From: Officer In Charge, Naval Medical Administrative Unit, Monterey
To: Chairman, Systems Engineering Department, 777 Dyer Road, Naval Postgraduate School, Monterey CA 93943

Subj: BASELINE INDUSTRIAL HYGIENE SURVEY, SYSTEMS ENGINEERING DEPARTMENT, NAVAL POSTGRADUATE SCHOOL, MONTEREY, REPORT 66271-10-5

Ref: (a) OPNAVINST 5100.23G, Chapter 8

Encl: (1) Industrial Hygiene Survey Report 66271-10-5

1. Per reference (a), a baseline industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was conducted by my Industrial Hygienist from 4 to 23 August 2010. The purpose of this survey was to assess the status of occupational health hazards in the workplace, identify areas in need of improvement with corrective actions, and develop the required Exposure Monitoring Plan.

2. It is imperative that the Biological Safety Cabinet in the Room 224B Defense Applications Lab be certified by a specially-qualified inspector prior to use and annually thereafter; because Naval expertise is unavailable, a listing of locally available outside qualified personnel was provided on 9 September 2010 to the departmental Laboratory Coordinator. Additional lighting needs to be installed in the Mechanical Integration and Assembly Room 201M to avoid potential accidents from occuring during use of machine or battery-powered tools.

3. If there are any changes in operations, please complete Appendix J and forward it to my Industrial Hygienist. If further consultation on this report is needed, please contact S. Eric Thurston at Commercial (831) 656-2477, email sethurst@nps.edu.

S. E. THURSTON
By direction

Copy to:
NPS GSEAS Assoc Dean
NHL/TH
NPS S&OH Mgr
2010 Baseline Industrial Hygiene Survey
of
Systems Engineering Department
Naval Postgraduate School, Monterey
4 to 23 August 2010

Survey Conducted by: S. Eric Thurston,
Industrial Hygienist

Survey Reviewed and Approved by: Michael J. Puckett, MPH, REHS
Supervisory Industrial Hygienist
TABLE OF CONTENTS

Table of Contents Page 1
Executive Summary Page 2
Departmental Space Designations Page 4
Discussion, Findings and Recommendations Page 5
Appendix A, IH Exposure Assessment/Monitoring Plans Page 11
Appendix B, Air Sampling Results Page 23
Appendix C, Measured Equipment Noise Levels Page 24
Appendix D, Field Noise Survey Forms Page 25
Appendix E, Local Exhaust Ventilation Systems Evaluation Page 30
Appendix F, Respiratory Protection Program Matrix Page 31
Appendix G, Medical Surveillance Program Matrix Page 32
Appendix H, Training Matrix Page 33
Appendix I, Room 201M, Mechanical Integration & Assembly, Room Sketch With Light Survey Results Page 34
Appendix J, Glossary Page 36
Appendix K, Change of Operation Notification Form Page 38
EXECUTIVE SUMMARY

1. The 2010 baseline industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was recently conducted to assess the occupational health portion of your NAVOSH Program.

2. The organization of the report is as follows:

   • Executive Summary
   • Departmental Space Designations
   • Discussion, Findings and Recommendations
   • IH Exposure Assessment/Monitoring Plans, Appendix A
   • Air Sampling Results, Appendix B
   • Measured Equipment Noise Levels, Appendix C
   • Field Noise Survey Forms, Appendix D
   • Local Exhaust Ventilation Systems Evaluation, Appendix E
   • Respiratory Protection Program Matrix, Appendix F
   • Medical Surveillance Program Matrix, Appendix G
   • Training Matrix, Appendix H
   • Light Survey Results, Appendix I
   • Standardized IH Glossary, Appendix J
   • Change of Operation Notification, Appendix K

3. Survey Assessment:

   a. The Biological Safety Cabinet located in the Room 224B Defense Applications Lab requires initial and annual certification prior to use. The Naval Industrial Hygiene community has no one currently available that possesses the expertise to conduct such certifications. A list of locally available and qualified outside personnel was provided to the departmental Laboratory Coordinator on 9 September 2010 so that the inspections and associated certifications can be completed. It is imperative that the initial certification be performed prior to use, and that the required annual cabinet recertification be performed annually thereafter.

   b. A light survey conducted in Room 201M identifies very low light levels during the morning hours; such low levels could possibly cause an injury during operation of machine or battery-powered hand tools. Supplemental lighting needs to be added to the room, the machine tools, and work benches.
EXECUTIVE SUMMARY (continued)

c. Air sampling during cutting of wood within Room 201M needs to be conducted for operations lasting 15 or more minutes to document wood dust exposures. The Industrial Hygienist needs to be contacted to schedule this air sampling when the next (rarely occurring) operation is conducted.

d. The Industrial Hygienist needs to be contacted when the band saw in Room 201M is repaired so required noise measurements can be conducted.

4. The cooperation and hospitality shown by Laboratory Coordinator, Juan Gonzalez, during the survey was highly appreciated.

5. Overall, the occupational health portion of the department’s NAVOSH Program is Excellent.
SPACE DESIGNATIONS
FOR SYSTEMS ENGINEERING DEPARTMENT ROOMS

BULLARD HALL, BUILDING 233, by room number

201L, Enterprise Systems Lab
201M, Mechanical Integration & Assembly
201P, Electrical Integration & Assembly
208, Ship/Combat Systems Lab
208A, Nuclear Detector Lab
212D, Lockheed Martin Lab
212E, Electro-Optical Sensor Systems Lab
221, Laser/LIDAR Lab
224A, Physical Systems Lab
224B, Defense Applications Lab
DISCUSSION, FINDINGS AND RECOMMENDATIONS

References:  (a) OPNAVINST 5100.23G  
(b) Navy Environmental Health Center Technical Manual, NEHC-TM6290.91-2, Revision B  
(c) IES Lighting Handbook, Application Volume, latest edition  
(d) TLVs and BEIs, Threshold Limit Values For Chemical Substances and Physical Agents, Biological Exposure Indices, ACGIH, latest edition

As required by Chapter 8 of reference (a), a baseline industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was conducted from 4 to 23 August 2010. The primary purpose of this survey was to identify and assess exposure to occupational hazards, review the occupational health portion of the NAVOSH program, and develop the required Exposure Monitoring Plan (EMP).

A. ENGINEERING CONTROLS: Engineering controls used in this department to reduce exposures include:

- use of temperature-controlled soldering irons to minimize the generation of airborne lead and other metal fumes
- engineering controls associated with use of lasers are discussed under the Non-Ionizing Radiation Control Program
- a biological safety cabinet used to eliminate exposure to biological spores and other related agents to be used in the future.

FINDING 66271-10-5-1: The department has a biological safety cabinet (BSC) located in the Room 224B, Defense Applications Lab, that has not been set up or in use.

