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	REVISION FINAL rev5
INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	DATE 04-09-04
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SUBJECT: Noise Measurement Principles: Personnel Dosimetry	

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1.0 Purpose/Scope

This procedure provides a standardized method for conducting personnel exposure assessment surveys with noise dosimeters. It should be used in conjunction with the SBMS Subject Area *Noise and Hearing Conservation* and an *Instrument Operation* procedure in the series IH96300- IH96699.

Generally, all employee exposure assessments should be made with a noise dosimeter. A dosimeter logs the exposure of the worker as they move through the work area. The microphone of the dosimeter is clipped on the workers collar and closely represents the actual exposure of the ear to the noise source. Logged exposure data is compared to occupational exposure limits to determine compliance with hearing conservation regulations.

An area survey meter (sound pressure level meter) should be used to determine baseline noise levels and area noise levels. While many dosimeters can be used as survey meters, SPL meters designed as precision area survey meters offer more features (such as impact/impulse capturing) and should be used for area surveys. Survey meters are typically used for conducting noise surveys to determine the need for area warning posting, locate problem-noise sources, and measuring the effectiveness of engineering controls.

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SPL Meters are typically used in conjunction with dosimeters to provide additional information on the relationship between noise exposure and specific tasks as well as to verify dosimeter operation. Area survey meters are to be used in accordance with the appropriate IH SOP.

2.0 Responsibilities

- 2.1 Personnel that perform exposure monitoring with this procedure are responsible to follow all steps in this procedure.
- 2.2 The data collected using this meter must have an appropriate evaluation of the hazard and risk by a skilled Industrial Hygiene professional.

3.0 Definitions

- 3.1 *Decibel (dB)*: A non-dimensional unit used to express sound pressure levels. It is the log of the ratio of the measured sound pressure level to a reference level.
 - *dBA*: A sound pressure level in decibels made on the A-scale of a sound level meter. This unit of measure approximates the response of the human ear.
 - *dBC*: Sound pressure based on a nearly flat, non-weighted scale.
- 3.2 *Impulse or Impact Noise Levels*: Variations in noise levels that involve peak levels spaced at periods of greater than one per second. Where the intervals are less than one second, it should be considered a continuous noise source.
- 3.3 *Occupational Exposure Limit (OEL)*: The maximum time weighted average (TWA) exposure permitted for employee exposure, based on the lesser of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV):

OSHA's current exposure levels are calculated on a 5 dB doubling rate, whereas ACGIH utilizes a 3 dB doubling rate (for each drop of 3 dB in the average noise measurement double the allowable work time). BNL follows the most protective OEL.

Table A: OSHA PEL & ACGIH TLV:

Duration/Day			OSHA PEL (dBA)	ACGIH TLV (dBA)
Hours	Minutes	Seconds		
24	1440			80
16	960			82
8	480		90	85
4	240		95	88
2	120		100	91
1	60		105	94

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Duration/Day			OSHA PEL (dBA)	ACGIH TLV (dBA)
Hours	Minutes	Seconds		
½	30		110	97
¼	15		115	100
1/8	7.5			103
	3.75			106
	1.88			109
	0.94			112
		28		115
		14		118
		7.03		121
		3.52		124
		1.76		127
		0.88		130
		0.44		133
		0.22		136
		0.11		139

*No exposure to continuous or intermittent noise levels in excess of 140 dBC peak should be allowed

4.0 Prerequisites

4.1 Steps prior to using this procedure:

- 4.1.1 Training for hazards other than noise may be needed for entry into restricted areas (check with ESH Coordinator or FS Representative for the facility).
- 4.1.2 Noise and Hearing Conservation Training and a Baseline audiogram is needed if the exposure to the person performing the survey will be in excess of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV), which ever is less (see Table A).

4.2 Area Access:

- 4.2.1 Contact the appropriate Facility Support Representative or FS Technician to obtain approval to enter radiological areas.
- 4.2.2 Verify with the appropriate Facility Support Representative or FS Technician if a Work Permit or Radiological Permit is needed or is in effect. If so, review and sign the permit.
- 4.2.3 Use appropriate PPE for area.

