APPENDIX 3

BROOKHAVEN NATIONAL LABORATORY

M E M O R A N D U M

DATE: April 15, 1985

TO: R. Gibbs

FROM: G. Wall

SUBJECT: Noise Survey During Compressor Acceptance Test

On April 10, 1985, while all the compressor machinery in the Helium Compressor Building was running, with the exception of skids nine and ten, noise level measurements throughout were made using a Model 1982 General Radio noise level meter. The results are shown on the attached diagram of the building plan.

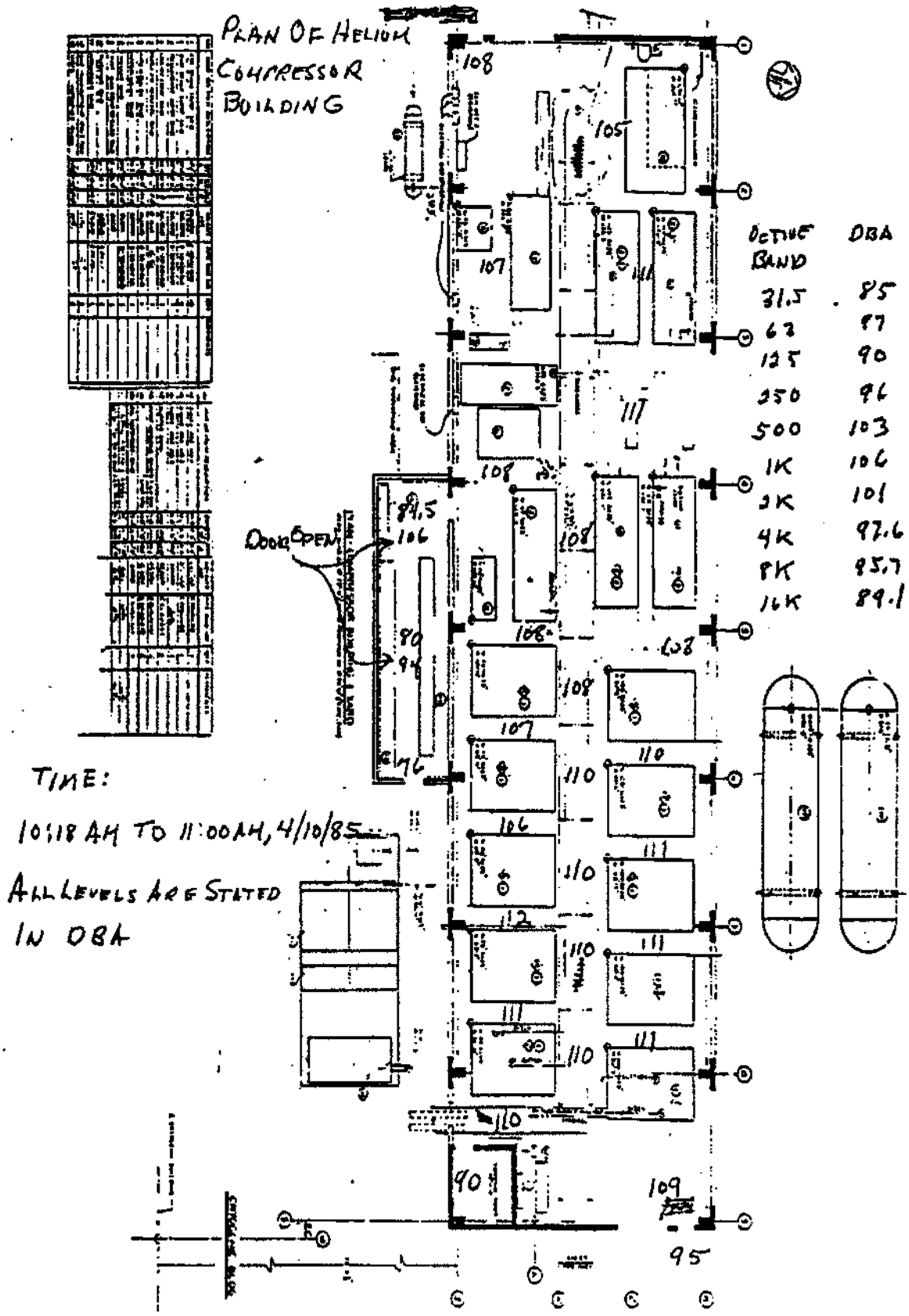
A fairly uniform noise level of about 110 dBA was found in the machine area. As expected, the noise level at skids nine and ten was lower because they were not contributing to the general noise level. Without hearing protection a maximum occupancy time of fifteen minutes would not cause hearing impairment. Even with ear muffs or ear plugs the maximum time is four hours. Hearing protection is obviously necessary.