RECOMMENDATION 66271-10-5-1: Prior to use, the cabinet must be initially and then annually certified as required by reference (b), Chapter 6, Section d(1). The Naval Industrial Hygiene community has no one currently available that possesses the expertise to conduct such certifications. A list of locally available and qualified outside personnel was provided to the departmental Laboratory Coordinator on 9 September 2010 so that the inspections and associated certifications can be completed. It is imperative that the initial certification be performed prior to use, and that the required annual cabinet recertification be performed annually thereafter. The department must refrain from using the BSC until it is properly certified.
A. **ENGINEERING CONTROLS** (continued):

**FINDING 66271-10-5-2:** A light survey of the Mechanical Integration and Assembly Room 201M was conducted out of concern that injury could occur during use of machine or battery-powered hand tools in this room in the early morning, where the operator of a machine tool may not be able to distinguish between the end of a material worked on and his/her hand, finger, or arm. The rooms of the Systems Engineering Department were erected in a space that was formerly an open bay in the department previously inhabiting this space. Overhead light standards barely extend into Room 201M, and in the morning little light is provided by the skylights inserted into the roof. A sketch with the light level readings noted is provided as Appendix I of this report. The recommended lighting levels for a Machine Shop working on items of small size are 50-75-100 footcandles, and in the early morning not even the lowest of these levels are reached.

**RECOMMENDATION 66271-10-5-2:** Submit a work order to the local Public Works Department to install ceiling lighting standards that are located completely within the boundaries of this room. Also ensure supplemental light is provided to all the machine tools through separate attached lamps similar to the lamp assembly currently present on the drill press. Equip the work benches where the battery-powered hand tools would be used with the same type of lamps except that they should be equipped with clamps (to attach to the bench table tops) so they could be moved and positioned where needed.

B. **HAZARDOUS MATERIAL CONTROL AND MANAGEMENT PROGRAM (HMCM):**

The department has many chemical products stored in the Room 224B Defense Applications Lab, but only a rubber cement, a two-part epoxy resin system, and the thread cutting oil used with the machine tools located in Room 201M are currently used within the department. The departmental Lab Coordinator has obtained Material Safety Data Sheets (MSDSs) for all of the products, and is awaiting assignment of unique identifier numbers to the MSDSs (as required by Chapter 7, paragraph 0702g(5) of reference (a)) by the NPS Hazardous Materials Program Manager. Complete hazardous materials inventory lists have been developed as required by Chapter 7, paragraph 0702g(4) of reference (a), and the identifier numbers will be added to the lists (to allow easy cross-referencing between the MSDS’s and the inventory lists) when they are provided to the departmental Lab Coordinator. All chemical products are properly stored in flammable, corrosive, or poison storage lockers. **Juan Gonzalez, the departmental Lab Coordinator, is to be congratulated on administering an excellent program, which serves as a role model.**
B. HAZARDOUS MATERIAL CONTROL AND MANAGEMENT PROGRAM (HMCM)
(continued):

FINDING 66271-10-5-3: The departmental Lab Coordinator indicates that there is the potential for cutting of wood using a battery-powered hand-held jig saw and/or band saw up to 1 hour per day, once per year. As such, air samples of an operation of this length need to be collected to document wood dust exposures.

RECOMMENDATION 66271-10-5-3: Contact the Industrial Hygienist when such a wood cutting operation of at least 15 minutes in duration is performed in this room so the air samples required by Chapter 8, section 0802d(1) of reference (a) can be collected.

C. RESPIRATORY PROTECTION PROGRAM (RPP): Operations requiring the use of respirators are not performed in this department, and personnel do not wear them on an elective basis.

D. NON-IONIZING RADIATION CONTROL PROGRAM: The sources of non-ionizing radiation include the following:

- microwave transmitter in the Room 208 Ship/Combat Systems Lab
- 3 class IIIb and one class IV lasers in the Room 221 Laser/LIDAR Lab
- 4 class II lasers in the Room 212E Electro-Optical Sensor Systems Lab

Laser radiation exposures above the TLVs during operation of the free space classes IIIb and IV lasers in Room 221 will be prevented when they are operational (which is not anticipated until the summer of 2011) by use of proper laser goggles, door interlocks (to be installed in the future by the local Public Works Department), and administrative control procedures, such as use of posted warning signs and a lighted laser hazard sign (again to be installed in the future by the local Public Works Department). The SOPs for laser use will be developed by the NPS GSEAS Laser Systems Safety Officer (LSSO) prior to laser use.

The blink mechanism of the eye will provide adequate protection against accidental exposure to laser radiation generated by class II lasers in the Room 212E Electro-Optical Sensor Systems Lab.

Microwave radiation TLVs do not exist for the microwave transmitters because of their extremely low power (15 mW).
E. HEARING CONSERVATION PROGRAM (HCP): The only 8-hour TWA noise exposure in this department that exceeds the Noise Occupation Exposure Limit (NOEL) is limited to the Lab Coordinator’s concurrent use of the mini-drill/milling machine and orbital jig saw in the 201M Mechanical Integration & Assembly Room. Students who may use this equipment would operate it for a much lesser amount of time per day, resulting in 8-hr TWA exposures which do not exceed the NOEL. Operators of all the machine and battery-powered hand tools in this room are instructed to wear hearing protection by the Lab Coordinator regardless of the equipment’s measured noise levels as an added safety precaution.

FINDING 66271-10-5-4: The Room 201M band saw was inoperable during the survey because of an apparent problem with the motor and/or belt, and it may be some time until it can be repaired. As such, the noise levels generated during use of the saw to cut wood and metal could not be measured.

RECOMMENDATION 66271-10-5-4: Contact the Industrial Hygienist when the band saw is operational to schedule the noise measurements required by Chapter 18, paragraph 1804a of reference (a).

FINDING 66271-10-5-5: The Room 201M Conair hair dryer, used as a heat gun to heat wire shrink tubing, generates noise above the Navy criterion level of 84 dBA at its high speed, which would require the use of hearing protection. The departmental Lab Coordinator indicates that it will only be used at its low speed, where the noise level is below the Navy noise criterion level, to minimize the noise exposure of the operator.

RECOMMENDATION 66271-10-5-5: Ensure that all users of the hair dryer are aware that it is to only be operated at low speed.

F. PERSONAL PROTECTIVE EQUIPMENT (PPE): The following PPE are staged and available for protection against potential health hazards associated with work center operations when these tasks commence. All PPE were found to be clean, serviceable, and properly stored except as noted below.
G. PERSONAL PROTECTIVE EQUIPMENT (PPE) (continued):

<table>
<thead>
<tr>
<th>PPE</th>
<th>PROCESS/PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser goggles</td>
<td>Future operation of class IIIb and IV lasers.</td>
</tr>
<tr>
<td>Ear plugs or muffs</td>
<td>Operation of any of the machine or battery-powered hand tools in the 201M Mechanical Integration &amp; Assembly Room.</td>
</tr>
<tr>
<td>N-Dex nitrile rubber or Longs vinyl exam gloves, chemical safety goggles, and faceshields</td>
<td>A variety of chemical products handled by departmental personnel or students.</td>
</tr>
<tr>
<td>Thermal gloves</td>
<td>Future handling of liquid nitrogen flasks</td>
</tr>
</tbody>
</table>

H. OCCUPATIONAL REPRODUCTIVE HAZARDS PROGRAM (ORHP):

Per reference (a), Chapter 29, reproductive hazards include:

- lead during minimal lead-tin soldering
- isopropanol (isopropyl alcohol) present as a minor ingredient in the Elmer’s Craft Bond Rubber Cement used to bond plastic parts of commercially available plastic models
- noise during operation of a variety of machine tools and battery-powered hand tools

Lead is a male and female hazard, and also presents a hazard to a developing fetus. Isopropyl alcohol presents a female reproductive hazard, while noise presents a hazard to developing fetuses. As discussed in Appendix A, the exposure assessment section of this report, significant exposures to the above chemicals are not expected.

