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From: Officer In Charge, Naval Medical Administrative Unit,
Monterey
To: Chairman, Systems Engineering Department, 777 Dyer Road,
Naval Postgraduate School, Monterey CA 93943
Subj: ANNUAL INDUSTRIAL HYGIENE SURVEY, SYSTEMS ENGINEERING
DEPARTMENT, NAVAL POSTGRADUATE SCHOOL, MONTEREY
Ref: (a) OPNAVINST 5100.23G, Chapter 8
Encl: (1) Industrial Hygiene Survey Report 62271-11-5

1. Per reference (a), an annual industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was conducted by the Naval Medical Administrative Unit, Monterey Industrial Hygienist on 21 July 2011. 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 update the required Exposure Monitoring Plan.

2. **Additional lighting still needs to be installed in the Mechanical Integration and Assembly Room 201M to avoid potential accidents from occurring during use of machine or battery-powered tools. 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.** .

3. If there are any changes in operations, please complete Appendix J and forward it to the NMAU 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
S. E. THURSTON
By direction

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2011 Annual Industrial Hygiene Survey
of
Systems Engineering Department
Naval Postgraduate School, Monterey
Report 62271-11-5
21 July 2011

Survey Conducted by:

S. Eric Thurston,
Industrial Hygienist

Survey Reviewed and Approved by:

Michael J. Puckett, MPH, REHS
Supervisory Industrial
Hygienist

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EXECUTIVE SUMMARY

1. The 2011 annual industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was recently conducted to assess the occupational health portion of the department's 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
- Local Exhaust Ventilation Systems Evaluation, Appendix D
- Respiratory Protection Program Matrix, Appendix E
- 29 CFR 1910.134, Appendix D, Mandatory, Information for Employees Using Respirators When Not Required Under the Standard, Appendix F
- Medical Surveillance Program Matrix, Appendix G
- Training Matrix, Appendix H
- Standardized IH Glossary, Appendix I
- Change of Operation Notification, Appendix J

3. Survey Assessment:

a. A light survey conducted in Room 201M during the previous survey identified 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. Since the previous survey, an energy conservation audit contracted by the local Public Works Department identified that lighting levels were adequate using that program's criterion. The department should request the NPS Safety and Occupational Health Office to generate an OSH Deficiency Finding on this situation to justify implementation of the recommendations to improve lighting since the low light levels can create an environment with a significant safety hazard.

b. The departmental Lab Coordinator needs to be scheduled for the Noise medical surveillance program as soon as possible, and class IIIB/IV laser operators need to be scheduled for Laser medical surveillance exams prior to their use.

EXECUTIVE SUMMARY (continued)

c. The Industrial Hygienist needs to be contacted when the band saw in Room 201M is repaired so required noise measurements can be conducted. It has not been repaired since the previous survey because of lack of funds.

d. The Biological Safety Cabinet located in the Room 224B Defense Applications Lab requires initial and annual certification prior to use. The cabinet has not been used since the previous survey and there are no current funds to support the certification process at this time. 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.

e. Air sampling during cutting of wood within Room 201M Still needs to be conducted for operations lasting 15 or more minutes to document wood dust exposures. This operation was not performed since the previous survey. The Industrial Hygienist needs to be contacted to schedule this air sampling when the next (rarely occurring) operation is conducted.

f. Users of dust masks worn by departmental personnel on an elective basis need to be annually provided required information and their issue and use needs to be coordinated with the NPS Respiratory Protection Program Manager.

4. The cooperation and hospitality shown by Laboratory Coordinator Juan Gonazalez 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, Autonomous 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) 29 CFR 1910.134
(e) 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), an annual industrial hygiene survey of the Systems Engineering Department, Naval Postgraduate School, Monterey was conducted on 21 July 2011. 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 and a small Fume Eliminator machine during soldering 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 62271-11-5-1: 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, with no change in status since the previous survey.

RECOMMENDATION 62271-11-5-1: Prior to use, the cabinet must be initially and then annually certified thereafter as required by Chapter 6, Section d(1) of reference (b). 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 cabinet until it is properly certified.

