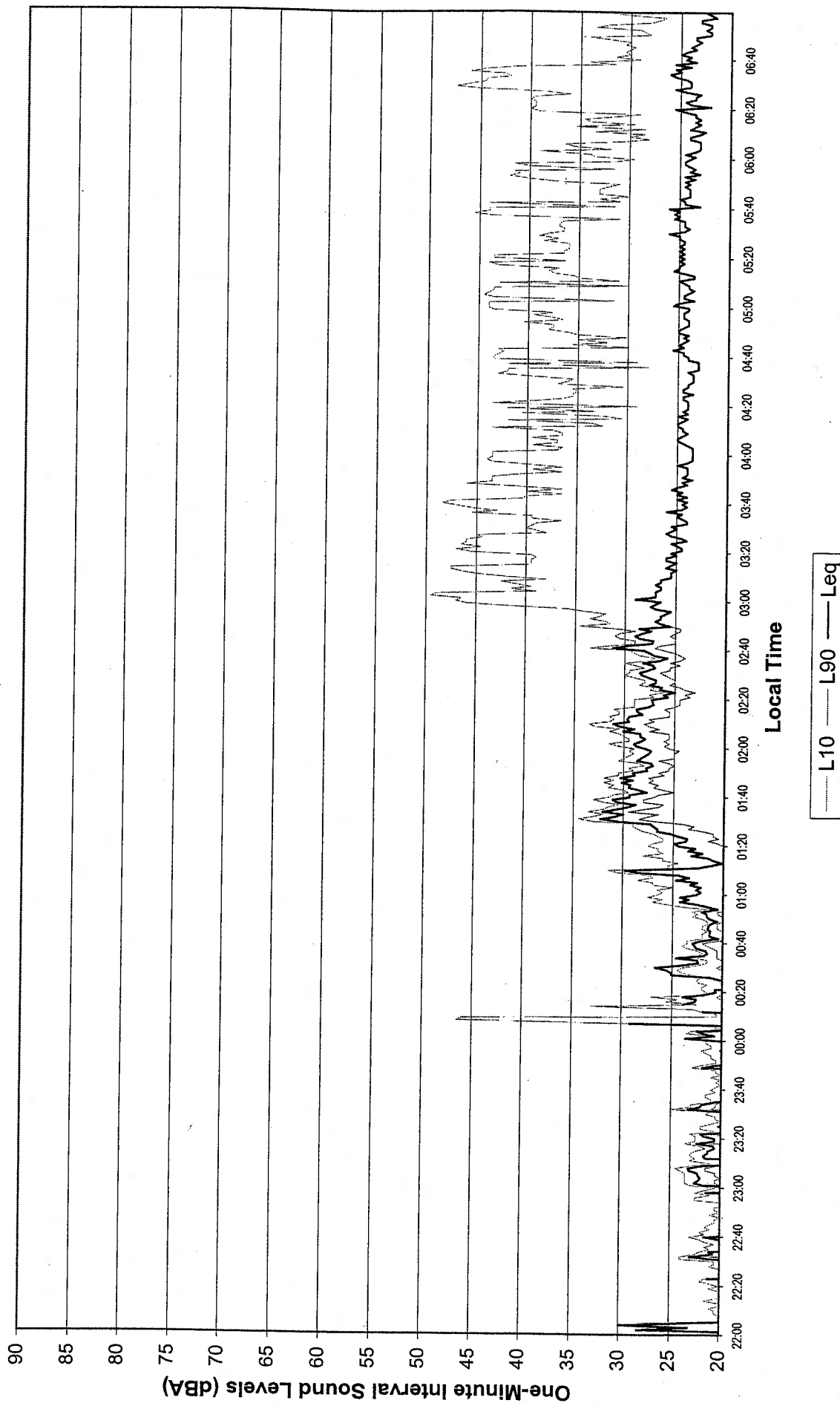
