19

COUNTY OF SACRAMENTO
DEPARTMENT OF AIRPORTS
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January 7, 1986

DIRECTOR OF AIRPORTS
George W. McLaughlin

APPROVED
BY THE CITY COUNCIL
JAN 28 1986
OFFICE OF THE
CITY CLERK

Sacramento City Council
City Hall
915 I Street
Sacramento, CA 95814

SUBJECT: EXECUTIVE AIRPORT - 1985 NOISE MONITORING REPORT

MEMBERS IN SESSION:

In accordance with Recommendation No. 66 of the Executive Airport Master Plan and as modified by the Board of Supervisors and City Council on April 27, 1982, the Department of Airports monitored aircraft noise impacts at Executive Airport from June through October 1985. Noise monitors were located at the north, south and east perimeter of Executive Airport to record and evaluate aircraft noise in the vicinity of Runway 2-20, 12-30, and 16-34.

The attached Exhibits, A through E, identify the Community Noise Equivalent Level (CNEL) for each 24-hour period during the months of June, July, August, September and October 1985. The 65-CNEL noise standard as set forth in the California Airport Noise Standards is also illustrated on these exhibits. Average noise levels at the south, north and east airport boundaries were 57.8 CNEL, 61.1 CNEL, and 64.4 CNEL respectively. Table I further summarizes the 1985 noise monitoring results.

The Department of Airports has been monitoring noise levels at Executive Airport since 1979. As the noise monitoring program has matured, the Department of Airports has recommended various modifications to both methodology and sequence. These modifications were recommended only after adequate data analysis supported the conclusion that no detraction in the overall goal for noise compatibility would result. The last such modification occurred in 1982 when noise monitoring was reduced from a continuous 12 months per year to a peak seasonal period of June through October of each year.

In July 1985, the Department of Airports advised the Board of Supervisors and the City Council that a further modification to the noise monitoring program would be proposed if the 1985 noise monitoring results were consistent with prior years. This has proven to be the case. Consequently, the Department of Airports now proposes a change in the noise monitoring program consisting of the following elements:

1. Initiate noise monitoring surveys within the residential community northwest of the Airport to verify noise exposure.

19

2. Replace full time noise monitoring at the east boundary/Romack Circle (Site No. 4) with detailed SENEL noise monitoring surveys as outlined in Appendix A.

3. Suspension of noise monitoring activities at the southern Airport boundary (Site No. 1).

4. Suspension of noise monitoring activities at the northern Airport boundary (Site No. 2).

These recommended alterations in the noise monitoring program are based on a 6 year analysis of the overall noise characteristics at Executive Airport which have resulted in the following conclusions:

1. Noise exposure at the north and south Airport boundaries has consistently remained in the 60 - 61 CNEL range.

2. Noise exposure at the east Airport boundary (Romack Circle) is consistently higher than any other location on the Airport. If noise exposure at this location can be maintained below 65-CNEL then all other sites may be assumed to be below 65-CNEL, i.e., Site No. 4 can be identified as "controlling".

3. Over 80% of the noise complaints received at Executive Airport are from the residential community northwest of the Airport, therefore it is appropriate to consider off-airport noise monitoring to verify noise impact in selected residential areas.

The proposed methodology for revised noise monitoring at Site No. 4 and in the residential community northwest of the Airport is the Single Event Noise Equivalent Level (SENEL) which is the basic component of the CNEL rating. The SENEL analysis differs from the current noise monitoring procedure in that only aircraft noise is considered in determining the composite CNEL. The noise monitoring equipment at the airport measures 100% of the sound at any given site. This measured sound includes community background noise such as people, autos, emergency vehicles, lawn mowers, etc., as well as aircraft. As long as the resultant CNEL is less than 65.0, the Department is unconcerned over the actual constituent parts. As the CNEL approaches or exceeds 65.0 the Department makes every effort to identify the individual source noises. Such research has taken place at the critical Site No. 4 monitoring location. Using tape recorder equipment, noise sources have been found to include bird chirps, dogs from an adjacent kennel, static caused by movement of the wind screen (birds perched on the wind screen) and rare, but occasional, CB radio transmissions. These interferences generally take place during late night and early morning hours when the noise sensitivity is at its highest. (CNEL weights noise events occurring at these times by a factor of 10.)

The proposed SENEL Methodology is an accurate way of determining the 24-hour CNEL component attributable solely to aircraft operations and employs the very same calculations used in CNEL computer computations. Appendix A describes the technical aspects of the SENEL and presents the results of the SENEL noise survey conducted at Site No. 4 on July 23 and 24, 1985. A similar report would be prepared on an annual basis. Full time noise monitoring would be reinstated

as the aircraft component of the CNEL approaches 65.0. This is currently estimated at approximately 250,000 operations. Full time noise monitoring would also be reinstated at any time noise characteristics or emission sources significantly changed. In the interim, the Department of Airports would continue to investigate alternative procedures for increased noise abatement.