A. ENGINEERING CONTROLS (continued):

FINDING 62271-11-5-2: A light survey of the Mechanical Integration and Assembly Room 201M was conducted during the previous survey 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. On one end of the room, the overhead light standard barely extends into the room, and in the morning little light is provided by the skylights inserted into the roof. A sketch with the measured light levels was provided as Appendix I of the previous survey 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 is reached. Since the previous survey was conducted, an energy conservation program audit was performed by an outside company contracted by the local Public Works Department. The audit reported that lighting levels were adequate using that program's criteria. No work has been requested from the local Public Works Department following recommendations from the previous survey report because of this audit's findings and because funding is currently unavailable to support the lighting modifications to the room.

RECOMMENDATION 62271-11-5-2: The light survey performed using the safety criterion outweigh any energy conservation criterion. Because of the increased probability of injury during operation of the machine tools, this deficiency actually falls under the Occupational Safety Program rather than the Industrial Hygiene Program. The department needs to contact the NPS Safety and Occupational Health Director, Mr. Michael Berry, for clarification and consultation/coordination with the local Public Works Department to resolve this issue. A work order to the local Public Works Department is still recommended to install ceiling lighting standards that are located completely within the boundaries of this room. Procurement of supplemental light for all the machine tools through separate attached lamps similar to the lamp assembly currently present on the drill press is still recommended. 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. It is suggested that Mr. Berry's office be requested to generate an OSH Deficiency Finding on this situation to justify implementation of the recommendations to improve lighting since the low light levels can create an environment with a significant safety hazard.

A. 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, the thread cutting oil used with the machine tools located in Room 201M, and a new chemical product since the previous survey, rubbing alcohol, utilized for general chemical cleaning, are currently used within the department. The departmental Lab Coordinator has obtained Material Safety Data Sheets (MSDSs) for all of the products, and is complying with the local program requirement involving 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 Gonazalez, the departmental Lab Coordinator, is to be congratulated on administering an excellent program, which serves as a role model.**

FINDING 62271-10-5-3: 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. This operation was not conducted since the previous survey since the band saw has not been repaired and the process was not performed using the portable jig saw.

RECOMMENDATION 62271-10-5-3: 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. There are Drager N-95 Model 6737490 dust masks available for elective use during processes where department personnel may be exposed to house dust.

C. RESPIRATORY PROTECTION PROGRAM (RPP) (continued):

FINDING 62271-11-5-2: Chapter 15, paragraph 1503g of reference (a) requires that respirators (such as the dust masks described above) worn on an elective basis be issued and controlled by the activity Respiratory Protection Program Manager (RPPM). Chapter 15, paragraph 1503g(1) of reference (a) further requires that the users be annually provided with information contained within Appendix D of reference (d), the Federal Respirator Standard. The Drager dust masks were procured without the knowledge and control of the RPPM, and users have not been provided the required information.

RECOMMENDATION 62271-11-3-2: Contact the RPPM, Mr. Martin Catanese of the NPS Safety and Occupational Health Office, to coordinate compliance with the requirements summarized above. Appendix F, which consists of the required information, is provided as a one-time courtesy, but its documented annual provision needs to be coordinated with the RPPM.

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 2012) 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 published in reference (e) 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. 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 is only used at its low speed setting as recommended in the previous survey report since the noise level at that setting is below the Navy noise criterion level. This practice minimizes the noise exposure of the operator.

FINDING 62271-11-5-4: The Room 201M band saw was inoperable during both the previous and current surveys because of a problem with the motor and/or belt. As such, the noise levels generated during use of the saw to cut wood and metal could not be measured. The band saw has not been repaired since the previous survey because of lacks of funding.

RECOMMENDATION 62271-11-5-4: Contact the Industrial Hygienist when the band saw is operational to schedule the noise measurements required by Chapter 18, paragraph 1804a of reference (a).

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:

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

All PPE were found to be clean, serviceable, and properly stored.

G. 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
- isopropyl alcohol present in the rubbing alcohol used for general chemical cleaning
- 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 musculoskeletal injuries.