I. ERGONOMICS: Repetitive tasks are not performed in this department. The departmental Lab Coordinator reports that the 24.5 pound lead bricks present in Room 208A, Nuclear Detector Lab, have been placed in designated permanent positions, and he does not anticipate that they will be handled or moved in the future. Therefore, as described, the bricks will not present a potential source of musculo-skeletal injuries.
J. MEDICAL SURVEILLANCE PROGRAM (MSP): See Appendix F for the Medical Surveillance Program Matrix, which provides guidance in which programs departmental personnel require enrollment. Note that enrollment in additional surveillance programs to comply with safety requirements may be prescribed by the NPS Safety and Occupational Health Office. **Note that the students or staff members other than the Lab Coordinator do not use the mini drill/milling machine or battery-powered orbital jig saw for enough time per any day that their noise exposure would be significant enough to require entry into the Noise medical surveillance program.**

K. OCCUPATIONAL HEALTH-RELATED TRAINING MATRIX: See Appendix G for the Training Matrix based on occupational health-related assessments conducted by the Industrial Hygienist. Additional training for safety-related hazards or requirements may be identified separately by the NPS Safety and Occupational Health Office, or as dictated by the Enterprise Safety Applications and Management System (ESAMS) when individual users log onto the system.
APPENDIX A

IH EXPOSURE ASSESSMENT/MONITORING PLAN

<table>
<thead>
<tr>
<th>WORKPLACE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization:</strong> Naval Postgraduate School, Monterey</td>
</tr>
<tr>
<td><strong>Location:</strong> Bldg 233, Rooms 201L &amp; 212D</td>
</tr>
<tr>
<td><strong>Workers:</strong> 1 staff, up to 20 students per class</td>
</tr>
</tbody>
</table>

**Operations:** The following laboratories are used for course demonstrations and individual student or staff research:

Room 201L, Enterprise Systems Lab: This laboratory supports experiments in the Enterprise Systems Engineering track courses. It provides network hardware, communication systems, and electronic measurement and analysis equipment, as well as multiple sensor types to provide input and network-controllable systems to utilize output.

Room 212D, Lockheed Martin Lab: This space is a computation lab that provides support for large-scale simulation, modeling, and systems engineering projects. The lab contains 24 student computer stations.

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IH EXPOSURE ASSESSMENT (EA)**

**NOISE:** There are no sources of hazardous noise in these labs.

**CHEMICALS:** Exposures to chemicals do not occur during performance of operations in these labs.

**ENGINEERING CONTROLS:** Not applicable.

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**RESPIRATORY PROTECTION:** Not required and not worn on an elective basis during operations listed above.

**MONITORING PLAN**

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable.

Signature: Signed/S. Eric Thurston, Industrial Hygienist

Date: 4 August 2010
**Organization:** Naval Postgraduate School, Monterey
**Dept:** Systems Engineering
**Room Description:** Mechanical Integration & Assembly Room

**Location:** Bldg 233, Room 201M

**Lab Coordinator:** Juan Gonzalez
**Phone:** 831-656-2374

**Workers:** 1-5 staff, up to 20 students per class

**Operations:** The departmental Lab Coordinator is the primary user of machine and battery-powered hand tools, and of chemical products in this room, but other users could include 4 other staff members and up to 20 students per class at any one time during the year. This room provides the tools and materials to support the fabrication, assembly, and integration of mechanical and structural components of complex systems.

Machine tools within the lab includes a mini-lathe, mini-milling machine, a 15-inch drill press, a 15-inch band saw, a dual bench-top grinding wheel, dual blade bench-top cutting wheel, and a combination manual shear/brake/roll. Currently, only the drill press, lathe, band saw, and milling machine are operational; the other powered machine tools cannot be operated until they are hard-wired into the room’s electrical system (which is awaiting action by the local Public Works department). No layout dyes are applied to the copper and aluminum stock prior to machining. The friction produced by contact between the machine tools and metals are minimized by use of a thread cutting oil.

A battery-powered hand drill/driver is used to drill both wood and metal, and a battery-powered orbital jig saw is used to cut wood. Other battery-powered hand tools, including a circular saw, are only stored and not used at this time.

The materials worked on by the machine and/or hand tools include soft woods (particle board, plywood, and pine), acrylic, copper, aluminum, and thin brass sheeting on a small spool.

Fabricated acrylic parts are bonded together using a two-part epoxy resin delivered using a dual-tube syringe.

* = Reproductive Hazard

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/ DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini drill-mill</td>
<td>*Noise, metal dust</td>
<td>1-5</td>
<td>4 hrs/day max</td>
<td>No-EA Nse, Chem</td>
</tr>
<tr>
<td>Cutting oil</td>
<td>Oil mist</td>
<td>1-5</td>
<td>1x/3mos, 5ml/x</td>
<td>No-EA Chem</td>
</tr>
<tr>
<td>Batt tools</td>
<td>*Noise, wood dust</td>
<td>1-5</td>
<td>1x/yr, 1 hr/dy</td>
<td>No-Nse, Y-Chem</td>
</tr>
<tr>
<td>Epoxy resin</td>
<td>Methyl methacrylate</td>
<td>2-21</td>
<td>1x/wk, 5ml/x</td>
<td>No-EA Chem</td>
</tr>
</tbody>
</table>
IH EXPOSURE ASSESSMENT/MONITORING PLAN (continued)

WORKPLACE INFORMATION

<table>
<thead>
<tr>
<th>Organization:</th>
<th>Dept:</th>
<th>Room Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naval Postgraduate School</td>
<td>Systems Engineering</td>
<td>Mechanical Integration &amp; Assembly Room</td>
</tr>
</tbody>
</table>

IH EXPOSURE ASSESSMENT (EA)

NOISE: The measured noise level of the Craftman 15 Inch Drill Press and the Craftsman ½ Inch Hand Drill/Driver are below the Navy noise criterion level of 84 dBA.
- The measured noise level of the Conair hair dryer exceeds the Navy noise criterion level of 84 dBA, but the Lab Coordinator indicates it will only be used at the low speed, where the noise level does not exceed the Navy noise criterion level.
- The calculated combined 8 hr-TWA noise exposure from use of the Microlux All Inch Mini Drill/Milling Machine and the Craftsman orbital jig saw (which could be used the same day) by the Lab Coordinator exceeds the NOEL of 84 dBA based on their measured noise levels and durations of use. Therefore, noise dosimetry does not need to be conducted.

CHEMICALS: Because local exhaust ventilation is not used, air sampling to determine wood dust exposure levels will need to be collected during cutting of wood with the band saw or battery-powered jig saw.
- The cutting oil used when machining metal parts using either machine or hand tools will prevent metal dust or fume exposures from exceeding the OELs.
- Epichlorohydrin and other solvent exposures during use of the epoxy resins will not exceed the MSALs and OELs based on minimal usage.

PERSONAL PROTECTIVE EQUIPMENT (PPE): Ear plugs or muffs during use of all machine tools and battery-powered hand tools regardless of their noise levels.

ENGINEERING CONTROLS: None.