5.0 Precautions

5.1 Hazard Determination:

- 5.1.1 The operation of a noise dosimeter does not cause exposure to any chemical, physical, or radiological hazards. The meters do not generate Hazardous Waste.

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- 5.1.2 By its very nature, a noise dosimeter may be used in areas where excessive noise levels exist or are suspected to be present. Exposures to noise levels above the PEL and/or TLV may cause temporary or permanent hearing loss.
- 5.1.3 The meters used in this procedure are light less than 2 pounds (1Kg) and do not pose an ergonomic hazard.

5.2 Personal Protective Equipment:

- 5.2.1 In areas where noise levels exceed the *Occupational Exposure Limit (OEL)*, hearing protection should be worn. The hearing protection should be able to reduce the noise levels below the OEL. See IH96150 Attachment 9.2 for Guidance on Hearing Protection Devices and their protection factors (Noise Reduction Ratio, NRR).
- 5.2.2 Additional PPE: Other appropriate PPE for hands, feet, skin, head, or eyes may be needed for the area being entered. Check with your FS Representative.

6.0 Procedure

6.1 Operate the meter as per the BNL Instrument Operation SOP.

- 6.1.1 Perform a Battery Check prior to use.
- 6.1.2 Warm-up the meter as per the Instrument Operation SOP.
- 6.1.3 Pre-calibrate (i.e. single point operational accuracy check) the meter as per the Instrument Operation SOP. BNL requires daily calibration to a portable calibrator. Daily calibration serves as a Bump check of the meter operation pre and post testing.
- 6.1.4 **Dosimeter Setting:** Conduct logging with dBA weighting, 3dB doubling, an 8-hour criteria level of 85, slow response and a range of 80-140 dBA.
- 6.1.5 **Microphone placement:** The microphone must be attached to the worker near the ear (on the collar) and attached in the position prior to starting the meter logging of exposure. This will reduce false impact noise signals that occur when handling the microphone.
- 6.1.6 Monitoring should be conducted in accordance with the directions of the

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responsible IHP designated to assess the noise exposure. This may include observations of the tasks and documentation of SLM readings at various locations during the monitoring period. In most cases, full-shift monitoring will be conducted. The IHP will determine the extent of daily monitoring in reference to known exposure levels.

6.1.7 Policy on monitoring during lunch breaks (30 –60 minutes) and short breaks (10-20 minutes):

6.1.7.1 During short breaks: The meter may be worn by the worker and left logging even if the worker leaves the noise area. If removed from the worker, the meter needs to be placed in the *pause mode* before handling the microphone.

6.1.7.2 During lunch breaks:

- The meter should be placed in the *pause mode* and removed from the worker. The worker may wear the meter from the noise area but it must be put into *the pause mode*.

- The meter should never be removed from the worker and left logging in the noise area.

6.1.7.3 Record the status of the placement and logging of the meter during breaks on the *BNL Noise Dosimeter Form*.

6.2 **Recording readings:**

6.2.1 Use a *BNL Noise Dosimeter Form* to record readings (Attachment 9.1).

6.2.2 Return meter and original sampling form to the SHSD IH Laboratory.

6.2.3 Download the dosimeter data at the IH Lab and keep a copy of the printout with the *Noise Dosimeter Form*. Ensure that a copy of any hazard evaluation report of the survey is written by a competent, hazard assessment person and sent to both the IH Laboratory and the Occupational Medicine Clinic.

6.2.4 Post-calibrate (i.e. single point operational accuracy check) the meter as per the Instrument Operation SOP.

6.3 **Results interpretation:**

6.3.1 A competent person should write a hazard evaluation report that evaluates the survey data and summarizes the potential for occupational exposure and compliance with OSHA and ACGIH Occupational Exposure Limits.

6.3.2 Ensure that a copy of the hazard evaluation report is sent to the IH Laboratory and is included in the ESHQ Directorate Recordkeeping system.

6.3.3 Ensure that a copy the written hazard evaluation report is sent to the Occupational Medicine Clinic with the worker(s) BNL Life Number(s) noted.