J. MEDICAL SURVEILLANCE PROGRAM (MSP): See Appendix G 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.**

FINDING 62271-11-5-5: The Lab Coordinator has not been scheduled for the Noise and Class IIIb/IV Laser medical surveillance exams since the previous survey as required by Chapter 8, paragraphs 0805a(2)(b) and 0808b of reference (a).

RECOMMENDATION 62271-11-5-5: The Lab Coordinator can schedule himself for the exams as outlined in Appendix G of this report since he is the lab supervisor. The NPS Laser Systems Safety Officer can be consulted on the Laser medical exam.

K. OCCUPATIONAL HEALTH-RELATED TRAINING MATRIX: See Appendix H 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		
WORKPLACE INFORMATION		
Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Miscellaneous Labs
Location: Bldg 233, Rooms 201L, 201P, 208, 208A, 212D, 212E, 224A	Lab Coordinator: Juan Gonzalez	Phone: 831-656-2374
Workers: 2 staff, up to 30 students per class and currently 6 summer interns, with the sex of the students and interns varying per class/time period	Male: 1 civilian and 1 enlisted military staff	Female: 0 staff
<p>Operations: <u>Room 201L, Autonomous Systems Lab:</u> Since the previous survey, the name of the Lab has changed from the Enterprise Systems Lab. Work on robots occurs in the lab, and the lab 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. There are no industrial hygiene stressors associated with the lab's processes. 4 of the current summer interns only perform work associated with this lab.</p> <p><u>Room 201P, Electrical Integration & Assembly Lab:</u> 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/electrical contacts, prior to soldering. In addition to the departmental Lab Coordinator, two of the current summer interns and the enlisted military assistant recently assigned to this department, conduct soldering.</p> <p><u>Room 208, Ship/ Combat Systems Lab:</u> 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.</p>		
<p>* = reproductive hazard</p>		

IH EXPOSURE ASSESSMENT/MONITORING PLAN

WORKPLACE INFORMATION

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Miscellaneous Labs
Location: Bldg 233, Rooms 201L, 201P, 208, 208A, 212D, 212E, 224A		

Operations (continued):

Room 208A, Nuclear Detector Lab: 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. The kits have not been used since the previous survey. 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.

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 computer stations. There are no industrial hygiene stressors associated with the lab's processes.

Room 212E, Electro-Optical Sensor Systems Lab: 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.

Room 224A, Physical Systems Lab: 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.

*** = reproductive hazard + = carcinogen**

WORK TASK	POTENTIAL HAZARD	WORKERS INVOLVD	FREQUENCY/DURATION	MONITORING RECOMMENDED?
Soldering	*Lead,tin fumes	4-8	Once/3mos,1 hr	No-EA Chem
Transmitters	Microwave radiatn	2-21	6wks/yr, 1hr/wk	No-EA Phys
Lead pellets	*Lead	2-21	2 mins/time	No-EA Chem
Radioctv srcs	*+Ionzng radtion	1-31	1x/yr, 20 mins	No-EA Phys
Class II lasers	Laser radiation	2-21	Highly varies	No-EA Phys
Mini wind tunnel	*Noise	2-21	< 1 hour/day	No-EA Noise

IH EXPOSURE ASSESSMENT/MONITORING PLAN**WORKPLACE INFORMATION**

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Miscellaneous Labs
Location: Bldg 233, Rooms 201L, 201P, 208, 208A, 212D, 212E, 224A		

IH EXPOSURE ASSESSMENT (EA)

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

CHEMICALS: *Lead and tin fume exposures in the Electrical Integration & Assembly Lab during *lead-tin 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) and a small Fume Eliminator machine. Note that since the previous survey, the new enlisted worker assigned to the department and 2 of the interns can be expected to perform lead-tin soldering.

-*Lead exposure from lead brick and pellet handling in the Nuclear Detector Lab is not expected to exceed the AL and PEL since they are not heated or mechanically acted upon, nor moved, having been placed in positions on the room's benches that are not anticipated to change.

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

- The blink mechanism of the eye will prevent ocular injury from accidental exposure to class II laser beams.

-Significant *+ionizing radiation exposure during use of radioactive sources is unlikely since their use occurs under the control procedures established by the NPS Radiation Safety Officer.