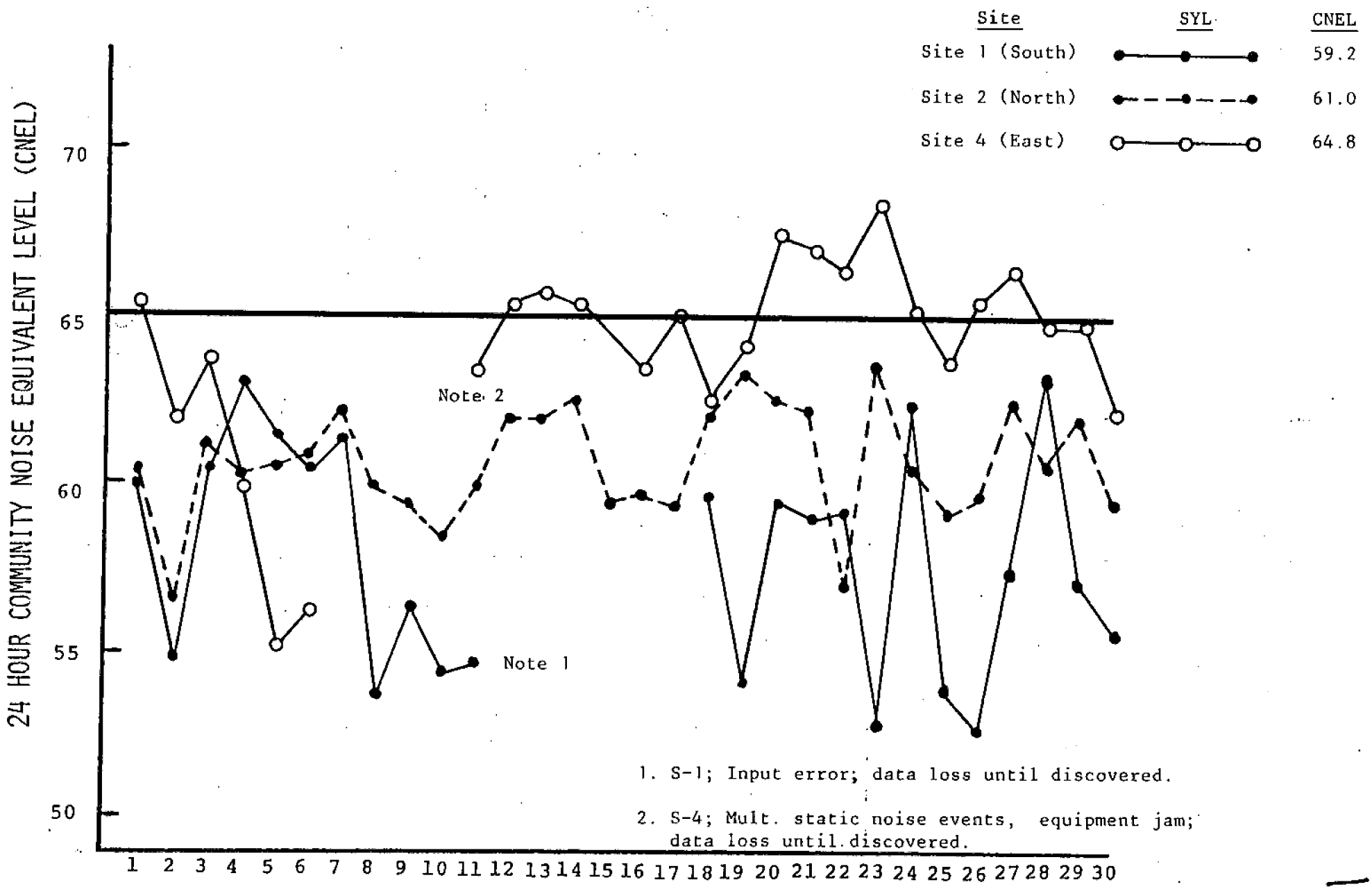
These recommended revisions to the noise monitoring effort in no way detracts from the program or alters the overall goal for noise reduction, but rather they enhance and improve upon it. The Department of Airports remains committed to the goal of airport noise compatibility.