The maximum occupancy time in the computer room and the substation room are considerably longer provided the connecting doors are kept closed.

An octave-band analysis of the noise indicates a peak energy at 1 kilohertz. The ear has a maximum response around this frequency. Excessive noise levels were found outside the building at the entrances. This calls for warning signs posted at some distance from the building.

cc: G. Adams
T. Malinowski
H. Schulman
F. Thornhill
O. White

cso



OCTAVE BAND	DBA
31.5	85
63	87
125	90
250	96
500	103
1K	106
2K	101
4K	97.6
8K	95.7
16K	89.1

TIME:

10:18 AM TO 11:00 AM, 4/10/85

ALL LEVELS ARE STATED IN DBA

BROOKHAVEN NATIONAL LABORATORY

MEMORANDUM

DATE: September 15, 1995

TO: A. Etkin

FROM: R. Selvey

SUBJECT: **NOISE EXPOSURE MEASUREMENTS IN BUILDING 1005, CRYOGEN COMPRESSOR ROOM**

On June 8, 1995, Jim Durnan and I measured the noise levels within the Building 1005 Cryogen Compressor Room during a test run of the facility. Measurements were made with a General Radio Model 1982 Sound Pressure Level Meter and Octave Band Analyzer. Sound pressure levels (SPL) were measured outside the building and within the compressor room.

The survey results are presented in Table 1A. The noise level within the building reached a maximum of 113 dBA. An octave band analysis of the noise in the room indicated that the sound peaks at 500 and 1000 Hz and is high from 250-2000 Hz. The octave band results are listed in Table 1B.

The data indicate that employees will be exposed in excess of the BNL Exposure Standard if time in the room exceeds 30 seconds per day. BNL Occupational Exposure Standards, based on American Conference of Governmental Industrial Hygienists Threshold Limit Values®, are presented in Table 2. The frequencies of highest exposure also overlap the human speech recognition frequencies, thus the potential for hearing loss is significant. Use of personal protective equipment (combination of ear plugs with ear muffs or noise cancelling muffs) must be mandatory for all employees regardless of the duration of entry into the room.

Reduction of the ambient noise levels by shielding or absorbing the sound should be investigated. The predominate frequencies may be successfully reduced with sound absorbing panels suspended from the roof and insulated barrier walls.

Please advise me if additional assistance is needed to address concerns not resolved by this monitoring. When routine work begins, please contact J. Durnan to schedule noise dosimetry of affected employees. If you have questions on these recommendations, please contact me at x-3066.

cc: G.Adams, B. Brientenstein, J. Durnan, S. Musolino

IH6920.95

Table 1A: Noise Exposure Levels in Building 1005 Compressor Room, 6/8/95

LOCATION	dBA
Outside Building: East side	78
Outside building: Under air intake, north side	88
At roll up door, east side	98
At roll up door, north side	95
Inside room, by compressor #4	113