ENGINEERING CONTROLS: Temperature-controlled soldering irons.

-Use of a small Fume Eliminator machine during soldering.

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.

* = reproductive hazard + = carcinogen

IH EXPOSURE ASSESSMENT/MONITORING PLAN**WORKPLACE INFORMATION**

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Miscellaneous Labs
Location: Bldg 233, Rooms 201L, 201P, 208, 208A, 212D, 212E, 224A		

MONITORING PLAN

POTENTIAL HAZARD	NUMBER OF MEASUREMNTS	METHOD OF MEASUREMNT 1	METHOD OF MEASUREMNT 2	FREQUENCY (per year)	MAN-HOURS (per year)
None					

Use the following codes: not applicable.

Signature: Signed/
S. Eric Thurston, Industrial Hygienist

Date: 21 July 2011

IH EXPOSURE ASSESSMENT/MONITORING PLAN

WORKPLACE INFORMATION

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	Male: 1-5 staff, up to 20 students per class	Female: 0 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, just as noted during the previous survey, 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**

WORK TASK	POTENTIAL HAZARD	WORKERS INVOLVD	FREQUENCY/DURATION	MONITORING RECOMMENDED?
Machine tools	*Noise, metal dust	1-5	4 hrs/day max	No-EA Nse, Chem
Cutting oil	Oil mist	1-5	1x/3mos, 5ml/x	No-EA Chem
Batt tools	*Noise, wood dust	1-5	1x/yr, 1 hr/dy	No-Nse, Y-Chem
Epoxy resin	Methyl methacrylte	2-21	1x/wk, 5ml/x	No-EA Chem

IH EXPOSURE ASSESSMENT/MONITORING PLAN (continued)

WORKPLACE INFORMATION

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Mechanical Integration & Assembly Room
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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 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.

-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.**

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.

-Methyl methacrylate and other solvent exposures during use of the epoxy resin 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

POTENTIAL HAZARD	NUMBER OF MEASUREMENTS	METHOD OF MEASUREMENT 1	METHOD OF MEASUREMENT 2	FREQUENCY (per year)	MAN-HOURS (per year)
Wood dust	2	FI		Initial	8

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: 21 July 2011
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IH EXPOSURE ASSESSMENT/MONITORING PLAN

WORKPLACE INFORMATION

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Laser/LIDAR Lab
Location: Bldg 233, Room 221	Lab Manager: Juan Gonzalez	Phone: 831-656-2374
Workers: 2 staff	Male: 2 staff	Female: 2 staff

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 2012.**

WORK TASK	POTENTIAL HAZARD	WORKERS INVOLVD	FREQUENCY/DURATION	MONITORING RECOMMENDED?
Class IIIb/IV lasers	Laser radiation	2	Not operated yet	No-EA Physical

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

POTENTIAL HAZARD	NUMBER OF MEASUREMENTS	METHOD OF MEASUREMENT 1	METHOD OF MEASUREMENT 2	FREQUENCY (per year)	MAN-HOURS (per year)
None					

Use the following codes: not applicable

Signature: Signed/
S. Eric Thurston, Industrial Hygienist

Date: 21 July 2011

IH EXPOSURE ASSESSMENT/MONITORING PLAN

WORKPLACE INFORMATION

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Defense Applications Lab
Location: Bldg 245, Room 224B	Lab Coordinator: Juan Gonzalez	Phone: 831-656-2374
Workers: Unknown at this time	Male: Unknown at this time	Female: Unknown at this time

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, the cutting fluid used when machining metals in the Mechanical Integration and Assembly Room 201M, and rubbing alcohol used for general chemical cleaning. 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	POTENTIAL HAZARD	WORKERS INVOLVD	FREQUENCY/DURATION	MONITORING RECOMMENDED?
Exact tasks in most cases cannot be identified at this time since the room is not operational yet	Same for the potential hazards	Unknow at this time	Cannot be provided as this time	Cannot be determined at this time
Rubbing alchl	*Isoprpl alchl	Varies	<1 oz/day	No-see EA Chem

IH EXPOSURE ASSESSMENT (EA)

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

CHEMICALS: Except for the isopropyl alcohol and the 3 other chemical products used in other labs, 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

Organization: Naval Postgraduate School	Dept: Systems Engineering	Room Description: Defense Applications Lab
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IH EXPOSURE ASSESSMENT (EA) (continued)

CHEMICALS (continued): *Isopropyl alcohol exposures above the MSAL and OELs is not expected due to the extremely small usage rate.