Respectfully submitted,

George W. McLaughlin
Director of Airports

LEK:sam

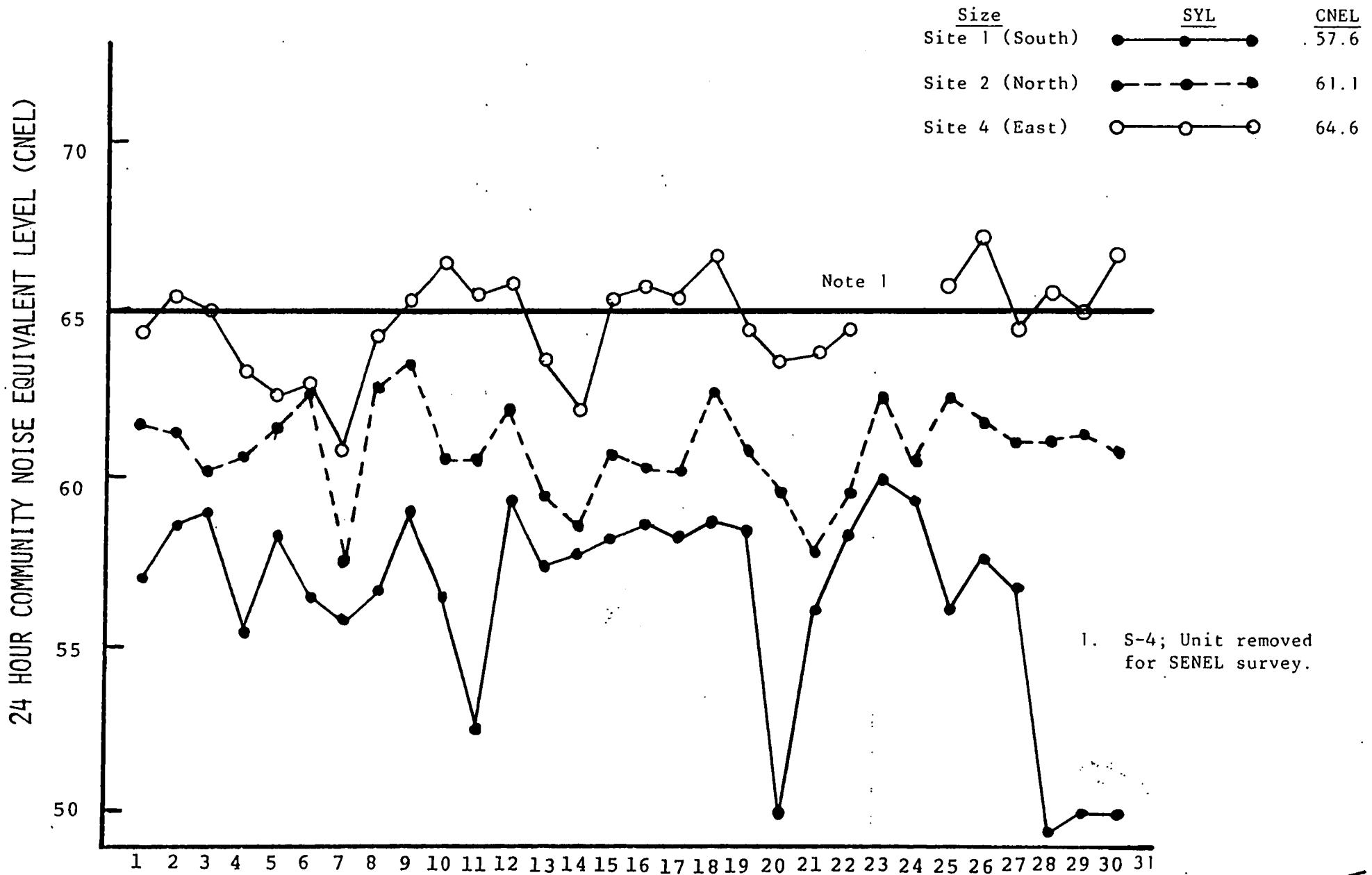
EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
EXHIBIT A
JUNE 1985



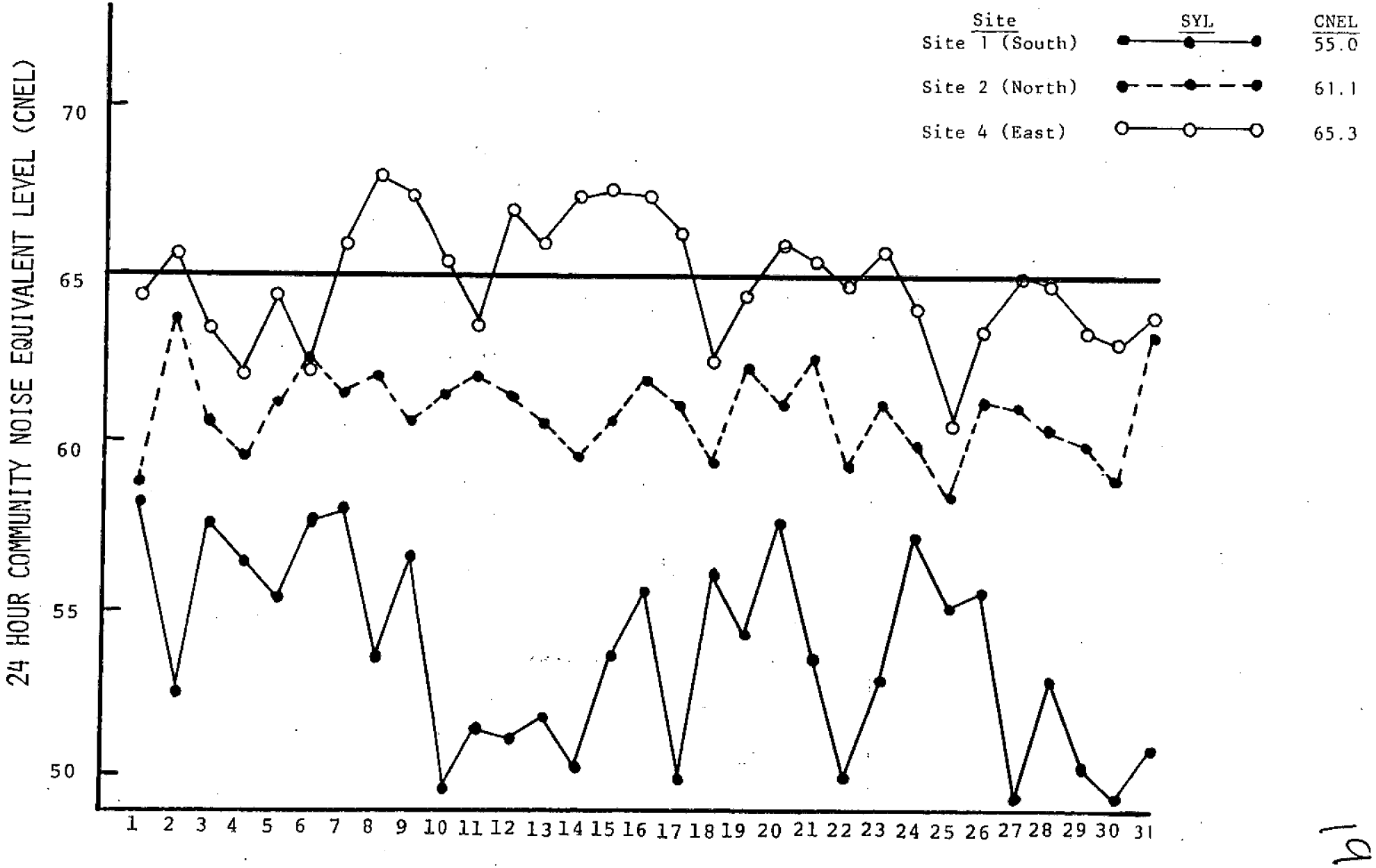
1. S-1; Input error; data loss until discovered.

