



Excellence Award

THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

March 14, 2014



Northrop Grumman Electronic Systems

- Developer, manufacturer, integrator and supporter of advanced electronic and maritime systems for U.S. and international customers for national security and non-defense applications.
- Systems include high performance sensors and intelligence processing and navigation systems operating in all environments from undersea to outer space.
- Electronic sensors and systems ranging from radar and targeting systems to tactical ground stations and navigation systems.



Northrop Grumman Electronic Systems

- Our divisions:
 - Advanced Concepts and Technologies Division
 - ISR and Targeting Systems Division
 - Land and Self Protection Systems Division
 - Navigation and Maritime Systems Division
- 15 U.S. campuses
- More than 15,000 employees
- Sector Headquarters: Linthicum, Md.
 - ~4000 employees



Our Team

Name of Member	Discipline	Role within the Team
Kip Keenan	Sector Director of Environmental, Health, Safety & Fire Protection	Sector Director
Kevin M. O'Connor	Sector Manager of Industrial Hygiene	Sector Hearing Conservation Administrator
Nancy A. Hall	Industrial Hygienist	Hearing Conservation Program Administrator
James McNamara	Certified Industrial Hygienist	Sr. Field Industrial Hygienist
Susan Brunson	Manager, Medical & Health Services	Medical Supervisor
Stephanie Myers	Certified Occupational Hearing Conservationist	Audiogram Administrator

Our Team



From left to right: Kevin O'Connor, Sector HCP Admin; Margaret Maccubbin, Admin; Kip Keenan, Director EHSFP; Nancy Hall, HCP Admin; Shawn O'Malia, Sector Safety Mgr; Stephanie Myers, Occupational Hearing Conservationist; Jim McNamara, Sr. Field Industrial Hygienist; and Roxy

Our Initiatives

- Identify and/or improve engineering controls for new or current high noise operations
- Adopt more restrictive assessment criteria for identifying participants in campus Hearing Conservation Program (HCP)
- Improve tracking system for maintenance/engineering personnel
- Improve system for assessing hearing protective devices and worker training
- Develop a community outreach program for all employees and families

Implement Engineering Controls

- Instituted a new equipment procedure with a sign-off element related to potential noise emissions
- Implemented internal requirements to evaluate and install engineering controls where feasible to reduce noise levels and worker exposures

New Equipment Sign-Off Form

Environmental, Health, Safety & Fire Protection (EHSFP) Information Request for New/Altered/Relocated Equipment and Processes

There are regulatory requirements associated with industrial equipment and/or processes. For example most processes or equipment that use chemicals need to be permitted or licensed under federal, state, and local laws. **THE PERMIT REVIEW OR MODIFICATION PROCESS TYPICALLY TAKES 2-3 MONTHS TO BE COMPLETED.** Therefore, it is imperative that this form is forwarded to the site EHSFP professional as early as possible when equipment or processes are purchased, altered or relocated.

CAMPUS/SITE NAME: [REDACTED]		PROJECT ENGINEER: [REDACTED]	
CONTACT NAME: [REDACTED]		PHONE: [REDACTED]	
LOCATION OF EQUIPMENT OR OTHER LOCATION DESIGNATION (AREA/MAIL STOP): [REDACTED]			
NAME OF EQUIPMENT [REDACTED]	MANUFACTURER (IF AVAILABLE) [REDACTED]	SERIAL NUMBER (IF AVAILABLE) [REDACTED]	
ANTICIPATED INSTALLATION DATE: [REDACTED]		DATE FORM COMPLETED: [REDACTED]	
PROCESS AND/OR ACTIVITY DESCRIPTION [REDACTED]			