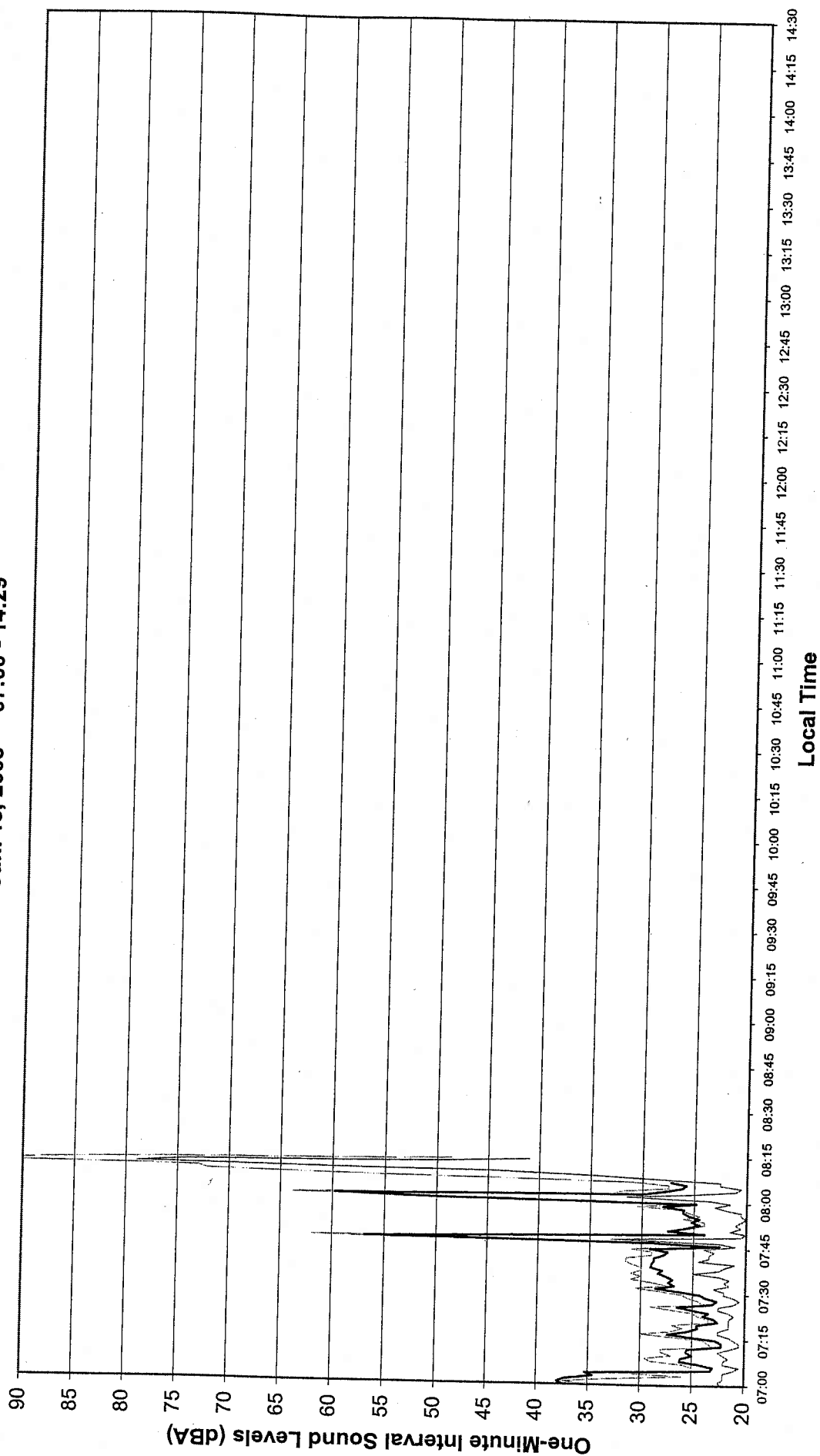