2. S-4; Mult. static noise events, equipment jam; data loss until discovered.

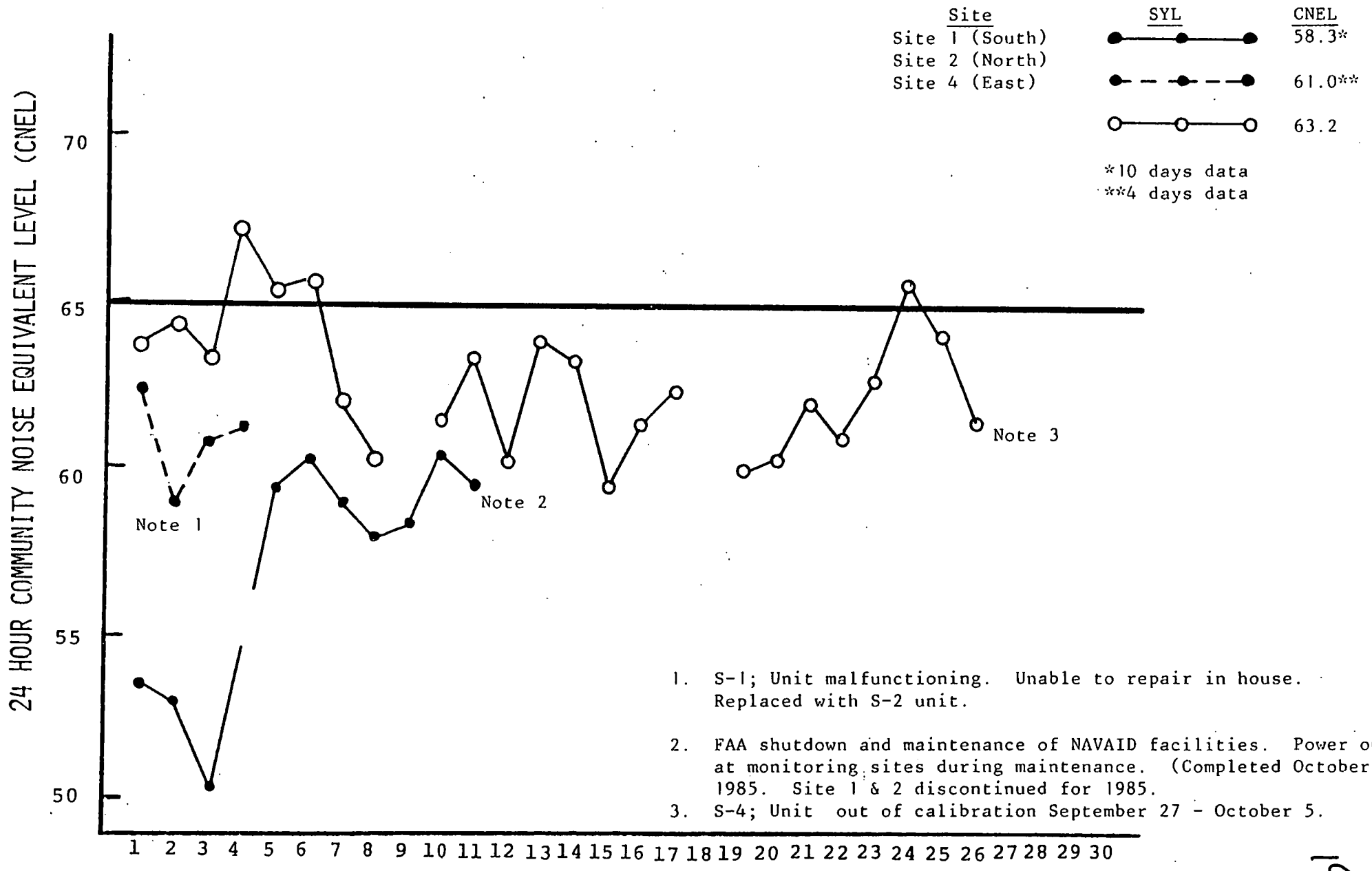
EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
EXHIBIT B
JULY 1985



EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
EXHIBIT C
AUGUST 1985

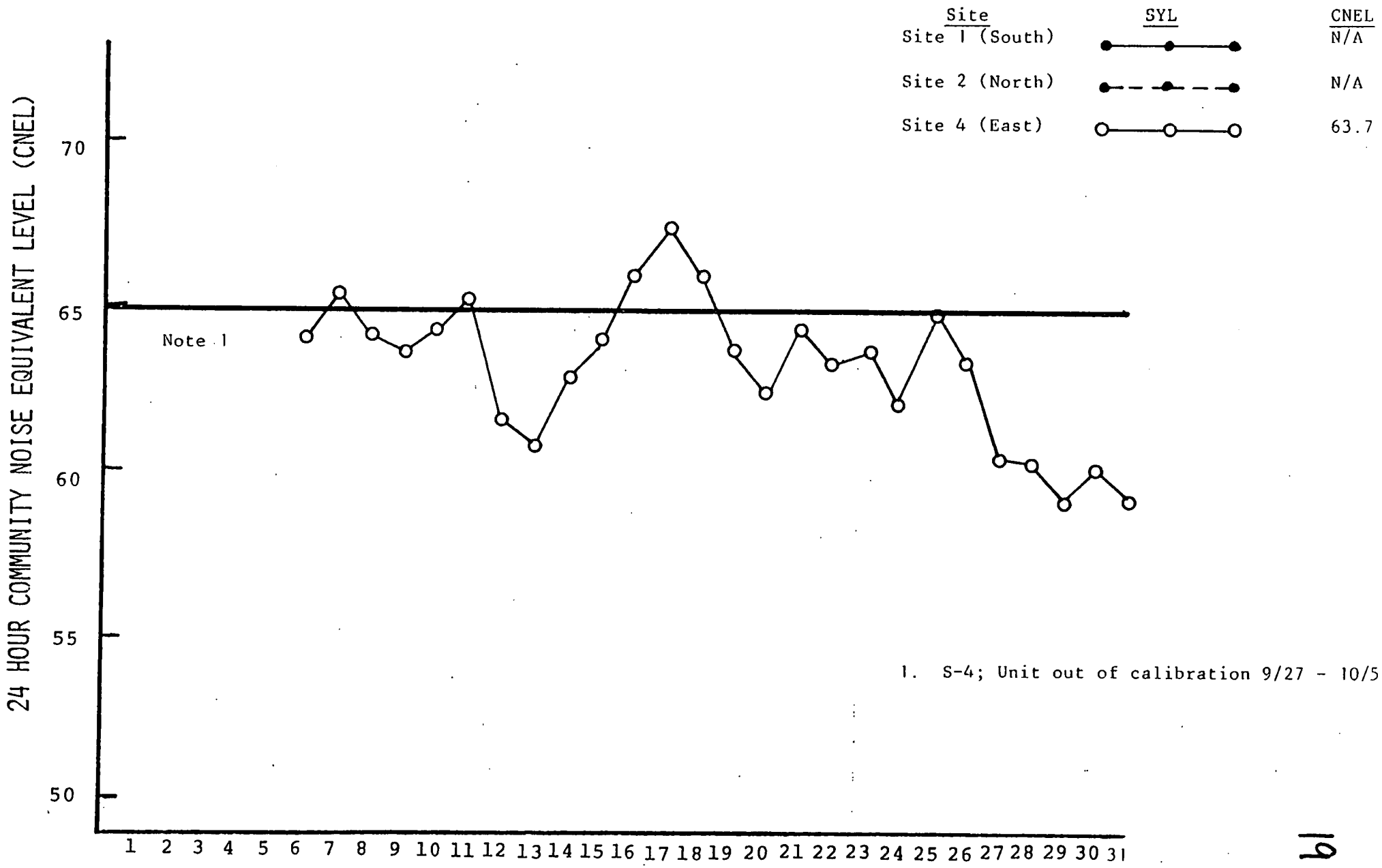


EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
EXHIBIT D
SEPTEMBER 1985



1. S-1; Unit malfunctioning. Unable to repair in house. Replaced with S-2 unit.
2. FAA shutdown and maintenance of NAVAID facilities. Power out at monitoring sites during maintenance. (Completed October 3. 1985. Site 1 & 2 discontinued for 1985.
3. S-4; Unit out of calibration September 27 - October 5.

EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
EXHIBIT E
OCTOBER 1985



1. S-4; Unit out of calibration 9/27 - 10/5

TABLE I
EXECUTIVE AIRPORT NOISE MONITORING PROGRAM

SUMMARY RESULTS
1985

	June	July	Aug.	Sept.	Oct.	1985 Average
Location No. 1 (South site)	59.2	57.6	55.0	58.3*	N.A.	57.8
Location No. 2 (North site)	61.0	61.1	61.1	61.0**	N.A.	61.1
Location No. 4 (East Airport/ Romack Circle)	64.8	64.6	65.3	63.2	63.7	64.4
Northwest - 35th Ave. & Freeport (Estimated)	63.2	63.0	63.3	63.1	62.7	63.1

*Includes data for ten days only
**Includes data for four days only

Days Exceeding 65-CNEL

						1984 Total
Location No. 1	0	0	0	0	0	0
Location No. 2	0	0	0	0	0	0
Location No. 4	10	13	14	4	5	46

Noise Complaints

April: 4/11/85; General complaint over use of R/W 30.

June: 6/25/85; General complaint over use of R/W 30.

July: None

August: None

Sept: Four complaints by same individual over use of R/W 12.
9/29/85; Three complaints, low flying aircraft N4976P

Oct: Two complaints by same individual over use of R/W 12.