Table 1B: Octave Band Analysis by Compressor #4, 6/8/95, dBC Weighted

WGT	31	62	125	250	500	1000	2000	4000	8000	16000
121	76	84	89	90	107	102	94	86	84	75

Table 2: Brookhaven National Laboratory Permissible Exposure Limits

Duration per day			Sound Level
Hours	Minutes	Seconds	dBA
24	1440		80
16	960		82
8	480		85
4	240		88
2	120		91
1	60		94
	30		97
	15		100
	7.5		103
	3.75		106
	1.88		109
	0.94	56	112
		28	115
		14	118

BROOKHAVEN NATIONAL LABORATORY
Safety and Environmental Protection Division

MEMORANDUM

DATE: March 4, 1996

TO: S. Musolino

FROM: R. Selvey

SUBJECT: **Noise Exposure Levels Outside RHIC 1005H**

A study was conducted to determine the impact of the RHIC cryogen (liquid helium) compressors on ambient noise levels around the RHIC ring and on residential communities to the north of the BNL site. The ambient noise level was measured over several days outside of the Compressor Building 1005H when the compressors were operating and when they were idle. Measurements were made with a General Radio Model 1565 Sound Pressure Level Meter. The survey results are presented in Table 1. The noise level within the building has a maximum of 113 dBA. The building consists of masonry block walls, metal ventilation louvers and roll-up doors on the north, east and west walls, and a metal and bituminous roof. In addition to the compressors located within the building, a cryogen (liquid nitrogen) storage tank with fan and pump is operated outside the building on the on the north side.

The monitoring data indicates the noise at off-site residential areas will not exceed BNL Employee Noise Exposure Standard (based on American Conference of Governmental Industrial Hygienists Threshold Limit Values®), EPA Ambient Noise levels (from the 1972 Noise Control Act), or Brookhaven Town residential exposure levels (based on guidelines provided by Rutgers University). These exposure standards are presented in Table 2.

The noise from the compressor building, which is located at the 5 o'clock position on the south end of the RHIC ring, was below 50 dBA at the 3, 8, and 12 o'clock positions and off-site. Although below exposure standards, the noise from the compressor was perceptible off-site on the days of monitoring as a faint, continuous tone. It is expected to be detectable off-site any day when the wind originates from the south and the roll up doors of the building are open. On the days we sampled, the major source of noise in the residential areas north of BNL was road traffic on Route 25 and rustling of the high winds through trees. Road traffic from the LIE and William Floyd Highway and aircraft overhead were also occasionally detected.

Please advise me if additional assistance is needed to address concerns not resolved by this monitoring.

cc: G. Adams
B. Brietenstein
J. Durnan
J. Hale
S. Musolino

IH6920.95

Table 2: Sound Pressure Levels Outside BNL RHIC Cryogen Building 1005H

Location	map	2-1-96	2-6-96	2-7-96	2-9-96	2-15-95
		Compressors Off	Compressors Running, Doors Closed	Compressors Running, Doors Open	Compressors Running, Doors Open	Compressors Off
Building 1005H: Outside North East Corner, 10 ft from building	A	58	89	89	91	63
Building 1005H: Outside by Cryogen Tank, North west side of building	A	77	83	86	90	66
Ring Road: 5 o'clock position	A	62	73	75	79	59
Ring Road: 8 o'clock position	B	<45	<45	54	49	<45
Ring Road: 12 o'clock position	E	<45	50	46	52	<45
Ring Road: 3 o'clock position	C	<45	<45	50	52	<45
RHIC interior road to Building 1101	D	47	<45	52	49	<45
Off-site Residential South end of Pleasant View	F			<45	<45 peaking at 49*	<45
Off-site Residential: West end of Elizabeth Way	H			<45	<45 peaking at 52*	<45
Off-site Residential: End of Crescent Bow	G				<45 peaking at 52*	<45
Off-site 20 feet from Middle Country Rd.. Automobile Traffic						79
Off-site 20 feet from Middle Country Rd.. School Bus traffic						85