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.

* = reproductive hazard

POTENTIAL HAZARD	NUMBER OF MEASUREMENTS	METHOD OF MEASUREMENT 1	METHOD OF MEASUREMENT 2	FREQUENCY (per year)	MAN-HOURS (per year)
None					

Use the following codes: not applicable at this time.

Signature: Signed/
S. Eric Thurston, Industrial Hygienist

Date: 21 July 2011

APPENDIX B
STRESSOR PERSONAL EXPOSURE SAMPLING RESULTS

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**

<u>LOCATION</u>	<u>SOURCE</u>	<u>READING</u>	<u>HAZARD RADIUS</u>
Bldg 233, Room 201M Mech Int & Assmby	Microlux Mini Drill/Milling Machine		
	-at idle	84 dBA	1 ft
	-under load (aluminum)	88 dBA	4 ft
	Craftsman 15 Inch Drill Press	70 dBA	N/A
	ConAir Hair Dryer (used as heat gun)		
	-high speed	85 dBA	1 ft
	-low speed	77 dBA	N/A
	Craftsman ½ Inch Hand Drive/Drill	77 dBA	N/A
Craftsman Orbital Jig Saw	90 dBA	6 ft	
Room 224A, Physical Systems Lab	(Self-fabricated) Mini-Wind Tunnel	73 dBA	N/A

APPENDIX D
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 external to the Navy at a future time.

APPENDIX E
RESPIRATORY PROTECTION PROGRAM MATRIX

Respirators are not required. Drager Model 6737490 N-95 Dust Masks are available and worn on an elective basis during procedures where personnel may be exposed to house dust.

APPENDIX F

29 CFR 1910.134, Appendix D, (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers.

However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

**APPENDIX G
MEDICAL SURVEILLANCE PROGRAM MATRIX**

COMMAND: Naval Postgraduate School, Monterey DATE: July 2011
DEPARTMENT: Systems Engineering

DESIGNATED PERSONNEL	MEDICAL SURVEILLANCE PROGRAM
Room 221 Laser/LIDAR Lab operation of class IIIB or IV lasers (future operation)	Laser Radiation (506)
Lab Coordinator's use of machine tools/battery-powered hand tools	Noise (503)

1. Occupational health examinations can be scheduled by contacting Ms. Flora Dela Pena, Occupational Health Nurse at the Presidio of Monterey, Army Medical Clinic. Her contact information is 831-242-4532, flora.delapena@us.army.mil. Their policy is to have the supervisor(s) contact them for scheduling instead of individuals scheduling themselves.

2. Only a Laser Radiation baseline and termination medical exam **would be necessary for those personnel who would, although unplanned and not foreseen for the near future, operate the class IIIb free space lasers currently in storage.** If there is an **accidental eye exposure incident during their use, an immediate exam would be necessary.** Enrollment in the Laser Safety medical surveillance program can also be determined by the NPS Laser Systems Safety Officer (LSSO). Questions about the specifics of the Laser Radiation Safety Program should be addressed to the GSEAS Laser Systems Safety Program Coordinator, Mr. Kerry Yarber.