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November 29, 1985

TABLE 2

EXECUTIVE AIRPORT NOISE MONITORING PROGRAM
SUMMARY 1979 - 1985

	1979	1980	1981	1982	1983	1984	1985
Location No. 1 (South Site)	63.0	63.5	61.6	59.6	58.5	60.7	57.8
Location No. 2 (North Site)	62.5	63.6	60.6	59.8	60.0	58.8	61.1
Location No. 3 (35th & Freeport)	NA	NA	66.1 1/	NA	63.0	63.1 2/	63.1
Location No. 4 (East Airport/ Romack Circle)	NA	NA	NA	63.2	63.6	63.8	64.4

Note 1. Represents Dec. 1980 and Jan., Feb., Mar., Apr. 1981. Site 3 interference from Freeport Blvd. traffic. Monitoring at Site 3 suspended April 28, 1981.

Note 2. Beginning May 1983, Site 3 noise impact was mathematically estimated using average single event noise levels multiplied by number of operations.

Department of Airports
Staff Technical Report
Executive Airport 1985 Noise Monitoring Program

APPENDIX A

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) DETERMINATION USING THE SINGLE EVENT NOISE EQUIVALENT (SENEL) METHODOLOGY MONITORING SITE NO. 4

July 1985

The total noise exposure at any given location is specified by the California Airport Noise Standards as the Community Noise Equivalent Level, and is expressed as follows:

$$CNEL = \overline{SENEL} + 10 \log N - 49.4$$

where,

$\overline{SENEL}$ = the average single event noise level

N = number of aircraft operations with appropriate penalty weightings for evening and night occurrence.

49.4 = constant in the CNEL equation representing 10 times the log of the number of seconds in a 24-hour day.

SENEL

As a noise event occurs, such as an aircraft overflight, the sound level increases to a peak and then decreases back down to the ambient threshold, much like the typical "bell curve". The total noise energy resulting from the single noise event is the Single Event Noise Exposure Level. Simply stated, the CNEL is an accumulation of all the individual SENEL's that occur over a specified time interval. The average SENEL ($\overline{SENEL}$) is a logarithmically calculated energy average of all single events during the same specified time interval.

Average SENEL

A BBN Model 614 noise monitor was used to measure the single event noise characteristics of aircraft flyovers at monitoring location Site No. 4 at Executive Airport on July 23 and 24, 1985. Tables A-1 through A-5 present the maximum peak noise level (L_{max}) and the individual SENEL for 116 single engine aircraft less than 200 hp, 64 single-engine aircraft greater than 200 hp, 45 multi-engine aircraft, 5 helicopters and 1 business jet as recorded during the survey period.

The resultant $\overline{SENEL}$ for the two single-engine aircraft types and the multi-engine aircraft types were determined directly from survey results.

The $\overline{\text{SENEL}}$ for the five helicopter operations was determined to be 77.9dB. Helicopter noise is perceived to be particularly annoying to a large segment of the community. It was, therefore, decided to use the highest individual SENEL (88.3dB) in the overall calculations in place of the actual recorded $\overline{\text{SENEL}}$.

As with helicopters, business jet activity at the airport continues to be a community concern with respect to noise. The single business jet noise event recorded during the survey period is consistent with the noise limits established by the City/County Noise Ordinance for Executive Airport. However, it was also decided to overweigh the impact of business jet activity. This was done in two ways. First, a separate survey of business jet activity occurring June through August 1983 was used. Only those jet events above the threshold of 88.0 SENEL was considered in calculating the $\overline{\text{SENEL}}$. Secondly, the overall CNEL calculations assume an average of one business jet per day which is approximately 7 times greater than actual occurrence.

Table A-6 presents the calculations used to determine the overall $\overline{\text{SENEL}}$ for Executive Airport at Site No. 4 using the measurements and assumptions noted above.

Equivalent Operations

The number of equivalent operations, as used in the CNEL equation, includes multiplication by a factor of 3 for operations occurring between 7:00 a.m. and 10:00 p.m. and a factor of 10 for operations that occur between 10:00 p.m. and 7:00 a.m. as expressed by the following:

Equivalent Operations = (1 x Day) + (3 x Evening) + (10 x Night)

These factors are applied to simulate community sensitivity to noise events that may occur during these hours. Equivalent operations are always greater than actual operations.

Before the weightings can be applied, the number of operations distributed through the 24-hour day must be known. Executive Airport FAA Air Traffic Control Tower records were used to determine the following distribution:

Days operations = 88%

Evening operations = 10%

Night operations = 2%

CNEL Determination

Applying the aforementioned input data, it is possible to determine the CNEL value at Site No. 4 which is totally resultant upon aircraft operations. Representative CNEL values are shown in the following examples:

Average Day, August 1985:

Total operations: 492 (take-off and landings)

No. of events at site: $\frac{492}{2}$ = 246 (departures)

24-hour distribution:

Day (80%)	=	217
Evening (10%)	=	24
Night (2%)	=	5
		246

Equivalent operations: (1 x 217) + (3 x 24) + (10 x 5) = 339

CNEL = $\overline{\text{SENEL}}$ + 10 log (operations) - 49.4

= 86.55 + 10 log (339) - 49.4

= 86.55 + 25.30 - 49.4

= 62.45

Worst Day, August 21, 1985

Total operations: 650

Total departures: 325

Distribution:

Day	=	286
Evening	=	33
Night	=	6

Equivalent ops: (1 x 286)+(3 x 33)+(10 x 6) = 445

CNEL = $\overline{\text{SENEL}}$ + 10 log (ops) - 49.4

= 86.55 + 10 log (445) - 49.4

= 86.55 + 26.48 - 49.4

= 63.6

Critical Operations Approaching 65.0 CNEL

250,000 ops = 20,833 per average month.