Figure 1.4
Paramount Cameron Hills

1.5 km northwest of Satellite

Jun. 13, 2003 07:00 - 14:29

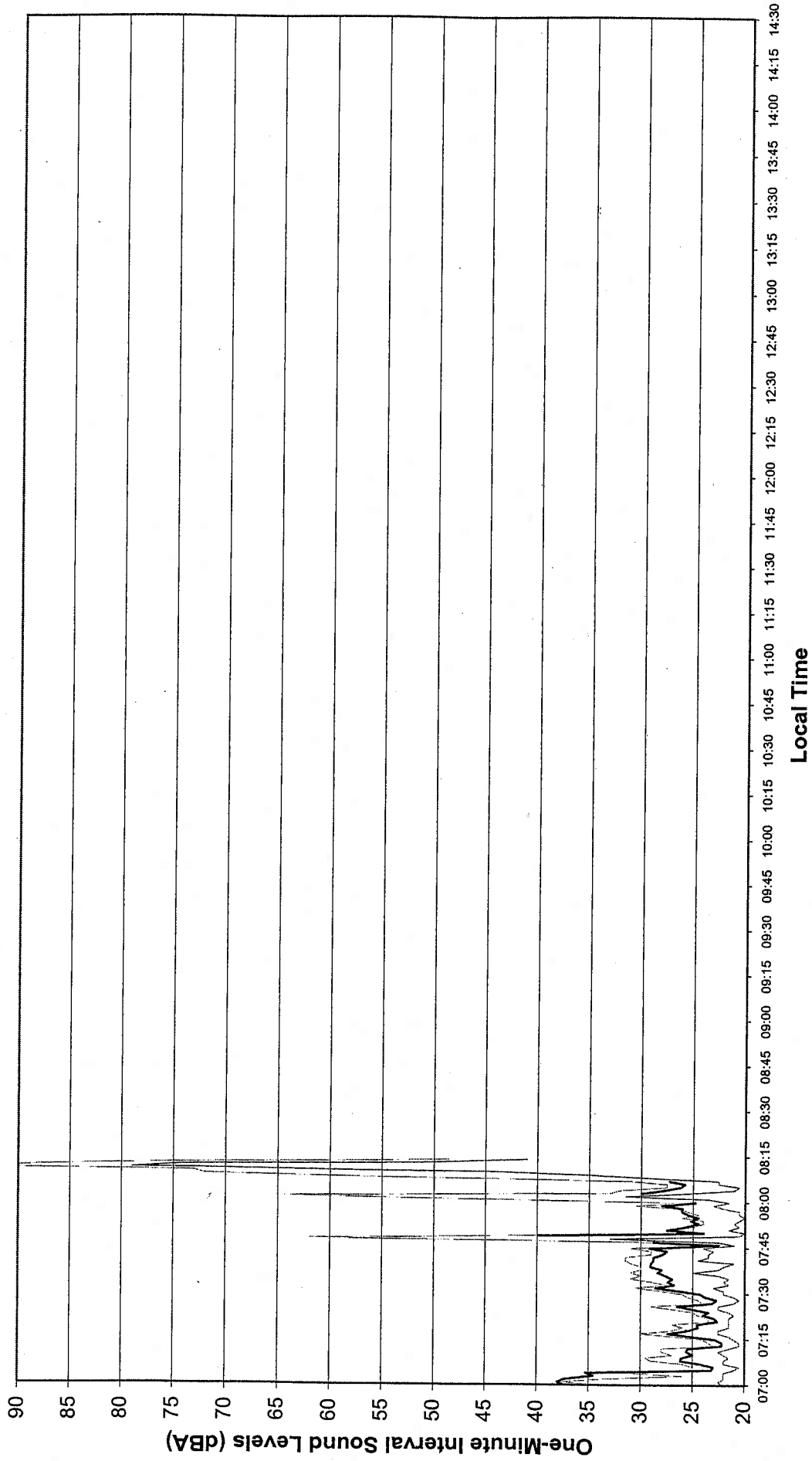


— L10 — L90 — Leq

Figure 1.4 - Isolated Paramount Cameron Hills

1.5 km northwest of Satellite

Jun. 13, 2003 07:00 - 14:29



— L10 — L90 — Leq

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 2.1
Paramount Cameron Hills
1.3 km South of Gas Plant
Daily Leq Values

Date	Time	Measured		Residual	
		Leq	Hours	Leq	Hours
Jun. 12, 2003	07:00 - 21:59	37.8	7.1	32.5	6.8
Jun. 12, 2003 - Jun. 13, 2003	22:00 - 06:59	28.4	9.0	28.4	9.0
Jun. 13, 2003	07:00 - 21:59	29.7	1.6	29.7	1.6
Jun 13, 2003 - Jun 14, 2003	22:00 - 06:59				
Jun. 14, 2003	07:00 - 21:59				
Overall Leq		34.6	17.7	30.6	17.4