RESPIRATORY PROTECTION: Not required and not worn on an elective basis during operations listed above.

* = reproductive hazard

MONITORING PLAN

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT</th>
<th>METHOD OF MEASUREMENT</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood dust</td>
<td>2</td>
<td>FI</td>
<td>Initial</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: FI = gravimetric filter. The 2 samples include collection of a 15-minute STE and a TWA sample.

Signature: Signed/ S. Eric Thurston, Industrial Hygienist | Date: 23 August 2010
## IH EXPOSURE ASSESSMENT/MONITORING PLAN

### WORKPLACE INFORMATION

<table>
<thead>
<tr>
<th>Organization: Naval Postgraduate School, Monterey</th>
<th>Dept: Systems Engineering</th>
<th>Room Description: Electrical Integration &amp; Assembly Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: Bldg 233, Room 201P</td>
<td>Lab Coordinator: Juan Gonzalez</td>
<td>Phone: 831-656-2374</td>
</tr>
<tr>
<td>Workers: 1-5 staff, up to 20 students per class</td>
<td>Male: 1-5 staff, up to 20 students per class</td>
<td>Female: 0 staff, up to 20 students per class</td>
</tr>
</tbody>
</table>

### Operations:
This laboratory provides the tools, components, and test equipment to support the fabrication, assembly, and integration of electrical and electronic assemblies of complex systems. Lab equipment includes National Instruments proto-boards, two-channel oscilloscopes, 10MHz function generators and one lead-tin soldering station. 

*Lead-tin solder, which has flux integrated into it, is used; no chemical products are used for cleaning surfaces, or electronic or electrical contacts, prior to soldering.

* = reproductive hazard

### IH EXPOSURE ASSESSMENT (EA)

**NOISE:** There are no sources of hazardous noise in this lab.

**CHEMICALS:** *Lead and tin exposures during soldering are unlikely to exceed the AL and PEL for lead, and the MSAL and OEL for tin, based on monitoring data of similar operations performed elsewhere and use of-temperature-controlled soldering irons (which limit generation of lead fumes).*

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**ENGINEERING CONTROLS:** Temperature-controlled soldering irons.

**RESPIRATORY PROTECTION PROGRAM:** Not required and not worn on an elective basis during operations listed above.

* = reproductive hazard

### MONITORING PLAN

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soldering</td>
<td>*Lead, tin fumes</td>
<td>1-5</td>
<td>Once/3mos, 1 hour</td>
<td>No-EA Chem</td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

Signature: Signed/S. Eric Thurston, Industrial Hygienist

Date: 23 August 2010
**Organization:** Naval Postgraduate School, Monterey  
**Dept:** Systems Engineering  
**Room Description:** Ship/Combat Systems Lab

**Location:** Bldg 233, Room 208  
**Lab Coordinator:** Juan Gonzalez  
**Phone:** 831-656-2374

**Workers:** 1 staff, up to 20 students per class  
**Male:** 1 staff, up to 20 students per class  
**Female:** 0 staff, up to 20 students per class

**Operations:** This laboratory supports experiments in the Ship Systems and Combat Systems track courses. It hosts a variety of active and passive microwave, infrared, acoustic, and magnetic sensor hardware, weapon subsystems and simulators of weapon systems, and devices permitting the investigation of platform characteristics. Equipment includes UHF function generators, microwave transmitters and receivers, and magnetic sensors.

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitters</td>
<td>Microwave radiatn</td>
<td>2-21</td>
<td>6wks/yr, 1hr/wk</td>
<td>No-EA Physical</td>
</tr>
</tbody>
</table>

**IH EXPOSURE ASSESSMENT (EA)**

**NOISE:** There are no sources of noise in this lab.

**CHEMICALS:** Chemical products are not used during performance of the operations described above.

**PHYSICAL AGENTS:** The microwave radiation TLVs do not exist for the microwave transmitters because of their extremely low power (15 mW).

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**ENGINEERING CONTROLS:** None.

**RESPIRATORY PROTECTION PROGRAM:** Not required and not worn on an elective basis during operations listed above.

**MONITORING PLAN**

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

**Signature:** Signed/S. Eric Thurston, Industrial Hygienist  
**Date:** 23 August 2010
**IH EXPOSURE ASSESSMENT/MONITORING PLAN**

**WORKPLACE INFORMATION**

<table>
<thead>
<tr>
<th>Organization:</th>
<th>Naval Postgraduate School, Monterey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept:</td>
<td>Systems Engineering</td>
</tr>
<tr>
<td>Room Description:</td>
<td>Nuclear Detector Lab</td>
</tr>
<tr>
<td>Location:</td>
<td>Bldg 233, Room 208A</td>
</tr>
<tr>
<td>Lab Coordinator:</td>
<td>Juan Gonzalez</td>
</tr>
<tr>
<td>Phone:</td>
<td>831-656-2374</td>
</tr>
<tr>
<td>Workers:</td>
<td>1 staff, up to 20 students per class</td>
</tr>
<tr>
<td>Male:</td>
<td>1 staff, up to 20 students per class</td>
</tr>
<tr>
<td>Female:</td>
<td>0 staff, up to 20 students per class</td>
</tr>
</tbody>
</table>

**Operations:** This laboratory supports experiments involving detection of nuclear radiation. It hosts a variety of low-level radioactive sources housed in a locker, five detector systems and signal processing electronics, and shielding against background radiation. The radioactive sources are stored and issued by the NPS Radiation Safety Officer (RASO), and are only present in this room during actual performance of experiments. The radioactive sources are part of a kit, which involves aluminum discs and an ionizing radiation solution, and they emit low levels of gamma rays. Shielding is provided by use of lead bricks. Lead pellets kept in small plastic containers (which are stored in a “Poisons Locker”) are used to add weight to parts used during experiments conducted both in this and other departmental rooms.

* = reproductive hazard

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead pellets</td>
<td>*Lead</td>
<td>2-22</td>
<td>2 mins/time</td>
<td>No-EA Chem</td>
</tr>
</tbody>
</table>

**IH EXPOSURE ASSESSMENT (EA)**

**NOISE:** There are no sources of noise in this lab.

**CHEMICALS:** *Lead exposure from handling of lead bricks and pellets is not expected to exceed the AL and PEL since they are not heated or mechanically acted upon, and they are not moved, having been placed in positions on the room’s benches that are not anticipated to be changed.

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**ENGINEERING CONTROLS:** Use of lead bricks for shielding of personnel from ionizing radiation.

**RESPIRATORY PROTECTION PROGRAM:** Not required and not worn on an elective basis during operations listed above.

**ERGONOMICS:** The departmental Lab Coordinator reports that the 24.5 pound lead bricks have been positioned on the benches where needed, and he does not foresee the need for them to be handled or moved in the future.
<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

Signature: Signed/ S. Eric Thurston, Industrial Hygienist

Date: 16 August 2010
**IH EXPOSURE ASSESSMENT/MONITORING PLAN**

**WORKPLACE INFORMATION**

<table>
<thead>
<tr>
<th>Organization:</th>
<th>Naval Postgraduate School, Monterey</th>
<th>Dept:</th>
<th>Systems Engineering</th>
<th>Room Description:</th>
<th>Electro-Optical Sensor Systems Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Bldg 233, Room 212E</td>
<td>Lab Coordinator:</td>
<td>Juan Gonzalez</td>
<td>Phone:</td>
<td>831-656-2374</td>
</tr>
<tr>
<td>Workers:</td>
<td>1 staff, up to 20 students per class</td>
<td>Male: 1 staff, up to 20 students per class</td>
<td>Female: 0 staff, up to 20 students per class</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operations:** This laboratory supports experiments involving electro-optical sensors that require complete darkness for some measurements. Equipment includes night-vision equipment, thermal imagers, rangefinders, and four Class II lasers.