IS THE AREA WITH EQUIPMENT BEING RENOVATED?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	ALL
DOES THE PROCESS OR EQUIPMENT USE CHEMICALS, BLAST MEDIA OR FUEL?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE AND SAFETY
DOES THE PROCESS OR EQUIPMENT DISCHARGE EXHAUST AIR?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	ENVIRONMENTAL
DOES THE PROCESS OR EQUIPMENT USE/DISCHARGE WATER?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	ENVIRONMENTAL
DOES THE PROCESS OR EQUIPMENT GENERATE WASTE?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	ENVIRONMENTAL
DOES THE PROCESS OR EQUIPMENT GENERATE HEAT?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE
DOES THE PROCESS OR EQUIPMENT FALL WITHIN THE LOWER OR UPPER EXPLOSIVE RANGE?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE
IS THE AREA IN A CONFINED SPACE (PITS, TANKS, MANHOLES)?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE
DOES THE PROCESS OR EQUIPMENT UTILIZE MOVING MACHINERY OR ROBOTICS?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
IS THE EQUIPMENT CAPABLE OF GENERATING IONIZING RADIATION?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
ARE HIGH NOISE LEVELS EXPECTED DURING NORMAL OR FULL LOAD OPERATION?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
DOES THE EQUIPMENT CONTAIN AN EMBEDDED OR ATTACHED LASER? IF YES, SPECIFY THE LASER CLASS (I, II, IIIA, IIIB, IV). [REDACTED]	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
IS THE EQUIPMENT CAPABLE OF GENERATING RADIOFREQUENCY (RF) RADIATION? IF YES, SPECIFY THE FREQUENCY? [REDACTED]	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
HAS THERE BEEN A CHANGE IN VOLUME, COMPOSITION OR LOCATION OF AN AIR, WATER OR HAZARDOUS WASTE DISCHARGE?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	ENVIRONMENTAL
HAS THERE BEEN A CHANGE IN THE VOLUME, PERCENTAGE OR COMPOSITION OF PROCESS CHEMISTRY?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	EHSFP
HAS THERE BEEN A CHANGE IN ELECTRICAL SERVICE, GAS LINES, HYDRAULIC LINES OR PNEUMATIC LINES?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE & SAFETY
HAS ANY EQUIPMENT CONTAINING A LASER, RF SOURCE, ULTRAVIOLET LAMP, RADIOACTIVE SOURCE, RADIATION PRODUCING TUBES, CRANES OR FIRE SUPPRESSION SYSTEMS BEEN RELOCATED?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	FIRE & SAFETY
HAS THERE BEEN A CHANGE IN CAPACITY IN CRANES, FORKLIFTS OR OTHER MATERIAL HANDLING EQUIPMENT?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY
HAS THERE BEEN A CHANGE IN GUARDING, INTERLOCKS, PROTECTIVE BARRIERS ON ANY MACHINERY?	<input type="checkbox"/> YES	<input type="checkbox"/> NO	SAFETY

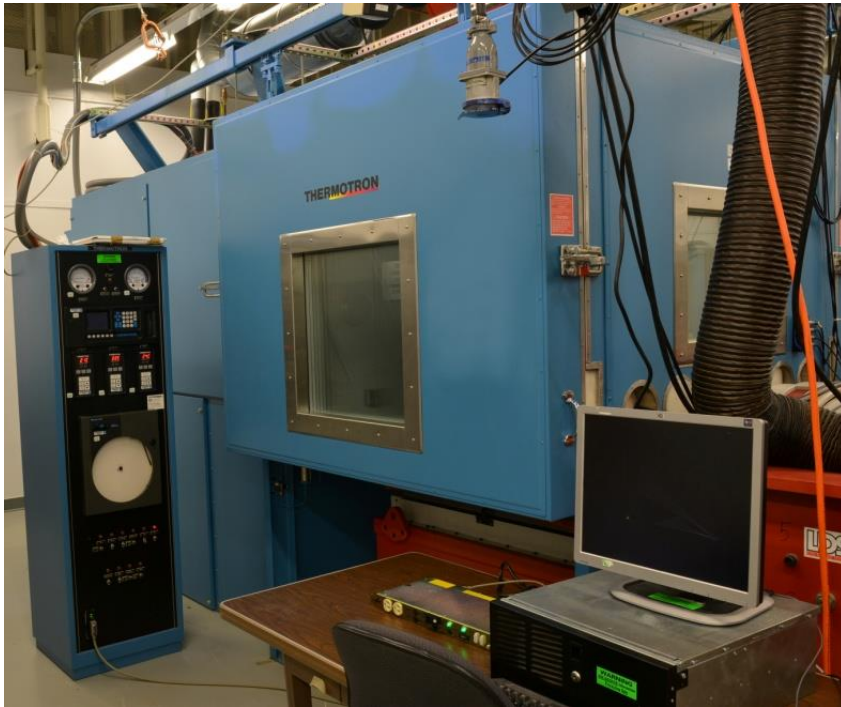
Return completed form to the site EHSFP professional(s)

New Equipment Sign-Off Form

Are high noise levels expected during normal or full load operation?