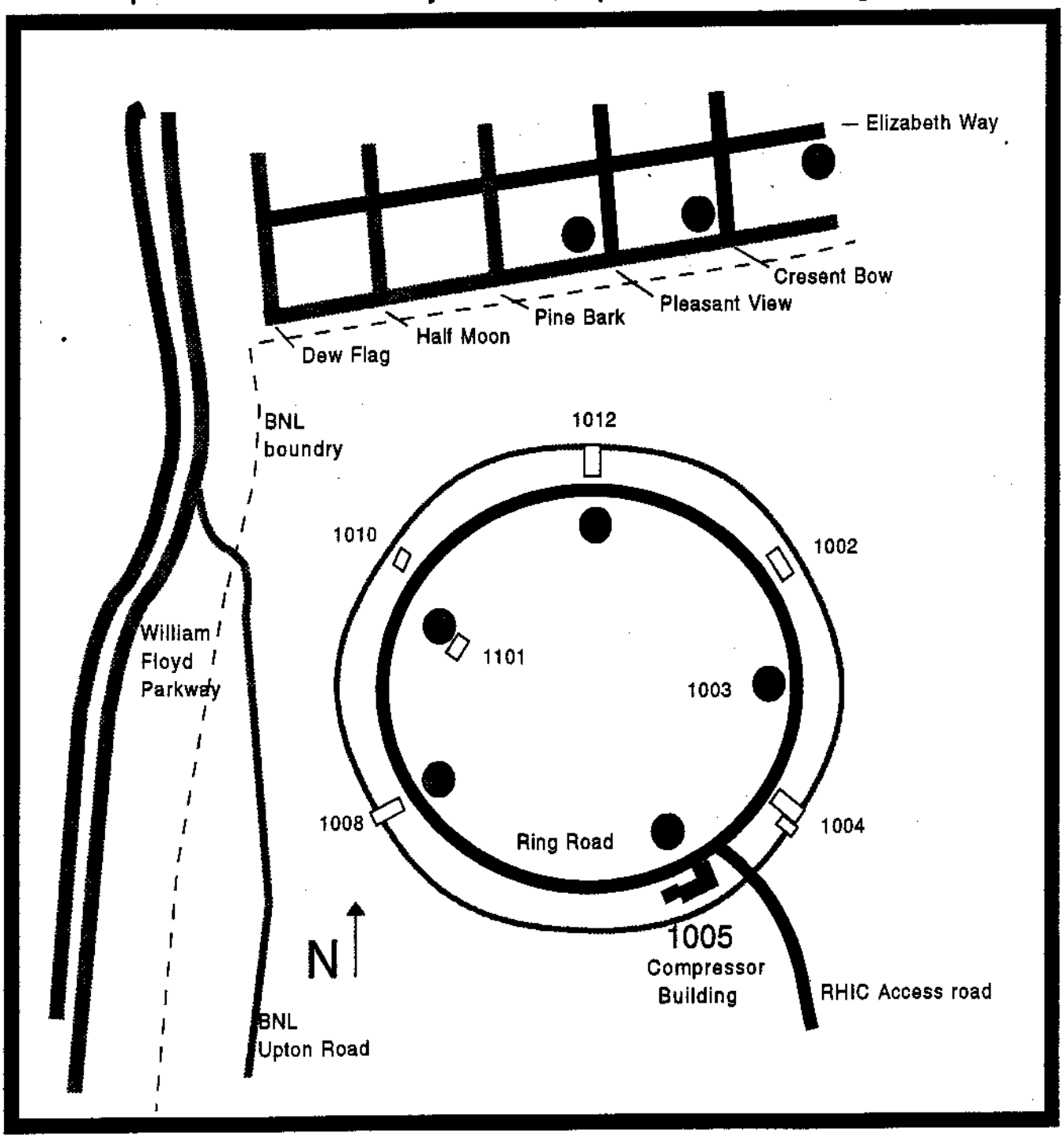
*** High winds this day caused periodic noise from rustling of trees which was higher than 50 dBA. These peaks in noise**

were not associated with the compressor noise. During periods of low wind, the compressor noise was less than 45 dBA.