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

Table 2.2
Paramount Cameron Hills
1.3 km South of Gas Plant
Hourly Leq Values

Date	12-Jun-03		13-Jun-03		14-Jun-03	
Start Time	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)	Comprehensive Sound Level (dBA Leq)	Residual Sound Level (dBA Leq)
00:00			29.9	29.9		
01:00			25.4	25.4		
02:00			24.9	24.9		
03:00			26.0	26.0		
04:00			25.0	25.0		
05:00			29.7	29.7		
06:00			25.8	25.8		
07:00			29.0	29.0		
08:00			30.5	30.5		
09:00						
10:00						
11:00						
12:00						
13:00						
14:00	38.8	34.8				
15:00	32.8	32.8				
16:00	33.1	33.1				
17:00	37.3	33.0				
18:00	38.9	34.5				
19:00	34.0	30.4				
20:00	42.4	29.1				
21:00	37.3	32.5				
22:00	30.7	30.7				
23:00	31.5	31.5				

Figure 2.1
Paramount Cameron Hills
 1.3 km South of Gas Plant
 Jun. 12, 2003 14:30 - 21:59

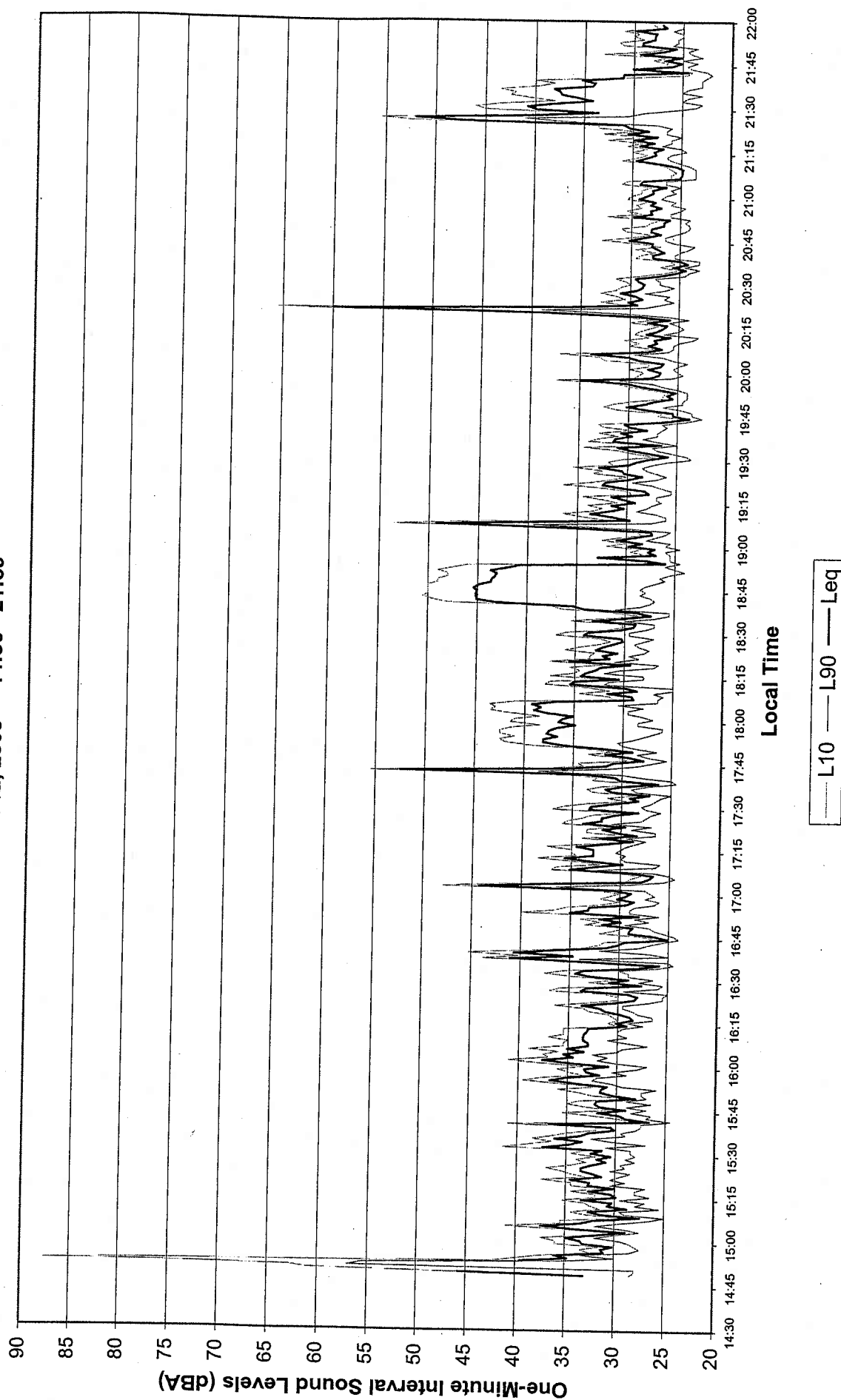


Figure 2.1
Paramount Cameron Hills

1.3 km South of Gas Plant

Jun. 12, 2003 14:30 - 21:59

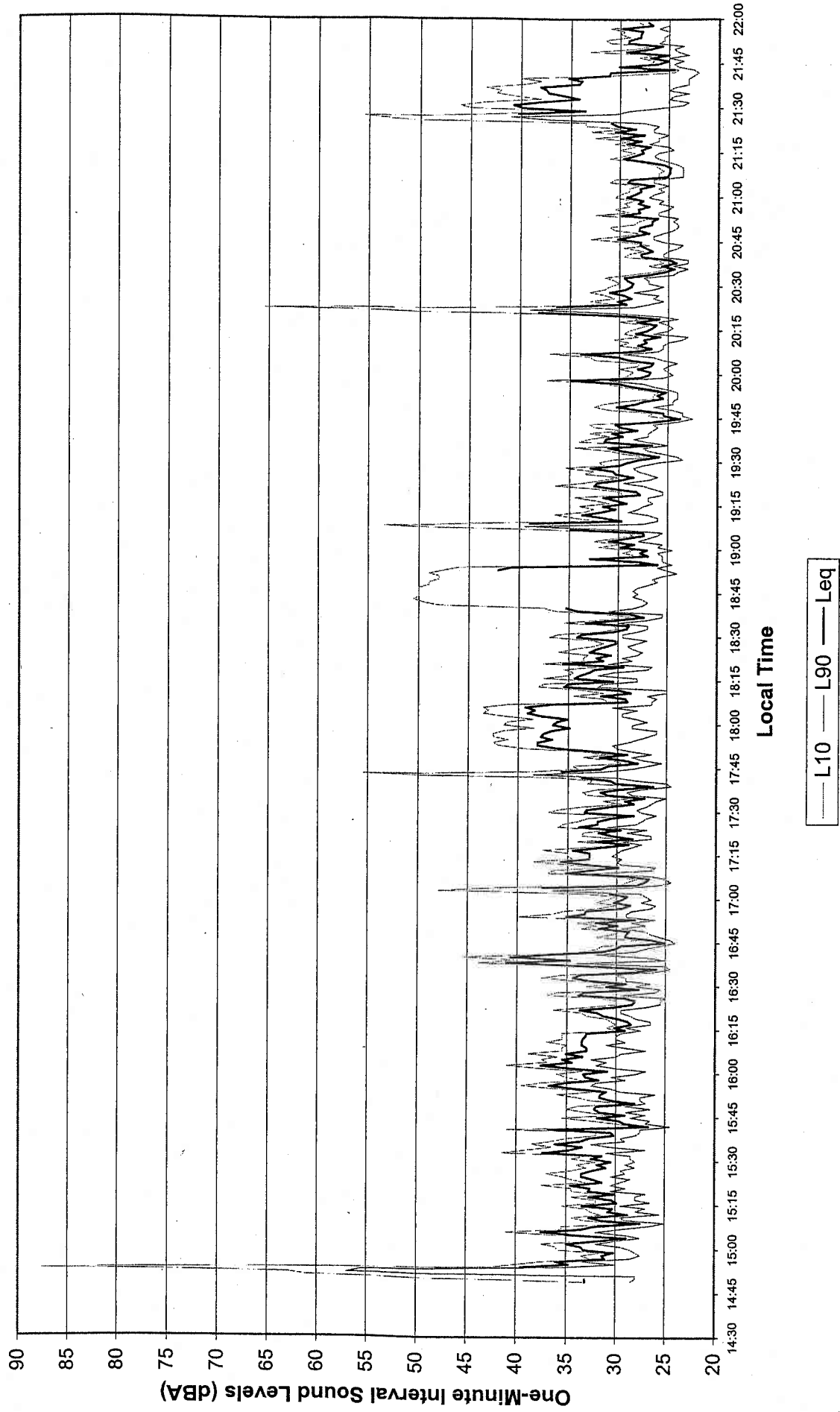


Figure 2.2
Paramount Cameron Hills
 1.3 km South of Gas Plant
 Jun. 12, 2003 - Jun. 13, 2003 22:00 - 06:59