- **If YES:**
 - EHSFP will evaluate equipment specs to assess expected sound pressure levels (SPLs) during normal operations. If SPLs are 85 dBA or higher discussions will be held with requestor to evaluate different equipment or optional control packages.
 - If SPLs are not known for full load operations (i.e. vibration tables at high Gs) SPLs are evaluated when equipment is operational. Noise control systems are then evaluated to achieve maximum reduction in SPLs.
 - Employees are enrolled in campus Hearing Conservation Program (HCP) if control systems can't get equipment below 85 dBA or while control systems are being evaluated.

Thermotron and What it Does



- Temperature of electronic equipment is raised and lowered several times during the work shift.
- Testing requires a large thermal chamber that can reach between 100 degrees C and – 40 degrees C
- Standard unit has about 48 cu ft of workspace – can heat and cool hundreds pounds of mass
- Requires two 25 hp compressor, one 8 hp blower, plus other small blowers

Noise Control Example: Thermotron

Location	Before	After
3' off floor at fan end	91.8 dBA	80.3 dBA
Middle of inlet flex	91.9	80.3
Fan housing	97.1	82.3
Fan discharge flex	90.7	83.5
Silencer casing	83.1	83.1
Silencer exhaust	96.0	86.3

Noise Control Example: Thermotron

Before Noise Control - SPL - **91.9 dBA**



After Noise Control - SPL - **80.3 dBA**

Vibration Table and its Function

- Vibration Tables are required to shake the electronic equipment at various frequencies
- Consists of a large platform, 48 square inches, that can reach levels of 8,000 force pounds
- Tables can also produce levels of about 100 dBA
- These units also require large cooling blowers that contribute to the noise