Table 2
Brookhaven National Laboratory, EPA, and Brookhaven Town Permissible Exposure Limits

BNL Employee Exposure Standard (ACGIH 1994-1995)		EPA (1974 Noise Act)		Brookhaven Town (1996)	
Duration per day (hours)	Sound Pressure Level (dBA)	Activity	Sound Level (dBA)	Time of Day	Sound Pressure Level (dBA)
24	80	Hearing Loss	<= 70	7:00 am - 10:00 pm	55
16	82	Outdoor Activity	<= 55	10:00 pm-7:00 am	50
8	85	Indoor Activity	<=45		

Map of Areas Survey for Compressor Building Noise



BROOKHAVEN NATIONAL LABORATORY

MEMORANDUM

DATE: March 11, 1999

TO: M. Iarocci

FROM: L.B. Stiegler LBS

SUBJECT: Noise Measurement Comparisons for 1005H

Sound level measurements were done on March 9, 1999 to determine the current impact of the RHIC cryogenic system on the surrounding area. This study was a repeat of several different measurements done in the last few years. During this test on 3/9/99, the system was running at approximately 10 MW of energy use. The MET51 data shows that the wind was predominantly out of the west at 4-8 mph. Tables 1-3 compare the sound level measurements taken at various locations by BNL using the same instrument. Tables 4 and 5 compare the measurements done by BNL and the consulting firm of Cerami & Associates Inc, Accoustical Engineers. The measurements on 2/27/97 were done by the consulting firm.

Table 1 - at 1005H North Side under middle vent

			Hz									
Date	dBA	dBC	31.5	63	125	250	500	1K	2K	4K	8K	16K
6/8/95	88.0											
2/6/96	83.0											
2/21/97	95.0	98.5	72.5	75.6	90.0	80.0	89.3	90.5	83.7	78.5	72.0	60.5
3/9/99	80.5	82.2	72.3	74.5	73.2	73.6	77.0	76.4	74.9	71.1	68.2	66.7

All measurements taken with GenRad 1982

Table 2 - at 1005H North East Side by Rollup Door

			Hz									
Date	dBA	dBC	31.5	63	125	250	500	1K	2K	4K	8K	16K
6/8/95	98.0											
2/6/96	89.0											
2/21/97	85.2	88.1	66.1	77.8	72.5	73.0	80.0	74.5	79.7	71.5	72.5	64.4
2/17/99			68.5	67.4	64.0	63.8	71.4	79.1	85.6	77.7	78.0	74.0
3/9/99	93.3	92.0	69.8	73.0	68.2	70.2	77.2	86.3	89.6	83.0	83.5	83.0

All measurements taken with GenRad 1982

Table 3 – at Building 1012

			Hz									
Date	dBA	dBC	31.5	63	125	250	500	1K	2K	4K	8K	16K
2/1/96	50.0											
2/21/97	49.5	78.7	68.7	55.1	54.7	47.8	44.5	40.4	36.7	29.2	22.0	25.1
3/9/99	44.0	60.0	52.3	48.2	46.4	38.4	40.2	38.4	38.2	28.2	28.4	28.8

All measurements taken with GenRad 1982

Table 4 – at Deer Leep and Half Moon Roads

Date	dBA	dBC	Hz 31.5	63	125	250	500	1K	2K	4K	8K	16K
2/21/97[1]	52.1	65.5	65.5	65.5	55.1	49.8	49.4	45.1	43.2	44.0	45.1	42.0
2/27/97	39.0			46.0	40.0	34.0	34.0	33.0	26.0	24.0		
3/9/99[1]	45.0	53.8	52.3	47.0	41.0	37.5	37.0	29.8	27.4	26.8	25.9	28.0

(1) Measurements taken with GenRad 1982

Table 5 – at Deer Leep and Pine Bark Roads

Date	dBA	dBC	Hz 31.5	63	125	250	500	1K	2K	4K	8K	16K
2/21/97[1]	49.1	62.1	61.1	58.5	55.2	47.2	47.2	48.1	45.5	40.2	37.0	33.5
2/27/97	40.0			46.0	38.0	34.0	35.0	32.0	24.0	23.0		
3/9/99[1]	45.2	52.6	51.8	46.8	42.0	37.0	36.2	26.8	26.2	26.0	24.8	26.0

(1) Measurements taken with GenRad 1982

The off-site sound level was not discernible on 3/9/99, and is within the Brookhaven Town limits of 50 dBA.