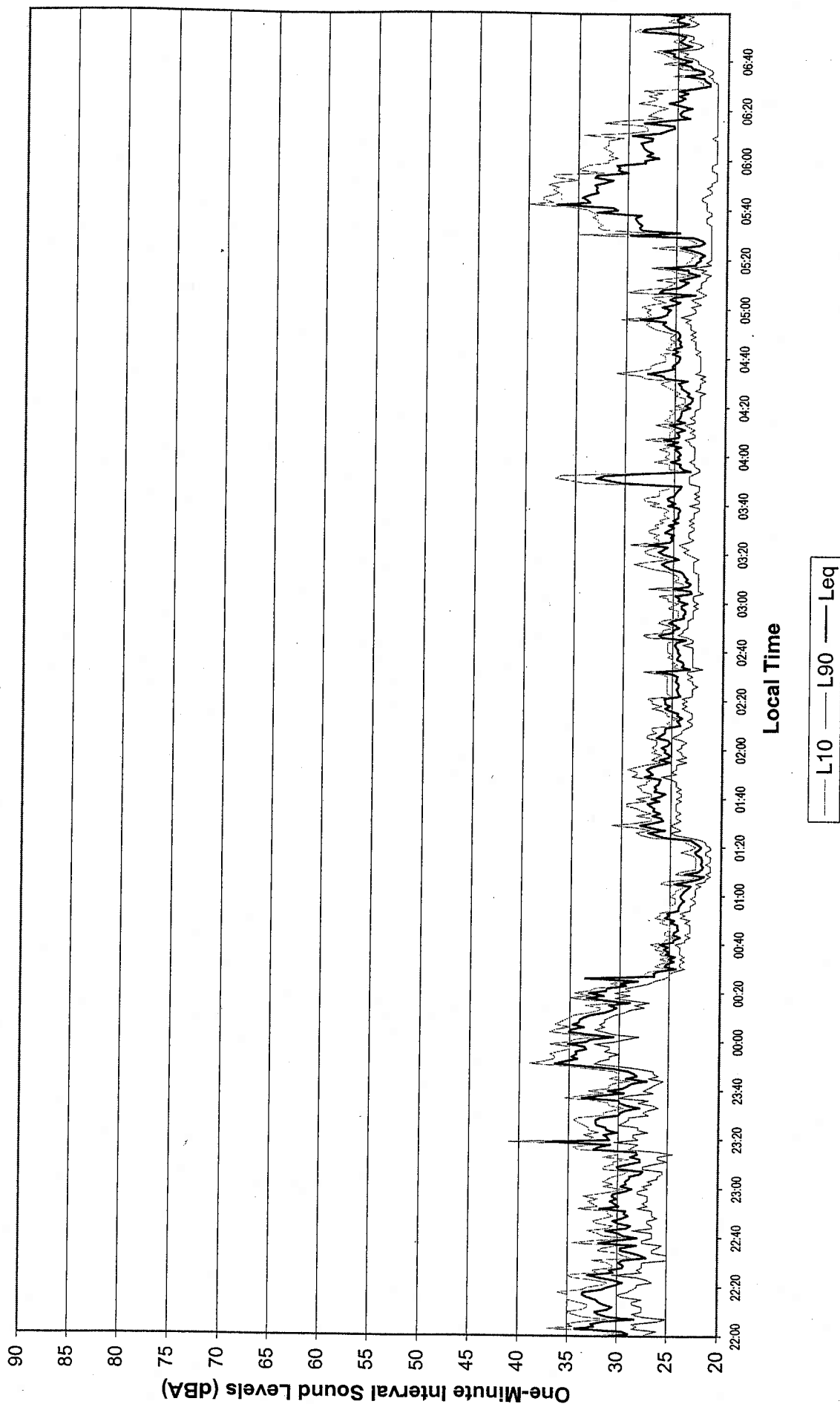
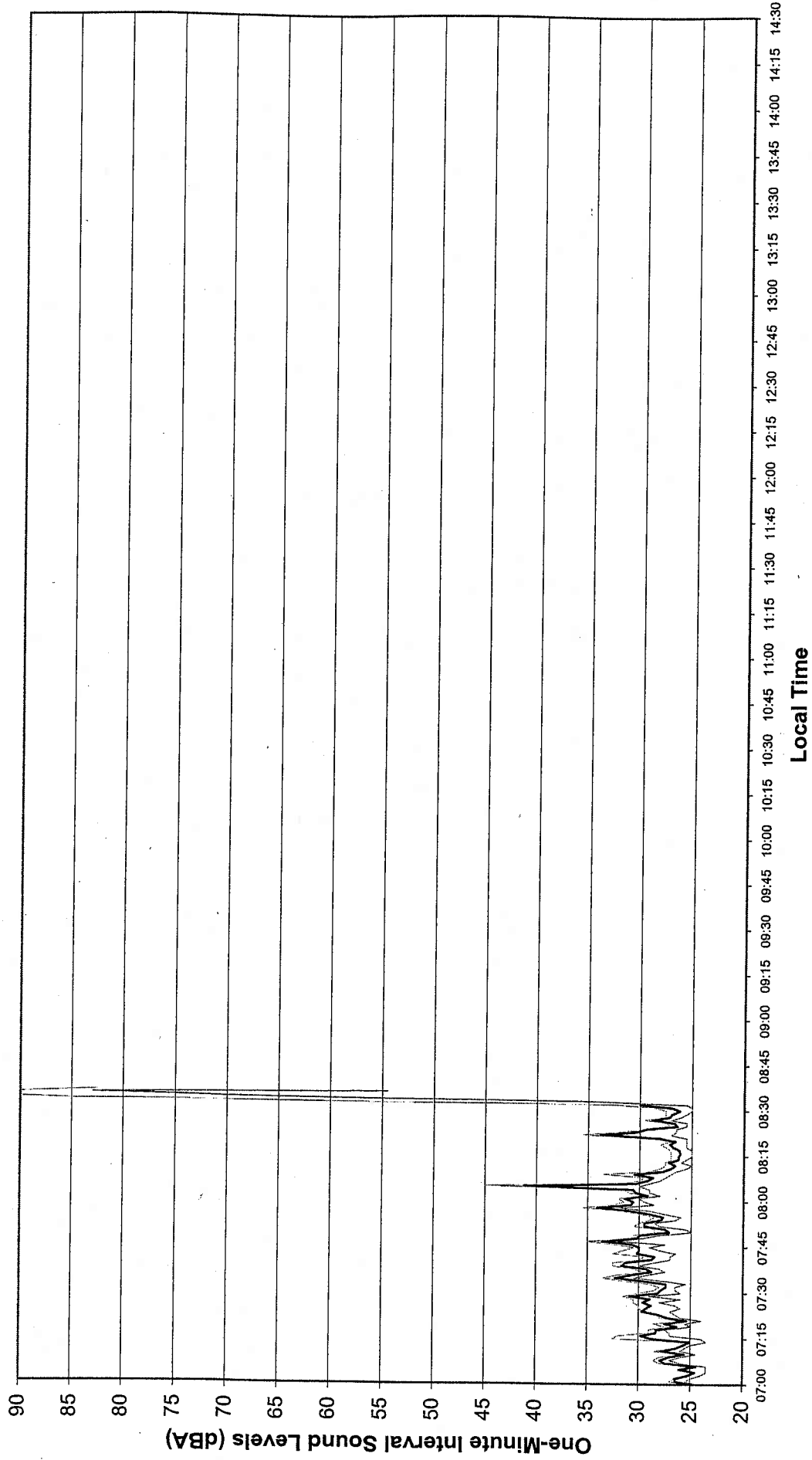


Figure 2.3
Paramount Cameron Hills

1.3 km South of Gas Plant

Jun. 13, 2003 07:00 - 14:29



— L10 — L90 — Leq

Figure 2.3
Paramount Cameron Hills
 1.3 km South of Gas Plant
 Jun. 13, 2003 07:00 - 14:29