Noise Control Example: Vibration Tables



Control Room Open

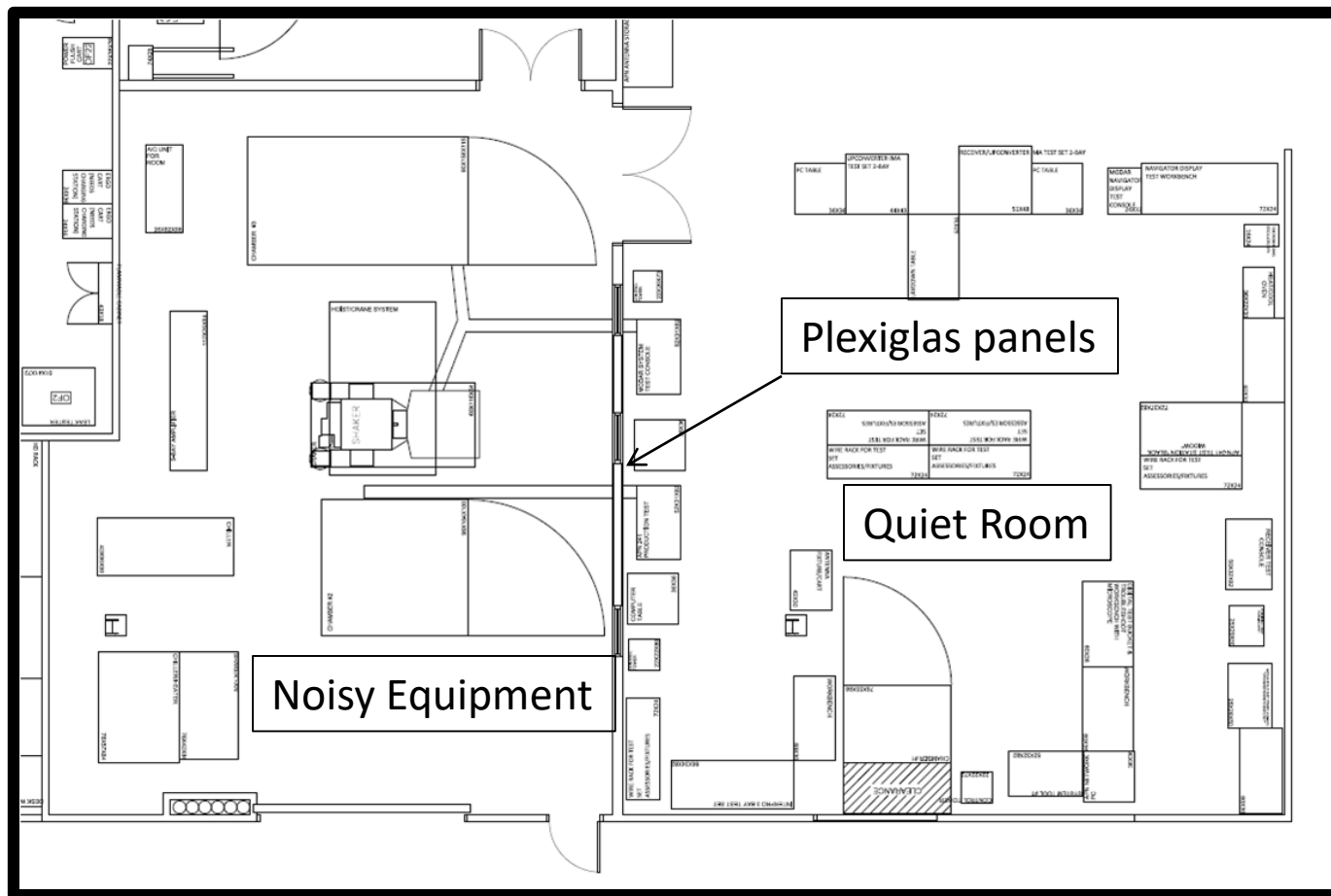
SPL- 126 dBA



Control Room Enclosed

SPL- 80 dBA

Employee Quiet Room – Blueprint



Quiet Room

OUTCOME:

The Quiet Room reduced employee noise exposures and eliminated the need for about 30 employees to be included in the HCP



Noise Control Outcomes:

- As new areas are created, engineering feasibility studies are conducted.
- Since 2006, 14 areas have had engineering feasibility studies completed. 10 of 14 areas have been outfitted with noise abatement.
- At least 30 employees no longer were required to participate in the Hearing Conservation Program.
- Some areas still require hearing protection devices, therefore, employees are still involved in the hearing conservation program.

More Restrictive Hearing Conservation Program Enrollment Criteria

- Assessed worker exposure by Occupational Safety and Health Act (OSHA) Permissible Exposure Levels (PEL) and Action Levels (AL), American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute of Occupational Safety & Health (NIOSH) limits.
- Employee enrollment in Hearing Conservation Program based on noise dosimetry using NIOSH/ACGIH limits using 85 dBA and 3 dB exchange rate.