August = 10% average year = 25,000 = 833/day = 416 departures

Distribution: Day = 366
Evening = 42
Night = 8

Equivalent operations: (1 x 366)+(3 x 42)+(10 x 8) = 572

$CNEL = \overline{SENEL} + 10 \log (ops) - 49.4$

$= 86.55 + 10 \log (572) - 49.4$

$= 86.55 + 27.57 - 49.4$

$= 64.72$

Conclusions

1. The calculated CNEL at Site No. 4 is currently within the limits established by the adopted Airport Master Plan.

2. The calculated CNEL at Site No. 4 is estimated to approach maximum permissible limits at 250,000 annual operations.

3. The $\overline{SENEL}$ should be updated on an annual basis to gauge relative success of the noise abatement procedures.

Larry E. Kozub
Sr. Airport Planner

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SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-1 SINGLE ENGINE LESS THAN 200 HP

Reference Event	Duration (Seconds)	L_{Max}	SENEL
1	8	76.5	83.6
2	7	79.5	84.9
3	4	72.0	77.8
4	11	91.3	96.1
5	7	76.1	82.5
6	7	78.1	84.0
7	7	73.3	80.4
8	2	70.3	67.3
9	7	74.0	81.3
10	9	74.6	82.1
11	5	76.3	81.0
12	4	71.0	70.8
13	8	74.2	81.3
14	5	74.6	79.6
15	11	82.8	88.8
16	3	72.5	76.8
17	6	74.4	80.4
18	1	70.1	70.1
19	5	72.0	78.1
20	4	75.1	79.5
21	6	74.2	80.4
22	8	83.4	87.7
23	3	71.6	75.0
24	4	73.5	78.3
25	5	73.5	78.7
26	5	78.0	81.7
27	5	75.0	80.0
28	9	81.7	87.5
29	4	72.9	78.3
30	3	73.5	77.0
31	4	74.2	78.7
32	6	74.4	80.2
33	7	75.9	81.5
34	5	73.5	79.5
35	3	72.1	76.1
36	4	73.1	78.5
37	3	73.5	78.0
38	7	79.1	84.3
39	4	73.8	78.5
40	6	75.3	81.3
41	3	71.4	75.5

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-1 SINGLE ENGINE LESS THAN 200 HP
(CONT'D.)

Reference Event	Duration (Seconds)	L_{Max}	SENEL
42	7	79.6	84.7
43	3	70.8	75.5
44	10	73.1	81.3
45	3	73.3	76.8
46	3	70.8	74.8
47	2	70.3	72.1
48	6	77.6	82.6
49	5	76.8	81.7
50	3	71.8	75.1
51	6	77.6	83.2
52	9	73.8	81.7
53	3	72.3	76.1
54	6	73.5	79.6
55	8	81.3	87.1
56	6	74.6	81.0
57	4	73.6	78.3
58	1	70.5	70.3
59	7	79.1	84.7
60	4	72.1	77.4
61	5	78.0	81.7
62	5	73.5	78.9
64	3	72.1	75.9
65	7	80.4	85.8
66	2	72.7	75.0
67	3	71.8	76.1
68	5	71.0	77.8
69	6	78.0	82.6
70	6	81.1	85.6
71	4	75.5	79.5
72	4	72.5	77.8
73	2	71.4	72.7
74	7	80.0	85.3
75	6	72.7	77.6
76	2	72.3	75.3
77	2	70.5	70.3
78	8	81.0	86.6
79	3	72.3	77.0
80-116	1	70.0	70.1

$\overline{SENEL} = 81.2$

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-2 SINGLE ENGINE LESS THAN 200 HP

Reference Event	Duration (Seconds)	L_{Max}	SENEL
1	11	95.4	99.3
2	10	77.8	84.9
3	4	76.1	80.2
4	6	84.9	88.6
5	4	75.7	79.6
6	6	80.4	85.5
7	9	88.3	92.8
8	10	93.0	97.5
9	7	89.2	93.1
10	6	78.1	83.0
11	6	76.1	81.5
12	7	81.1	87.0
13	8	82.3	87.7
14	8	80.6	85.5
15	5	81.0	85.1
16	6	76.8	81.7
17	7	81.5	85.8
18	4	74.2	79.3
19	8	79.1	84.5
20	7	81.9	86.6
21	4	74.2	78.7
22	9	83.2	88.8
23	7	84.5	88.8
24	9	88.3	92.8
25	8	79.8	85.5
26	7	81.3	87.0
27	6	81.9	85.8
28	5	79.8	84.0
29	6	79.3	83.8
30	17	92.2	98.8
31	5	80.0	84.5
32	6	84.7	88.8
33	3	75.0	78.5
34	9	87.1	92.6
35	7	79.3	84.5

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-2 SINGLE ENGINE LESS THAN 200 HP
(CONT'D.)