3. Enrollment in the Radiation Safety medical surveillance program needs to occur under the guidance of the Radiation Safety Officer (RASO) since that person is considered to be the subject matter expert. **The frequency of the Ionizing Radiation exam is based on age:**

- less than 25 years old: periodic exam not required after initial exam
- 26 to 49 years old: every 5 years
- 50 to 59 years old: every 2 years
- more than 59 years old: annual

4. The Noise exam is required yearly.

**APPENDIX H
OCCUPATIONAL HEALTH-RELATED TRAINING MATRIX**

COMMAND: Naval Postgraduate School, Monterey DATE: July 2011
DEPARTMENT: Systems Engineering

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

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
GLOSSARY**

TERM	MEANING
AL	Action Level - Normally half of PEL. Exposure level at which air sampling, employee training, and medical surveillance are required.
ACGIH	American Conference of Government Industrial Hygienist
AC/HR	Air Changes Per Hour
ANSI	American National Standards Institute
AQS	Air Quality Standard
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASTC	Aviation Survival Training Center
C	Ceiling - Toxic material exposure level which cannot be exceeded for any length of time.
CFM	Cubic Feet Per Minute
CFR	Code of Federal Regulation
EL	Excursion Limit - Concentration limit which cannot be exceeded at any time.
EAMP	Exposure Assessment/Monitoring Program. A program to evaluate workplace health hazards through surveys and exposure measurement.
EPA	Environmental Protection Agency
ERT	Emergency Reclamation Team
FC	Footcandles
F/CC	Fibers Per Cubic Centimeter. A means for expressing airborne asbestos fiber concentrations.
FeA	Field Area
FiA	Filter Area
FPM	Feet Per Minute
FT3	Cubic Feet
HDI	Hexamethylene Diisocyanate
HEPA	High Efficiency Particulate Air
HM	Hazardous Material
HMC&M	Hazardous Material Control and Management
HW	Hazardous Waste
IES	Illumination Engineering Society
IH	Industrial Hygiene
L	Liter
LPM	Liters Per Minute
LOD	Limit of Detection
LOQ	Limit of Quantitation
MG/M3	Milligram Per Cubic Meter of air. A means of expressing concentrations of dust and metal fumes in the air.

APPENDIX I
GLOSSARY (continued)

TERM	MEANING
MSAL	Medical Surveillance Action Level. Concentration of air contaminant at which medical surveillance examinations must be provided to exposed personnel.
MSDS	Material Safety Data Sheet. A form used by manufacturers to communicate to users the chemical and physical properties of their products.
MSM	Medical Surveillance Matrix
NAVOSH	Navy Occupational Safety and Health
NEHC	Navy Environmental Health Center
NIOSH	National Institute of Occupational Safety and Health
OEL	Occupational Exposure Limit
OH/PM	Occupational Health/Preventive Medicine
OSHA	Occupational Safety and Health Administration
OV	Organic Vapor
PPE	Personal Protective Equipment
PPM	Parts Per Million. A means of expressing the concentration of gases and vapors in the air.
PSI	Pounds Per Square Inch
RF	Radio Frequency
SOP	Standard Operating Procedure
SQFT	Square Feet
STEL	Short Term Exposure Limit. A 15 minute time weighted average exposure which should not be exceeded at anytime during a workday.
STRESSOR	Potential hazard (e.g. Noise, Chemicals, Dusts, etc.)
TLV	Threshold Limit Value. Established by ACGIH as levels of airborne contaminants or physical hazards under which it is believed workers may be exposed on a daily basis without adverse effect.
TWA	Time Weighted Average. A method of averaging varying concentrations over a specified period of time, usually 8 hours.
UG	Microgram
VOL	Volume
>	Greater Than
<	Less Than

**APPENDIX J
CHANGE OF OPERATION NOTIFICATION**

Please use this form to notify the Industrial Hygienist of any changes to operations. This form needs to be completed and e-mailed to S. Eric Thurston, Industrial Hygienist, at sethurst@nps.edu.

POINT OF CONTACT:

TELEPHONE:

E-MAIL ADDRESS:

BLDG/ROOM #:

COMMAND/DEPARTMENT/SHOP:

INSTRUCTIONS:

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

- a. New operations with suspected health hazards are performed
- b. New chemical products are used (please attach a brief list and only the page(s) of associated MSDS's listing the product's manufacturer, product name, and the chemical ingredients)
- c. An increase in major chemical usage
- d. New equipment with potential noise hazards is used
- e. Other new equipment posing suspected or known health hazards, such as lasers, is used
- e. Exposure frequency and time changes of operations with potential or known health hazards
- f. A change in local exhaust ventilation systems

List any changes below.

Date forwarded: _____