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- 6.3.4 The hazard evaluation report and/or an *Employee Notification Form* (see Attachment 9.3) must be used to inform all monitored employees of the results of the air sampling and the implication to compliance with OELs. Reporting to employees must be within the 15 days. (BNL policy in lieu of limits established by regulatory drivers).
- 6.3.5 Complete an *IH Database Entry* form (Attachment 9.2) and return to the IH Laboratory.

7.0 Implementation and training

8.0 References

- 8.1 BNL SBMS Subject Area *Noise and Hearing Conservation*
- 8.2 OSHA Noise/Hearing Conservation Standard 29CFR1910.95.
- 8.3 NIOSH Criteria for a Recommended Standard-Occupational Noise Exposure, 1998
- 8.4 ACGIH American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices 2004.
- 8.5 ANSI S1.13: Methods for the Measurement of Sound Pressure Levels.

9.0 Attachments

- 9.1 BNL Program Administrator Guidance on Hazard Assessment and Exposure Monitoring
- 9.2 Noise Dosimetry Form
- 9.3 Database Entry Form

The only official copy is on-line at the SHSD IH Group website.
 Before using a printed copy, verify that it is current by checking the document issue date on the website.

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10.0 Documentation

Document Review Tracking Sheet		
PREPARED BY: <i>(Signature and date on file)</i> R. Selvey Author Date 03/13/01	REVIEWED BY: <i>(Signature and date on file)</i> J. Peters SHSD IH Group Date 03/13/01	APPROVED BY: <i>(Signature and date on file)</i> R. Selvey SHSD IH Group Leader Date 03/13/01
Filing Code: IH51SR.01	DQAR Date	Effective Date: 03/13/01

Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
03/19/01	<i>(Signature and date on file)</i> R. Selvey	Add Attachment 8.1 Noise Dosimetry Form and 8.2 IH Noise Database Entry Form and text on each.
05/08/01	<i>(Signature and date on file)</i> R. Selvey	Referred to IH96150 for NRR calculations in 5.2.1. Revised with ACGIH TLV for 24 hrs. Verified new 2001 ACGIH TLVs.
06/08/01	<i>(Signature and date on file)</i> R. Selvey	Clarified wording on pre and post calibration to reinforce policy in IH51660.
08/31/01	<i>(Signature and date on file)</i> R. Selvey	Added section 6.1.7 to set policy for monitoring during short breaks and lunch.
04/09/04	<i>(Signature and date on file)</i> R. Selvey	Revised format in Section 7. Updated references to SBMS.

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Attachment 9.1

BNL Program Administrator Guidance on Hazard Assessment and Exposure Monitoring

- 1.0 **Occupational Exposure Periodic Surveys-** Periodic surveys are done to determine compliance with occupational exposure standards based on measurement of employee exposure to noise.
 - 1.1 Assessment of high noise areas shall be accomplished by means of Sound Pressure Level (SPL) measuring devices including Survey Meters and/or Personal Noise Dosimeters. Selection of the appropriate type of equipment shall conform to specifications established in SHSD IH Group IH96 series SOPs and to the requirements cited in OSHA and ANSI standards.
 - 1.2 All equipment shall be calibrated as per IH51600.
 - 1.3 Initial assessment should be done at the installation and start of operation or for any equipment in operation that has not been previously evaluated by measurement or analogy to existing representative equipment.
 - 1.4 Surveys should be re-done, optimally on an annual basis, but at no more than a three-year interval.
 - 1.5 Surveys should be re-done if equipment or operation changes are made that could affect the noise level.
- 2.0 **Personal Noise Dosimeters (PDM)-**
 - 2.1 In areas where Survey meters will not provide representative measurements of worker exposure due to:
 - 2.1.1 variation of the noise levels within the areas workers occupy during typical work activities
 - 2.1.2 variation in the noise level dependent on the time of the work shift, or
 - 2.1.3 work activities that require the employees to be highly mobile and to enter and leave the exposure area, PDMs shall be used to measure employee time weighted average exposure for compliance monitoring.
 - 2.2 PDMs shall be place on the worker as close to the hearing zone as is reasonably achievable.
 - 2.3 PDMs shall be operated for the full shift of the exposed employee.
 - 2.4 Employee monitored shall perform duties which are representative of typical

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activities.
2.5 PDMs shall be set to make A-weighted measurements.