* = reproductive hazard

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II lasers</td>
<td>Laser radiation</td>
<td>2-21</td>
<td>Varies</td>
<td>No-EA Physical</td>
</tr>
</tbody>
</table>

**IH EXPOSURE ASSESSMENT (EA)**

**NOISE:** There are no sources of noise in this lab.

**CHEMICALS:** Chemical products are not used during performance of the operations described above.

**PHYSICAL AGENTS:** The blink mechanism of the eye will prevent ocular injury from accidental exposure to class II laser beams.

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**ENGINEERING CONTROLS:** None.

**RESPIRATORY PROTECTION PROGRAM:** Not required and not worn on an elective basis during operations listed above.

**MONITORING PLAN**

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

**Signature:** Signed/ S. Eric Thurston, Industrial Hygienist  
**Date:** 16 August 2010
### Workplace Information

<table>
<thead>
<tr>
<th>Organization</th>
<th>Naval Postgraduate School, Monterey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept</td>
<td>Systems Engineering</td>
</tr>
<tr>
<td>Room Description</td>
<td>Laser/LIDAR Lab</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Bldg 233, Room 221</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Manager</td>
<td>Juan Gonzalez</td>
</tr>
<tr>
<td>Phone</td>
<td>831-656-2374</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Workers</th>
<th>2 staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2 staff</td>
</tr>
<tr>
<td>Female</td>
<td>2 staff</td>
</tr>
</tbody>
</table>

**Operations:** This laboratory provides a facility for the safe conduct of experiments that involve laser sources. It provides optical tables, breadboard optical hardware, laser measurement equipment, and use of one Class IIIb argon ion laser, two class IIIb diode lasers, and one class IV carbon dioxide laser. **This lab is not expected to be operational until the summer of 2011.**

### Work Task

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class IIIb/IV lasers</td>
<td>Laser radiation</td>
<td>2</td>
<td>Not operated yet</td>
<td>No-EA Physical</td>
</tr>
</tbody>
</table>

### IH Exposure Assessment (EA)

**Noise:** There are no sources of noise in this lab.

**Chemicals:** Chemical products are not anticipated to be used during performance of the operations described above.

**Physical Agents:** Laser radiation exposure above the TLVs during operation of the free space classes IIIb and IV lasers will be prevented by use of proper laser goggles, door interlocks, and a lighted laser hazard sign (the latter two to be installed by the local Public Works department prior to the lab being operational). The SOPs for laser use will be developed by the NPS GSEAS Laser Systems Safety Officer (LSSO) (again prior to the lasers being operated).

**Personal Protective Equipment (PPE):** Laser safety goggles.

**Engineering Controls:** None.

**Respiratory Protection Program:** Not required and not anticipated to be worn on an elective basis during operations listed above.

### Monitoring Plan

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

**Signature:** Signed/
S. Eric Thurston, Industrial Hygienist

**Date:** 8 August 2010
**IH EXPOSURE ASSESSMENT/MONITORING PLAN**

**WORKPLACE INFORMATION**

<table>
<thead>
<tr>
<th>Organization:</th>
<th>Naval Postgraduate School, Monterey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept:</td>
<td>Systems Engineering</td>
</tr>
<tr>
<td>Room Description:</td>
<td>Physical Systems Lab</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Bldg 233, Room 224A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Coordinator:</td>
<td>Juan Gonzalez</td>
</tr>
<tr>
<td>Phone:</td>
<td>831-656-2374</td>
</tr>
</tbody>
</table>

**Workers:** 1 staff, up to 20 students per class  
**Male:** 1 staff, up to 20 students per class  
**Female:** 0 staff, up to 20 students per class

**Operations:** This laboratory supports experiments that elucidate the fundamental properties, characteristics, and interactions of mechanical, thermodynamic, and electromagnetic systems. The lab is equipped with multiple sets of PASCO science experiments as well as basic lab equipment such as power supplies and oscilloscopes. Mini-wind tunnels internally fabricated by the department, and consisting of glass columns mounted on vacuum motors, are used during lab experiments.

<table>
<thead>
<tr>
<th>WORK TASK</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-wind tunnel</td>
<td>*Noise</td>
<td>2-21</td>
<td>&lt;1 hour/day</td>
<td>No-EA Noise</td>
</tr>
</tbody>
</table>

**NOISE:** The measured noise level of the wind tunnel vacuum motors is far below the Navy criterion level of 84 dBA.

**CHEMICALS:** Chemical products are not used during performance of the operations described above.

**PERSONAL PROTECTIVE EQUIPMENT (PPE):** None worn during the operations described above.

**ENGINEERING CONTROLS:** None.

**RESPIRATORY PROTECTION PROGRAM:** Not required and not worn on an elective basis during operations listed above.

**MONITORING PLAN**

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable

**Signature:** Signed/S. Eric Thurston, Industrial Hygienist  
**Date:** 16 August 2010
### IH EXPOSURE ASSESSMENT/MONITORING PLAN

#### WORKPLACE INFORMATION

| Organization          | Dept: Systems Engineering | Room Description:  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Naval Postgraduate School, Monterey</td>
<td></td>
<td>Defense Applications Lab</td>
</tr>
<tr>
<td><strong>Location:</strong> Bldg 245, Room 224B</td>
<td><strong>Lab Coordinator:</strong> Juan Gonzalez</td>
<td><strong>Phone:</strong> 831-656-2374</td>
</tr>
<tr>
<td><strong>Workers:</strong> Unknown at this time</td>
<td><strong>Male:</strong> Unknown at this time</td>
<td><strong>Female:</strong> Unknown at this time</td>
</tr>
</tbody>
</table>

**Operations:** This laboratory is currently not operational, but will support experiments involving wet chemistry, microorganisms, and/or biological materials. It will provide facilities and equipment for simple chemical synthesis, chemical analysis, electrochemistry, microbial culture, microscopy, DNA analysis, and other biotechnologies. Equipment present includes four tabletop laminar flow hoods, one carbon filter hood, and one Purifier biological safety cabinet (which will be used to control exposure to bacterial spores). The laboratory also houses one corrosives locker, one “poisons” locker, and two flammables locker as well as a chemical-only storage refrigerator. Currently the only chemical products being used (in other rooms) are the rubber cement used for bonding plastics parts of commercially-available models (such as plastic jet airplanes) used during experiments, and the cutting fluid used when machining metals in the Mechanical Integration and Assembly Room 201M. The chemical products and the the personal protective equipment present in this room are available for use in any of the departmental labs.