Noise Exposure Measurements

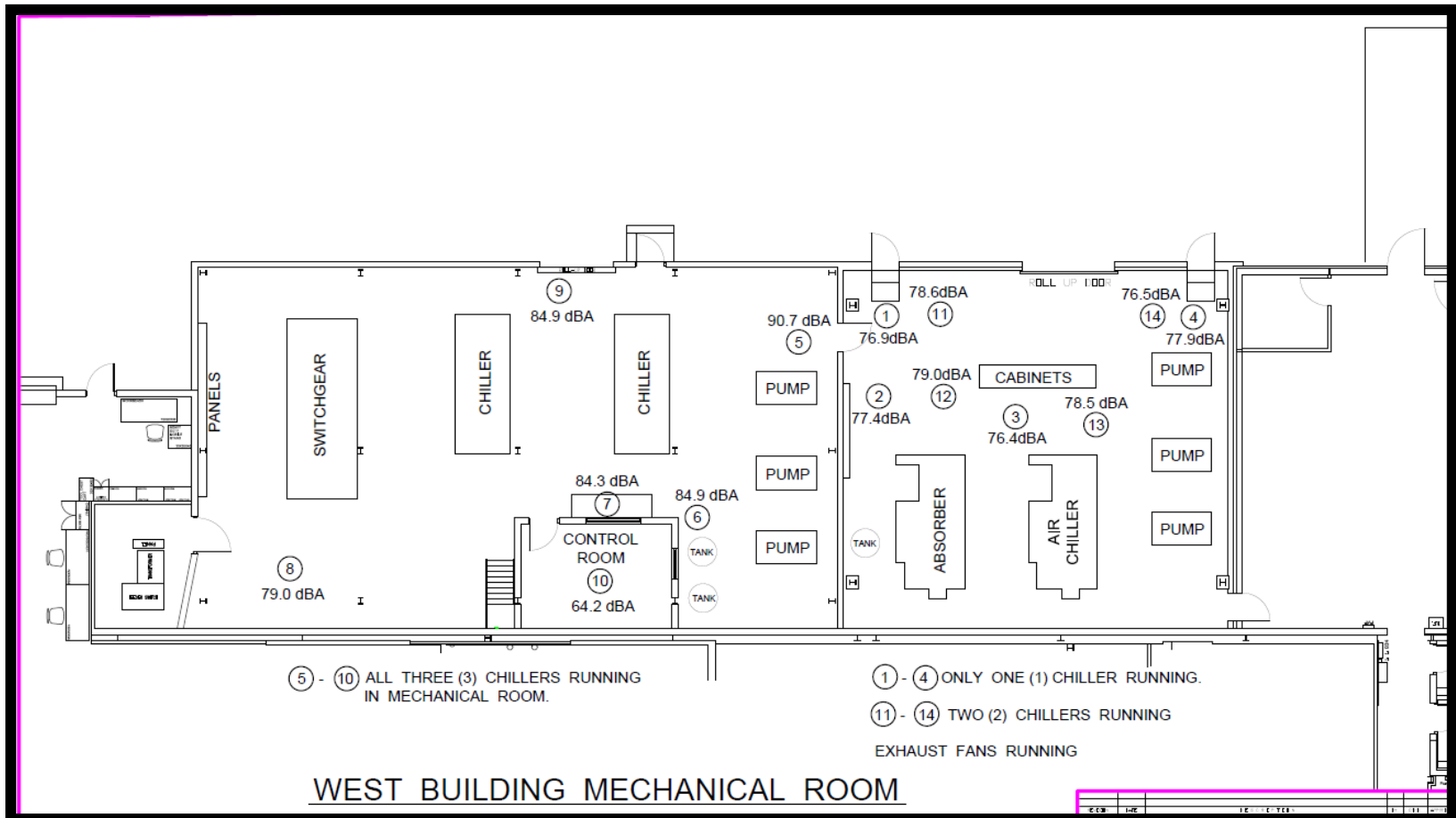
- **Area Survey** – measurements taken using a data-logging sound level meter

Accuracy	Response	Weighting
Type I	Slow	A

- **Noise Mapping** - measurements obtained during noise exposure survey marked on floor plan
- **Noise Dosimetry** – conducted after assessing need based on initial sound level readings

Noise Exposure Measurements

Typical Mechanical Room with Noise Mapping



Noise Exposure Measurements

- Dosimetry – based on initial sound level readings using a representative sampling of workers.
 - All 8 Hr Time Weighted Average (TWA) measurements are assessed using personal dosimeters pre and post sample calibrated.
- The three different criteria used when collecting dosimetry measurements are below

Setup	Response	Exchange Rate	Criterion Level	Criterion Time	Threshold	Upper Limit
OSHA HC	Slow	5 dB	90 dB	8 Hr	80 dB	115 dB
OSHA PEL	Slow	5 dB	90 dB	8 Hr	90 dB	115 dB
NIOSH/ACGIH	Slow	3 dB	85 dB	8 Hr	80 dB	115 dB

Tracking System/Sustainability

- Enrolled employees in HCP utilize a computer based training system which provides reminders to both employees and their supervisors
- Supervisors are made aware of noise exposure issues and their responsibilities through the annual “Environment, Health, Safety, and Fire Protection (EHSFP)” University Course offered by the Sector Campus
- Implemented questions on internal assessment/audit checklist to ensure appropriate engineering controls have been implemented or employees have been enrolled in the hearing conservation program

Internal Assessment/Audit Checklist

BWI – Environmental, Health, Safety, and Fire Protection Audit Checklist Industrial Hygiene