There is still a problem outside building 1005H at the north east side, where the piping comes out of the building. The noise levels due to the hissing sound is still above the allowable limits of 85 dBA, and should be reduced if possible.

LBS/IH6920.99

Cc: N. Bernholc
S. Musolino
A. Reuter

BROOKHAVEN NATIONAL LABORATORY
SAFETY & ENVIRONMENTAL PROTECTION DIVISION

OCTAVE BAND ANALYSIS
NOISE MEASUREMENT FORM

DATE: 3/9/99 | SURVEYOR(S): Stiegler, Robles

I. AREA INFORMATION

DEPT: RHIC | BLDG: 1005H | ROOM:

SOURCE: Compressors, approx 10 MWatts power being used

ENGINEERING CONTROLS:

II. EMPLOYEE INFORMATION

FIRST NAME: N/A | LAST NAME: N/A | BNL #: N/A

DEPT: | BLDG: | JOB TITLE:

EXPOSURE DURATION (HRS): | EXPOSURE (TIMES PER DAY): | EXPOSURE (DAYS PER YR):

JOB PERFORMED:

PPE USED:

III. SURVEY INSTRUMENT INFORMATION

INSTRUMENT: Gen Rad | MODEL: 1982 | SERIAL#: 2765

FACTORY CALIBRATION DATE: 4/98 | PRE-CAL: 3/9/99 BY: LSS | POST CAL: 3/11/99 BY: LSS

BATTERY CHECK (Y/N): Y

CALIBRATOR SERIAL #: 16972

	125	250	500	1000	2000		125	250	500	1000	2000
dBA	97.7	105.1	110.6	113.8	114.3	dBA	97.5	105.0	110.7	113.6	114.2
dBC	113.6	113.2	114.0	113.7	113.1	dBC	113.5	113.5	113.9	113.7	112.9

IV. SAMPLING INFORMATION & RESULTS

Response: ___FAST ___SLOW ___PEAK ___IMPULSE Weighting: ___A ___B ___C ___Flat WIND SCREEN: (Y) N

No	LOCATION OF SAMPLE	A/C WGT	31	62	125	250	500	1000	2000	4000	8000	16000
410	NE Corner 1005H	93.3/92.0	69.8	73.0	68.2	70.2	77.2	86.3	89.6	83.0	83.5	83.0
415	North Side 1005H under middle vent	80.5/82.2	72.3	74.5	73.2	73.6	77.0	76.4	74.9	71.1	68.2	66.7
422	West Side 1005 by R/U door	74.3/78.2	69.2	77.0	70.5	74.2	69.5	68.0	64.2	59.3	55.6	47.2
430	Bldg 1012	44.0/60.0	52.3	48.2	46.4	38.4	40.2	38.4	38.2	28.2	28.4	28.8
515	Deer Leap + Half Moon	45.0/53.8	52.3	47.0	41.0	37.5	37.0	29.8	27.4	26.8	25.9	28.0
520	Deer Leap + Pine Bark	45.2/52.6	51.8	46.8	42.0	37.0	36.2	26.8	26.2	26.0	24.8	26.0
10	1005H NE Compressors OFF	73.0/71.6	67.2	65.4	62.4	60.0	54.0	55.8	53.4	45.4	39.0	34.3

V. CONCLUSIONS & RECOMMENDATIONS

Return completed form to: IH Lab, Building 129A

FILE CODE: IH 6920. FORM IH-FP-1.2-B (10/92)