### IH EXPOSURE ASSESSMENT/MONITORING PLAN

#### WORK TASK

<table>
<thead>
<tr>
<th>Exact tasks cannot be identified at this time since the room is not operational yet</th>
<th>POTENTIAL HAZARD</th>
<th>WORKERS INVOLVED</th>
<th>FREQUENCY/DURATION</th>
<th>MONITORING RECOMMENDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same for the potential hazards</td>
<td>Unknown at this time</td>
<td>Cannot be provided as this time</td>
<td>Cannot be determined at this time</td>
<td></td>
</tr>
</tbody>
</table>

#### IH EXPOSURE ASSESSMENT (EA)

**NOISE:** There are no sources of noise in this lab.

**CHEMICALS:** Chemical exposure assessments cannot be made at this time since the exact chemicals to be used, frequency and duration of use, and other necessary information is not available at this time since the room is not operational except for storage and issue of the chemical products discussed above (and since they are used in another room, their exposure assessment is found with the Appendix A form for that room).
### IH EXPOSURE ASSESSMENT/MONITORING PLAN (continued)

#### WORKPLACE INFORMATION

<table>
<thead>
<tr>
<th>Organization</th>
<th>Dept</th>
<th>Room Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naval Postgraduate School, Monterey</td>
<td>Systems Engineering</td>
<td>Defense Applications Lab</td>
</tr>
</tbody>
</table>

#### PERSONAL PROTECTIVE EQUIPMENT (PPE): N-Dex nitrile rubber and Longs vinyl exam gloves, chemical safety goggles, and faceshields for handling of chemical or biological products, and thermal gloves to be used for handling of flasks that are to be used to transport liquid nitrogen from the dispensing cylinders in the adjacent Watkins Hall.

#### ENGINEERING CONTROLS: Four tabletop laminar flow hoods, one carbon filter hood, and one Purifier biological safety cabinet. **Note that the Industrial Hygienist lacks the expertise and specialized equipment necessary to perform the required initial and annual certifications of the biological safety cabinet.**

#### RESPIRATORY PROTECTION PROGRAM: At this time, future operations to be performed here are not anticipated to require the use of respirators.

<table>
<thead>
<tr>
<th>POTENTIAL HAZARD</th>
<th>NUMBER OF MEASUREMENTS</th>
<th>METHOD OF MEASUREMENT 1</th>
<th>METHOD OF MEASUREMENT 2</th>
<th>FREQUENCY (per year)</th>
<th>MAN-HOURS (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the following codes: not applicable at this time.

Signature: Signed/
S. Eric Thurston, Industrial Hygienist

Date: 4 August 2010
Air sampling to determine chemical exposure levels, or use of personal noise monitors to determine 8-hour TWA noise exposures, have not been conducted to date.
APPENDIX C
MEASURED EQUIPMENT NOISE LEVELS

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SOURCE</th>
<th>READING</th>
<th>HAZARD</th>
<th>RADIUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bldg 233, Room 201M</td>
<td>Microlux Mini Drill/Milling Machine</td>
<td>84 dBA</td>
<td>1 ft</td>
<td></td>
</tr>
<tr>
<td>Mech Int &amp; Assembly</td>
<td>-at idle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-under load (aluminum)</td>
<td>88 dBA</td>
<td>4 ft</td>
<td></td>
</tr>
<tr>
<td>ConAir Hair Dryer</td>
<td>Craftsman 15 Inch Drill Press</td>
<td>70 dBA</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>(used as heat gun)</td>
<td>-high speed</td>
<td>85 dBA</td>
<td>1 ft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-low speed</td>
<td>77 dBA</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Craftsman ½ Inch Hand</td>
<td>Craftsman Orbital Jig Saw</td>
<td>90 dBA</td>
<td></td>
<td>6 ft</td>
</tr>
<tr>
<td>(Self-fabricated) Mini-Wind Tunnel</td>
<td>室制迷你风洞</td>
<td>73 dBA</td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

Physical Systems Lab
## INDUSTRIAL HYGIENE NOISE SURVEY FORM

**Date:** 9 Aug 10  
**IH UIC:** 39162  
**Activity:** Naval Postgraduate School, Monterey, Systems Eng Dept

**Shop Location:** Bldg 233, Rm 201M  
**Shop Name:** Mech Integrtn & Assembly

### Sound Level Meter Results

<table>
<thead>
<tr>
<th>Source Description</th>
<th>Item #</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microlux All Inch Mini Drill/Mill Machine (idle)</td>
<td>No model # Or S/N</td>
<td>None</td>
<td>None</td>
<td>S/N G0536</td>
</tr>
<tr>
<td>ConAir Hair Dryer (Used As Heat Gun) (High Speed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craftsman Model 315.115410 Orbital Jig Saw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Noise Pattern:  
C = Continuous  
IN = Intermittent  
IM = Impulse/Impact | XC | XC | XC | XC | XC |
| Noise Source Labeled | Yes | Yes | Yes | Yes | Yes |
| No | No | X | X | X |
| Noise Radius (ft) | 1 | 4 | 2 | N/A | 6 |
| Meter Response  
F = Fast  
S = Slow  
I = Impulse/Impact | F | F | F | F | F |
| Results | 84 dBA | 88 dBA | 85 dBA | 77 dBA | 90 dBA |

The ConAir Heat gun will be operated only at low speed to minimize operator’s noise exposure. The noise levels of the mini drill/milling machine and jig saw exceed the Navy noise criterion level, and require the use of either ear plugs or muffs during their operation.
Date: 9 Aug 10  IH UIC: 39162  Activity: Naval Postgraduate School, Monterey, Systems Eng Dept
UIC: 62771
Shop Location: Bldg 233, Rm 201M  Shop Name: Mech Integrtn & Assembly

Area Posted: Yes ( Single or Double)  No
Hearing Protection In Use: Yes  No

### Sound Level Meter Results

<table>
<thead>
<tr>
<th>Item #</th>
<th>#4</th>
<th>#5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Description</td>
<td>Craftsman Model 152.229000 15 Inch Drill Press</td>
<td>Craftsman ½ Inch Model 315.115410 Hand Drill/Driver (under load)</td>
</tr>
<tr>
<td>Machine#/USN#</td>
<td>S/N 0544-W</td>
<td>S/N BD 0536</td>
</tr>
<tr>
<td>Noise Pattern: C = Continuous IN = Intermittent IM = Impulse/Impact</td>
<td>XC</td>
<td>XC</td>
</tr>
<tr>
<td>XC</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>IM</td>
<td>IM</td>
<td>IM</td>
</tr>
<tr>
<td>Noise Source Labeled</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>XNo</td>
<td>XNo</td>
<td>XNo</td>
</tr>
<tr>
<td>Noise Radius (ft)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Meter Response F = Fast S = Slow I = Impulse/Impact</td>
<td>F XS I</td>
<td>F XS I</td>
</tr>
<tr>
<td>Results</td>
<td>70 dBA</td>
<td>77 dBA</td>
</tr>
</tbody>
</table>