Reference Event	Duration (Seconds)	L_{Max}	SENEL
36	7	79.1	84.7
37	6	82.5	87.0
38	7	83.8	88.1
39	5	72.7	78.1
40	6	81.1	85.6
41	8	78.7	84.5
42	7	85.8	90.7
43	7	82.3	87.0
44	6	79.6	84.0
45	4	74.6	79.6
46	9	88.5	93.5
47	7	88.3	92.2
48	6	82.6	87.1
49	6	78.3	83.8
50	6	89.4	94.6
51	5	81.1	84.7
52	7	78.9	84.1
53	5	75.1	79.6
54	7	89.6	93.5
55	6	77.4	82.6
56	7	80.2	85.3
57	2	71.4	75.1
58	6	76.3	81.1
59	10	80.2	85.5
60	10	84.1	89.0
61	3	72.7	76.5
62	7	79.3	84.5
63	8	81.5	87.0
64	6	83.8	87.7

$\overline{SENEL} = 89.5$

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-3 SINGLE ENGINE LESS THAN 200 HP

Reference Event	Duration (Seconds)	L_{Max}	SENEL
1	10	87.7	92.8
2	5	81.9	85.1
3	5	77.8	81.9
4	4	77.0	81.0
5	9	80.4	86.8
6	6	80.8	85.3
7	3	75.5	79.5
8	10	84.1	90.3
9	10	80.0	86.8
10	4	75.7	80.2
11	2	70.3	72.1
12	4	72.3	76.8
13	7	80.6	86.0
14	6	78.3	82.6
15	5	84.5	88.1
16	5	77.2	81.5
17	4	75.7	80.2
18	5	78.7	82.8
19	5	76.3	81.3
20	9	85.6	90.7
21	4	75.0	79.6
22	8	78.3	84.7
23	6	78.7	84.0
24	9	82.3	87.1
25	5	79.1	82.3
26	9	85.1	90.9
27	8	74.0	79.1
28	3	73.6	77.2
29	6	79.1	83.6
30	4	75.5	79.8
31	2	71.8	75.1
32	5	81.1	85.1

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-3 SINGLE ENGINE LESS THAN 200 HP
(CONT'D.)

Reference Event	Duration (Seconds)	L_{Max}	SENEL
33	4	78.9	83.2
34	5	76.1	81.7
35	4	75.1	79.6
36	4	74.2	78.5
37	4	75.1	79.1
38	4	75.1	79.6
39	5	82.1	85.1
40	8	77.4	84.3
41	3	72.3	75.9
42	5	79.5	84.3
43	7	80.0	85.3
44	3	73.6	76.8
45	3	74.6	78.7

$\overline{SENEL} = 84.8$

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-4 HELICOPTER

Reference Event	L_{Max}	SENEL
1	72.9	76.5
2	72.1	73.5
3	95.0	76.3
4	76.3	88.3
5	78.3	84.9

$\overline{SENEL} = 77.9$

SACRAMENTO EXECUTIVE AIRPORT

SENEL SURVEY JULY 23 & 24, 1985

MONITORING LOCATION: SITE 4

TABLE A-5A JET

Reference Event	L_{Max}	SENEL
1	81.3	88.8

TABLE A-5B JET (JUNE-SEPT. 1983; SENEL GREATER THAN 88.0)

Reference Event	L_{Max}	SENEL	Jet Type
1	89.8	89.2	FAA Saberliner
2	88.5	88.3	FAA Saberliner
3	103.1	109.1	Lear 25
4	89.0	90.3	
5	91.8	94.5	Falcon Jet
6	88.8	90.3	Falcon Jet
7	92.4	95.6	
8	93.3	97.8	
9	98.2	105.1	
10	100.1	105.5	
11	99.3	105.3	
12	93.7	99.0	
13	92.6	99.5	
14	101.8	106.3	Lear 25
15	92.8	93.9	
16	94.1	96.5	
17	93.3	96.5	FAA Saberliner
18	96.1	102.1	
19	91.5	95.0	

$\overline{SENEL} = 101.8$

SACRAMENTO EXECUTIVE AIRPORT
SENEL SURVEY - JULY 23 & 24, 1985
MONITORING LOCATION: SITE 4

TABLE A-6 DETERMINATION OF AVERAGE SENEL (SENEL)

Table No.	Ave. SENEL per Aircraft Type	No. of Events
A1-SE_1	81.2	116
A2-SE_2	89.5	64
A3-ME	84.8	45
A4-Hel	77.9 (use 88.3)	5
A5-Jet	88.8 (use 101.8)	1
		231

Ave. SENEL for all operations in sample = $\frac{\text{Weighted SENEL ave. for each aircraft type}}{\text{Total number of all operations in sample}}$

$$\overline{SENEL} = 10 \log \left[\frac{116(\text{Alog } \frac{SENEL}{10})_{A-1} + 64(\text{Alog } \frac{SENEL}{10})_{A-2} + 45(\text{Alog } \frac{SENEL}{10})_{A-3} + 5(\text{Alog } \frac{SENEL}{10})_{A-4} + 1(\text{Alog } \frac{SENEL}{10})_{A-5}}{231} \right]$$

$\overline{SENEL} = 86.55$

19

COUNTY OF SACRAMENTO
DEPARTMENT OF AIRPORTS
6900 AIRPORT BOULEVARD
SACRAMENTO, CALIFORNIA 95837
(916) 929-5411

DIRECTOR OF AIRPORTS
George W. McLaughlin

January 7, 1986

Ms. Lorraine Magana
City Clerk
City Hall
Sacramento, CA 95814

Dear Ms. Magana:

Please find attached the Department of Airport's report to Sacramento City Council summarizing the Executive Airport Noise Monitoring Program for calendar year 1985.

Larry Kozub, representing the Department of Airports, will be available to present this report and respond to City Council questions.

Please advise Mr. Kozub of the date that this item is scheduled for the City Council agenda. Mr. Kozub may be reached at 648-0620.

Sincerely,

George W. McLaughlin
Director of Airports

LEK:sam