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Attachment 9.2

Noise Dosimetry Form (2 sided, 2 page form)

Attachment 9.3

Employee Notification Form (1 page form)

Attachment 9.4

Exposure Database Entry Form (1 page form)

(see next 4 pages)

DATE:	SURVEYOR(S):
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I. AREA INFORMATION

DEPT:	BLDG:	ROOM:
SOURCE:		
ENGINEERING CONTROLS:		

II. EMPLOYEE INFORMATION

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (HRS):	EXPOSURE (TIMES PER DAY):	EXPOSURE (DAYS PER YR):
JOB PERFORMED:		
PPE USED:		

III. SURVEY INSTRUMENT INFORMATION

INSTRUMENT:	MODEL:	SERIAL#:
FACTORY CALIBRATION DATE:	PRE-CAL: BY:	POST CAL: BY:
BATTERY CHECK (Y/N):	125 250 500 1000 2000	125 250 500 1000 2000
CALIBRATOR SERIAL #:	dBA	dBA
CALIB. (1000 Hz 110 dB):	dBC	dBC

IV. SAMPLING INFORMATION & RESULTS Record Below or See Printed Data Log Report

SAMPLE TIME		COMMENTS
ON	OFF	

TOTAL TIME (hh.mm)	DOSE %	L AVG	L MAX	OVER-EXPOSURE
				Y / N
				Y / N

V. CONCLUSIONS & RECOMMENDATIONS

**Exposure Monitoring
Employee Notification Record**

IH96250 Attachment 9.3

This Section to be completed by Sample Submitter	
Send results to Responsible Party:	Name: _____ Building: _____ <i>Responsible Party will be expected to notify over exposed workers of monitoring results.</i>
Send copy to:	Name: _____ Building: _____
Send copy to:	Name: _____ Building: _____
Send copy to:	Name: _____ Building: _____
Copy to IHG:	_____Horn _____Peters _____ Selvey _____Bernholc

This section to be completed by the Industrial Hygiene Group	
Data Received from Sampler:	Date: _____ Hour: _____
Hardcopy of sent to Responsible Party:	Date: _____ Hour: _____
Phone call to Responsible Party:	Date: _____ Hour: _____
Report sent By:	_____Wilson _____ Selvey _____Bernholc _____Horn

Notification to employee must be made by:	Date _____
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Lab Login# _____	C of C#: _____
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This Section to be completed by the Responsible Party before date above (within regulatory set time periods).		
Exposure in Compliance within Standards (ACGIH & OSHA)	or	Exposure exceeds Standards (ACGIH or OSHA)
<p>Employee Notification</p> <p>Review of this data indicates exposure levels were in compliance with regulatory limits.</p> <p>The employees represented by this exposure monitoring were informed of the results by:</p> <p>Name: _____</p> <p>Date: _____</p> <p>Informed by: _____</p>		<p>Employee Notification</p> <p>Review of this data indicates exposure levels were ABOVE a regulatory limit.</p> <p>The employees represented by this monitoring were informed of the results and corrective actions.</p> <p>Name: _____</p> <p>Date: _____</p> <p>Informed by: _____</p>

Note: If a formal BNL Memorandum is written, send a copy to the SHSD Industrial Hygiene Group (Building 129) and the Occupational Medicine Clinic (Building 490).

Return this form to the Industrial Hygiene Group (Building 129) as soon as employee notification is made.



IH96250 ATTACHMENT 9.4
IH NOISE DATABASE ENTRY FORM

Date	
Dept	
Building	
Source/Job <small>50 cahacters</small>	
First Name	
Last Name	
Life#	
PPE Used: <small>50 cahacters</small>	
Area Sampled <small>40 cahacters</small>	
Contaminant	NOISE- Personal Dosimetry
Concentration	
Units	%DOSE
Sample Technique	Personal Dosimeter
Sampled By	
Comments <small>200 cahacters</small>	

Data Entry By:	Date:
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