The noise levels of the drill press and hand drill/drive do not exceed the Navy criterion level, and no corrective is necessary.
<table>
<thead>
<tr>
<th>SOUND LEVEL METER</th>
<th>MICROPHONE</th>
<th>CALIBRATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mfg:</strong> SIMPSON</td>
<td><strong>Mfg:</strong> SIMPSON</td>
<td><strong>Mfg:</strong> SIMPSON</td>
</tr>
<tr>
<td><strong>Model:</strong> 886-2</td>
<td>Serial #: 007336</td>
<td><strong>Model:</strong> 890-2</td>
</tr>
<tr>
<td><strong>Last Electro-acoustic Cal Date:</strong> 28 Jun 10</td>
<td><strong>Next Electro-acoustic Cal Date:</strong> 28 Jun 11</td>
<td><strong>Last Electro-acoustic Cal Date:</strong> 28 Jun 10</td>
</tr>
<tr>
<td><strong>Field Calibration:</strong> Pre Cal Date:</td>
<td>Post Cal Date:</td>
<td><strong>Field Calibration:</strong> Pre Cal Date:</td>
</tr>
<tr>
<td>Yes</td>
<td>9 August 2010</td>
<td>Yes</td>
</tr>
<tr>
<td>Field Calibration OK:</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Measurements Obtained:</strong></td>
<td>Indoors</td>
<td>Outdoors</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wind Screen:</strong></td>
<td>Used</td>
<td>Not Used</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Sampler:</strong> Eric Thurston</td>
<td><strong>Date Completed:</strong> 9 August 2010</td>
<td></td>
</tr>
<tr>
<td><strong>Reviewing IH:</strong> Michael J. Puckett</td>
<td><strong>Date Reviewed:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Data Entered By:</strong> Eric Thurston</td>
<td><strong>Date Entered:</strong> 9 August 2010</td>
<td></td>
</tr>
</tbody>
</table>
## INDUSTRIAL HYGIENE NOISE SURVEY FORM

<table>
<thead>
<tr>
<th>Date: 11 Aug 10</th>
<th>IH UIC: <em>39162</em></th>
<th>Activity: Naval Postgraduate School, Monterey, Systems Eng Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIC: <em>62771</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop Location:</td>
<td>Bldg 233, Rm 224A</td>
<td>Shop Name: Physical Systems Lab</td>
</tr>
</tbody>
</table>

Area Posted: [ ] Yes ( [ ] Single or [ ] Double) [X] No

Hearing Protection In Use: [ ] Yes [X] No

### Sound Level Meter Results

<table>
<thead>
<tr>
<th>Item #</th>
<th>#1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Description</td>
<td>(Self-fabricated) Mini Wind Tunnel</td>
</tr>
<tr>
<td>Machine#/USN#</td>
<td>None</td>
</tr>
<tr>
<td>Noise Pattern:</td>
<td>C = Continuous, IN = Intermittent, IM = Impulse/Impact</td>
</tr>
<tr>
<td>Noise Source Labeled</td>
<td>Yes [X] No</td>
</tr>
<tr>
<td>Noise Radius (ft)</td>
<td>N/A</td>
</tr>
<tr>
<td>Meter Response</td>
<td>F = Fast, XS = Impulse/Impact</td>
</tr>
<tr>
<td>Results</td>
<td>73 dBA</td>
</tr>
</tbody>
</table>

There are several mini wind tunnels in this room which are fabricated within the department using a vacuum motor at the bottom, which is the noise source. Because the noise level is below the Navy noise criterion level of 84 dBA, hearing protection is unnecessary.
<table>
<thead>
<tr>
<th><strong>SOUND LEVEL METER</strong></th>
<th><strong>MICROPHONE</strong></th>
<th><strong>CALIBRATOR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mfg: SIMPSON</td>
<td>Mfg: SIMPSON</td>
<td>Mfg: SIMPSON</td>
</tr>
<tr>
<td>Model: 886-2</td>
<td>Serial #: 007336</td>
<td>Model: 30394</td>
</tr>
<tr>
<td>Last Electro-acoustic</td>
<td>Cal Date: 28 Jun 10</td>
<td>Last Electro-acoustic</td>
</tr>
<tr>
<td>Field Calibration:</td>
<td>Pre Cal Date: 11 August 2010</td>
<td>Post Cal Date: 11 August 2010</td>
</tr>
<tr>
<td>Field Calibration OK:</td>
<td>X Yes</td>
<td>No</td>
</tr>
<tr>
<td>Measurements Obtained:</td>
<td>X Indoors</td>
<td></td>
</tr>
<tr>
<td>Wind Screen:</td>
<td>Used</td>
<td>X Not Used</td>
</tr>
<tr>
<td>Sampler:</td>
<td>X Eric Thurston</td>
<td>Date Completed: 11 August 2010</td>
</tr>
<tr>
<td>Reviewing IH:</td>
<td>Michael J. Puckett</td>
<td>Date Reviewed:</td>
</tr>
<tr>
<td>Data Entered By:</td>
<td>X Eric Thurston</td>
<td>Date Entered: 11 August 2010</td>
</tr>
</tbody>
</table>
APPENDIX E
LOCAL EXHAUST VENTILATION SYSTEM EVALUATION

Not applicable. The air flow rate of the biological safety cabinet will be assessed during its certification by a qualified person at a future time.
APPENDIX F
RESPIRATORY PROTECTION PROGRAM MATRIX

Respirators are not required and are not worn on an elective basis during departmental operations.
### DESIGNATED PERSONNEL

| Room 221 Laser/LIDAR Lab operation of class IIIB or IV lasers (future operation) | Laser Radiation (Program 506) |
| Lab Coordinator’s use of machine tools/battery-powered hand tools | Noise (Program 503) |

- Exams can be scheduled with the Presidio of Monterey, Army Medical Clinic, Occupational Health Department. Please contact Ms. Flora Delapena, Occupational Health Nurse, at 831-242-4532, e-mail flora.delapena@us.army.mil.

- Questions about the specifics of the Laser Radiation medical surveillance exams should be addressed to the GSEAS Laser Radiation Systems Safety Coordinator, Mr. Kerry Yarber, Physics Department Lab Manager at 831-656-3886, ryarber@nps.edu.

- Only baseline and termination exams are necessary for the Laser Radiation program unless there is an eye exposure incident, where an immediate exam is necessary.

- The Noise exam is required yearly.
## APPENDIX H
### OCCUPATIONAL HEALTH-RELATED TRAINING MATRIX

**COMMAND:** Naval Postgraduate School, Monterey  
**DATE:** August 2010  
**DEPARTMENT:** Systems Engineering

<table>
<thead>
<tr>
<th>PROCESS</th>
<th>ESAMS TRAINING MODULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Manager use of machine and battery-powered hand tools</td>
<td>Hearing Conservation (110), PPE (Initial Only) 1398</td>
</tr>
<tr>
<td>Student use of machine and battery-powered hand tools</td>
<td>PPE (Initial Only) 1398</td>
</tr>
<tr>
<td>Handling of lead bricks or lead pellets</td>
<td>Lead Awareness (322), Occupational Reproductive Awareness (1242), Back Injury Prevention Training (40)</td>
</tr>
<tr>
<td>Lead-tin soldering</td>
<td>Lead Awareness (322), Occupational Reproductive Awareness (1242)</td>
</tr>
<tr>
<td>Use of Elmer’s Craft Bond Rubber Cement</td>
<td>Occupational Reproductive Awareness (1242)</td>
</tr>
<tr>
<td>(Future) Handling of anthrax spores</td>
<td>Anthrax Exposure and Awareness (1071)</td>
</tr>
<tr>
<td>Use of latex, nitrile rubber, or similar gloves for handling chemical products</td>
<td>PPE (Initial Only) 1398</td>
</tr>
<tr>
<td>(Future) use of laser goggles</td>
<td>PPE (Initial Only) 1398</td>
</tr>
<tr>
<td>Use of safety glasses or faceshields</td>
<td>PPE (Initial Only) 1398</td>
</tr>
<tr>
<td>Hazardous Materials Use</td>
<td>HAZCOM Initial Training (1169)<em>, HAZCOM Training For Supervisors (1058)</em></td>
</tr>
</tbody>
</table>

All training is required annually except as noted.