Item	REQUIREMENTS	Pass	Fail	N/A	Reference	Compliance Notes
4.07	If the area has high noise producing equipment or processes, have sound level measurements or noise dosimetry been conducted to determine employee's potential exposure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K306	
4.08	If the area is identified as a "High Noise Area": Does the operator have an authorization card? Are appropriate hearing protection devices available for use (necessary NRR)? Have employees been trained on the hazards of high noise and how to use hearing protection devices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K306	
4.09	If the area is designated as a "respiratory protection" area: Does the operator have an authorization card? Is the appropriate respiratory protection available? Is respiratory protection properly stored in a re-sealable bag?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K311	
4.10	Does the area use local exhaust ventilation (spray booths, fume hoods, ventilated enclosures, slotted-exhaust, capture hoods, etc.)? Is there a barcode? Have the local exhaust ventilation systems been evaluated? (Dip tanks – quarterly; spray booths, fume hoods, ventilated enclosures, slotted-exhaust, etc. – annual) Do fume hoods have an inspection sticker with face velocity and sash height identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K307	

Internal Assessment/Audit Checklist: Noise

BWI – Environmental, Health, Safety, and Fire Protection Industrial Hygiene

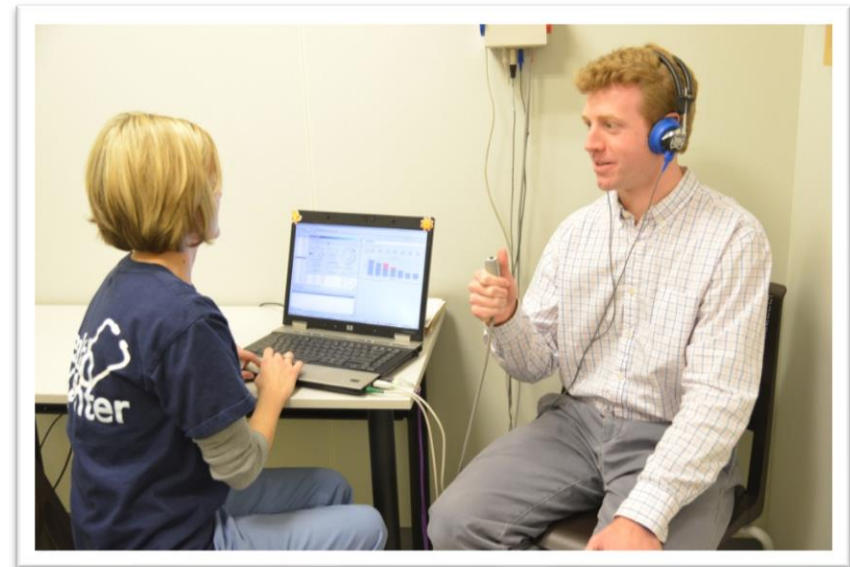
Item	REQUIREMENTS	Pass	Fail	N/A	Reference
4.07	If the area has high noise producing equipment or processes, have sound level measurements or noise dosimetry been conducted to determine employee's potential exposure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K306
4.08	If the area is identified as a "High Noise Area": Does the operator have an authorization card? Are appropriate hearing protection devices available for use (necessary NRR)? Have employees been trained on the hazards of high noise and how to use hearing protection devices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K306

Improve System for Assessing Hearing Conservation Program Elements

- Audiometric Testing Program
- Training – Employee Certification Program
- Hearing Protector Fit-Testing

Audiometric Testing Program

- Annual audiogram administered in a specially designed room meeting OSHA ambient noise levels.
- All tests are provided and reviewed initially by the CAOHC certified audiometric technician.
- Any “problem” audiograms are referred to otolaryngologist.



Audiometric Testing Program

OUTCOMES:

- Between 2011-2013 an average of 239 employees were tested
- 100% completed annually. Supervisors need to help ensure employees attend.
- STS rate for 2011-2013 = 0%



Fit-Testing & Training

- Purchased quantitative fit-test apparatus (VeriPro) to promote better hearing protector fit and noise attenuation
- 50% reduction of stocked variety of hearing protection devices
- Appropriate selection of earplugs resulted in a 15% improvement in the average Personal Attenuation Rating (PAR) for individuals
- Proper fitting of earplugs showed an 11% improvement in PAR from year to year.



Fit-Testing & Training

- 50% reduction of stocked hearing protection devices
 - Prior to fit-testing approximately 12 to 16 different earplugs and a couple of ear muffs types were being used.
 - Now, there are 8 different earplugs from three different manufacturers in various sizes that are stocked. We still use two types of ear muffs.
- Many employees prefer to use ear muffs as opposed to their fit-tested ear plugs.

Training



- The Hearing Conservation Protection Training: two-part program:
1) online course; 2) audiogram
- Completion of both parts; then VeriPro fit-test
- With Supervisor aid, 90-100% trained & fit-tested annually

Hearing Conservation Program Authorization Card

Implemented fit-testing of hearing protective devices based on noise exposure measurements followed by the issuance of Hearing Conservation Program authorization cards for dispensing and auditing purposes.

Front

The front of the card features the Northrop Grumman logo in the top left corner. The title "HEARING PROTECTION AUTHORIZATION CARD" is centered at the top. Below the title, there are two horizontal lines for "Employee Name" and "My ID Number". A third horizontal line is labeled "Work Area". Below this, a paragraph states: "The employee listed above is authorized by the Hearing Protection Program Administrator to obtain the following hearing protection equipment:". This is followed by three horizontal lines for listing equipment. At the bottom, there is a section for "Expiration Year" with three boxes containing the numbers 15, 16, and 17. The card number "CS-10413.001" is printed in the bottom right corner.

Back

The back of the card is mostly blank, with the text "Command Media Reference No. K30601" centered. Below this, there is a horizontal line followed by the text "Program Administrator". At the bottom, there is a line of text that reads "If you have questions contact the Program Administrator at Ext. _____".

Employee “Buy-In” of HCP Efforts

Nancy,

I just wanted to let you know that I believe the hearing conservation program here at Northrop Grumman has been a huge benefit to everyone. A lot of the guys here are involved with activities outside of work that require a need for hearing protection and I believe our program has increased their awareness of the need for that protection.

Aside from the fact that we are all getting older, some of us hunt, shoot, cut grass, race cars, etc. etc. and I think most of us are now realizing the benefit of what we have learned here at Northrop so we are all able to preserve our hearing as much as possible.

Much Thanks go out to you and your department for the time and effort you have spent teaching us about how important it is to use hearing protection in our everyday activities here and at home.

Maintenance Supervisor

Community Outreach

- Purchased mannequin to create Roxy from Dangerous Decibels' "The Jolene Cookbook"
- Roxy has an incorporated sound level instrument that measures listening levels for personal audio (music) devices
- Used Roxy to demonstrate noise concerns with personal audio devices at various Safety & Health Fairs, Safety Observer Noise Presentations, and Bring Your Child to Work Day.

Community Outreach

Roxy



Bring Your Child to Work Day



≈ 600 registered youth 8-15 years old participated,
≈ 100 youth socialized with Roxy

Employee “Buy-In” of HCP Efforts

Hi Nancy,

My eldest son is the one who liked listening to his music loud, I guess so everyone around him could enjoy the tunes. But since the “bring your child to work day” a couple years ago when we named Roxy and won the gift certificate, my son has since then lowered the volume. He now makes sure that the volume is low and checks the earphones before putting them in his 2 younger brothers’ ears.

I have mentioned to other mother’s about the volume on the iPod. I thank you for all of your helpful information about the issue. I guess I was too busy to realize that I really needed to keep up on the volume issue, a short and sweet TURN THAT DOWN, was not successful when I was not around. So hopefully this lesson will stay with him for the years to come, and that his hearing was saved.

Employee Comment

Lessons Learned

- Engineering controls have dramatically reduced worker noise exposures
- One-on-one training via quantitative fit-testing increases worker enthusiasm and understanding of hazardous noise effects
- Roxy demonstrations have had a direct impact on the volume used by employees and their families when using personal audio devices
- EDUCATION is critical

What Does the Future Bring?

- Set goals and perform more extended personal noise dosimetry to better characterize exposure levels
- Investigate potential high noise warning systems
- Trend audiometric testing data to assess effectiveness of HCP
- Improve employee/family use of personal hearing protection devices both on and off the job
- Assess technology for fit testing capability for ear muffs
- Standardize approach across entire Sector

Significance of the Award

- Will help other sector HCP administrators promote:
 - The importance of engineering controls and
 - The advantages of using more restrictive noise assessment criteria than required by OSHA.



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