* Per Chapter 6, Appendix 6-B of OPNAVINST 5100.23 personnel also need to receive documented initial training covering their work center’s MSDSs, with MSDS training repeated whenever new chemical products are introduced into the workplace.
APPENDIX I, LIGHT SURVEY
ROOM 201M, MECHANICAL INTEGRATION AND ASSEMBLY
# APPENDIX J
## GLOSSARY

<table>
<thead>
<tr>
<th>TERM</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Action Level - Normally half of PEL. Exposure level at which air sampling, employee training, and medical surveillance are required.</td>
</tr>
<tr>
<td>ACGIH</td>
<td>American Conference of Government Industrial Hygienist</td>
</tr>
<tr>
<td>AC/HR</td>
<td>Air Changes Per Hour</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AQS</td>
<td>Air Quality Standard</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigeration, and Air Conditioning Engineers</td>
</tr>
<tr>
<td>ASTC</td>
<td>Aviation Survival Training Center</td>
</tr>
<tr>
<td>C</td>
<td>Ceiling - Toxic material exposure level which cannot be exceeded for any length of time.</td>
</tr>
<tr>
<td>CFM</td>
<td>Cubic Feet Per Minute</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulation</td>
</tr>
<tr>
<td>EL</td>
<td>Excursion Limit - Concentration limit which cannot be exceeded at any time.</td>
</tr>
<tr>
<td>EAMP</td>
<td>Exposure Assessment/Monitoring Program. A program to evaluate workplace health hazards through surveys and exposure measurement.</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>ERT</td>
<td>Emergency Reclamation Team</td>
</tr>
<tr>
<td>FC</td>
<td>Footcandles</td>
</tr>
<tr>
<td>F/CC</td>
<td>Fibers Per Cubic Centimeter. A means for expressing airborne asbestos fiber concentrations.</td>
</tr>
<tr>
<td>FeA</td>
<td>Field Area</td>
</tr>
<tr>
<td>FiA</td>
<td>Filter Area</td>
</tr>
<tr>
<td>FPM</td>
<td>Feet Per Minute</td>
</tr>
<tr>
<td>FT3</td>
<td>Cubic Feet</td>
</tr>
<tr>
<td>HDI</td>
<td>Hexamethylene Diisocyanate</td>
</tr>
<tr>
<td>HEPA</td>
<td>High Efficiency Particulate Air</td>
</tr>
<tr>
<td>HM</td>
<td>Hazardous Material</td>
</tr>
<tr>
<td>HMC&amp;M</td>
<td>Hazardous Material Control and Management</td>
</tr>
<tr>
<td>HW</td>
<td>Hazardous Waste</td>
</tr>
<tr>
<td>IES</td>
<td>Illumination Engineering Society</td>
</tr>
<tr>
<td>IH</td>
<td>Industrial Hygiene</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
</tr>
<tr>
<td>LPM</td>
<td>Liters Per Minute</td>
</tr>
<tr>
<td>LOD</td>
<td>Limit of Detection</td>
</tr>
<tr>
<td>LOQ</td>
<td>Limit of Quantitation</td>
</tr>
<tr>
<td>MG/M3</td>
<td>Milligram Per Cubic Meter of air. A means of expressing concentrations of dust and metal fumes in the air.</td>
</tr>
<tr>
<td>TERM</td>
<td>MEANING</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MSAL</td>
<td>Medical Surveillance Action Level. Concentration of air contaminant at</td>
</tr>
<tr>
<td></td>
<td>which medical surveillance examinations must be provided to exposed</td>
</tr>
<tr>
<td></td>
<td>personnel.</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Data Sheet. A form used by manufacturers to communicate</td>
</tr>
<tr>
<td></td>
<td>to users the chemical and physical properties of their products.</td>
</tr>
<tr>
<td>MSM</td>
<td>Medical Surveillance Matrix</td>
</tr>
<tr>
<td>NAVOSH</td>
<td>Navy Occupational Safety and Health</td>
</tr>
<tr>
<td>NEHC</td>
<td>Navy Environmental Health Center</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute of Occupational Safety and Health</td>
</tr>
<tr>
<td>OEL</td>
<td>Occupational Exposure Limit</td>
</tr>
<tr>
<td>OH/PM</td>
<td>Occupational Health/Preventive Medicine</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>OV</td>
<td>Organic Vapor</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>PPM</td>
<td>Parts Per Million. A means of expressing the concentration of gases and</td>
</tr>
<tr>
<td></td>
<td>vapors in the air.</td>
</tr>
<tr>
<td>PSI</td>
<td>Pounds Per Square Inch</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SQFT</td>
<td>Square Feet</td>
</tr>
<tr>
<td>STEL</td>
<td>Short Term Exposure Limit. A 15 minute time weighted average exposure</td>
</tr>
<tr>
<td></td>
<td>which should not be exceeded at anytime during a workday.</td>
</tr>
<tr>
<td>STRESSOR</td>
<td>Potential hazard (e.g. Noise, Chemicals, Dusts, etc.)</td>
</tr>
<tr>
<td>TLV</td>
<td>Threshold Limit Value. Established by ACGIH as levels of airborne</td>
</tr>
<tr>
<td></td>
<td>contaminants or physical hazards under which it is believed workers may</td>
</tr>
<tr>
<td></td>
<td>be exposed on a daily basis without adverse effect.</td>
</tr>
<tr>
<td>TWA</td>
<td>Time Weighted Average. A method of averaging varying concentrations</td>
</tr>
<tr>
<td></td>
<td>over a specified period of time, usually 8 hours.</td>
</tr>
<tr>
<td>UG</td>
<td>Microgram</td>
</tr>
<tr>
<td>VOL</td>
<td>Volume</td>
</tr>
<tr>
<td>&gt;</td>
<td>Greater Than</td>
</tr>
<tr>
<td>&lt;</td>
<td>Less Than</td>
</tr>
</tbody>
</table>
APPENDIX K

CHANGE OF OPERATION NOTIFICATION

Please use this form to notify the Industrial Hygienist of any changes to operations conducted by your department. The notification form needs to be completed and e-mailed to sethurst@nps.edu.

POINT OF CONTACT:
TELEPHONE: E-MAIL ADDRESS:

BLDG: COMMAND/DEPT: NPS Systems Engineering

WORK AREA: ROOM NUMBER(S):

SURVEY REPORT: 62771-10-5

INSTRUCTIONS TO FOREMAN/SUPERVISOR:

The industrial hygiene survey evaluated the potential hazards to your employees based on the operations existing at the time. When your operations change, the potential hazards can also change, and these new conditions must be evaluated. Please contact the Industrial Hygienist if any of the following occur:

a. New operations are performed    b. New chemical products

c. Increase in major chemical usage d. New equipment is used

e. Exposure frequency/time change    f. A change in exhaust ventilation

List any changes below.

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

Date forwarded: ________________