

NAVAL RESEARCH LABORATORY
Washington, D.C.

NRLINST 5101.3C
Code 1240
13 July 1998

NRL INSTRUCTION 5101.3C

From: Commanding Officer
To: Distribution Lists A and B

Subj: FIRE SAFETY IN ANECHOIC CHAMBER OPERATIONS

1. Purpose. To update guidance regarding fire prevention and procedures to be followed in case of fire during use of anechoic chambers at NRL.

2. Cancellation. This instruction cancels and supersedes NRLINST 5101.3B.

3. Scope. This instruction applies to NRL-DC only.

4. Information

a. Anechoic chambers pose unique fire hazards. They are lined with various polymers, most of which produce dense smoke if ignited. Fires in such materials are very difficult to extinguish. Their smoke contains highly toxic gases such as hydrogen chloride (HCl), carbon monoxide (CO), toluene diisocyanate, and hydrogen cyanide (HCN) (the latter being absorbable through the skin as well as through inhalation). Besides the immediate danger of these gases, there is the possibility of death from pulmonary edema (chemical pneumonia) 24 to 48 hours after exposure to HCl.

b. Following an anechoic chamber fire in 1973 in NRL-DC Building 56, a research project was started in the Navy Technology Center for Safety and Survivability (Code 6180) to determine fire prevention, fire fighting, and hazard control procedures. The measures developed by Code 6180 are contained in this instruction.

5. Policy. All anechoic chambers at NRL shall meet the design requirements and have the safety features and precautions described in this instruction. A fire inspector shall be assigned to each anechoic chamber to carry out fire safety responsibilities. Design specifications for all new anechoic chambers shall be submitted to the Safety Branch (Code 1240), the NDW Fire Department (Code 1250), and the Research and Development Services Division (Code 3500) for review prior to construction.

6. Definitions. For purposes of this instruction, an anechoic chamber is any device or installation in which quantities of polymers (e.g., polyurethane foam, polystyrene, polyvinylchloride, and

nitrile rubber) are used to reduce electromagnetic wave echoes. An anechoic chamber is generally located within a parent room.

7. Responsibilities

a. Code 1240 shall:

(1) Review designs for new anechoic chambers, and for modifications or renovations of existing anechoic chambers.

(2) Review anechoic chamber safety procedures submitted by chamber safety engineers.

(3) Review work requests and service calls involving maintenance or repair work in anechoic chambers and prescribe appropriate precautionary measures.

(4) Conduct evaluations of anechoic chambers during regularly scheduled workplace safety inspections.

(5) Inspect storage areas where bulk quantities of polymer materials are stored to ensure that material is stored properly and that protective measures are in place.

(6) Conduct, on request, evaluations of unusual odors associated with anechoic chambers.

(7) Conduct evaluations of conditions following an anechoic chamber fire before permitting personnel to reenter the area.

b. Division superintendents shall:

(1) Appoint an anechoic chamber safety representative for each anechoic chamber, including the parent room. One safety representative may be appointed for all anechoic chambers in each branch or division. The person(s) appointed must be thoroughly familiar with all anechoic chambers and with the operations conducted under their areas of responsibility.

(2) Review and approve written procedures prepared by the anechoic chamber safety engineers.

(3) Ensure compliance with this instruction and with the specific procedures developed by the anechoic chamber safety engineers.

c. Anechoic Chamber Safety Representatives shall:

(1) Review, within 90 days of assignment, fire safety procedures for all anechoic chambers under their responsibility to ensure compliance with the safety precautions provided in paragraph 8 of this instruction. Include in this review the procedures for handling classified materials in the event of a fire. If any

deviations from paragraph 8 are noted, such as lack of mechanical ventilation, provide the rationale for the deviation. Prepare appropriate amendments to the safety procedures where necessary. Send copies of the proposed amendments via the division superintendent to Codes 1240, 1250, and 6180.

(2) Ensure that all personnel working in their assigned anechoic chamber have been informed of the potential hazards of chamber fires and have received instructions on safe operating procedures and emergency evacuation procedures for the particular chamber.

(3) Monitor the operations in the chamber to ensure compliance with safety procedures and regulations. Report violations to the division superintendent.

(4) Ensure that all visitors are indoctrinated about the hazards associated with anechoic chamber fires prior to entry. This may be accomplished through an oral briefing, furnishing a briefing paper, or posting signs at each entrance.

(5) Review and approve plans for new chamber operations that may pose unusual fire hazards. Develop additional fire safety measures, as necessary, that are consistent with the precautions provided in this instruction.

(6) Correct any hazardous conditions noted by Code 1250 during periodic inspections.

(7) Coordinate with Code 3500 in planning and developing fire safety for new anechoic chambers, and modification/renovation of existing chambers.

(8) Route all work requests and service calls involving maintenance or repair work in anechoic chambers via Code 1240. Code 1240 shall review the type of work to be performed and prescribe appropriate precautionary measures to supervisory personnel.

d. Code 3500 shall:

(1) Review designs for new anechoic chambers, and for modifications or renovations of existing anechoic chambers.

(2) Provide guidance and recommendations for improving the fire safety of new and existing anechoic chambers.

(3) Provide instructions on the hazards of anechoic chamber fires to Code 3500 personnel when maintenance or repair work is to be conducted inside anechoic chambers. Code 1240 shall provide technical guidance on request.

e. Code 1250 shall:

(1) Review safety procedures submitted by anechoic chamber safety engineers and make recommendations for changes or improvements.

(2) Review designs for new anechoic chambers, and for modifications or renovations of existing anechoic chambers, and make recommendations for changes or improvements.

(3) Assign a fire inspector to each anechoic chamber and conduct inspections of anechoic chambers during regularly scheduled building inspections. Provide the chamber safety representative with a written report of any identified discrepancies.

(4) Conduct an annual fire prevention training class and evacuation drill for each anechoic chamber.

8. Safety Precautions. It is essential in preventing anechoic chamber fires to eliminate sources of ignition such as overheating cables or motors, welding, soldering, smoking, or anything that could produce the heat necessary for ignition of anechoic chamber material or of materials used inside the chamber; and to educate anechoic chamber personnel about fire hazards.

a. The following signs shall be posted:

(1) At all entrances to buildings containing anechoic chambers, a Building Fire Bill (NAVFAC-11320/9) and a sign stating:

"This building contains an anechoic chamber facility that shall produce lethal gases when exposed to fire. In the event of fire, evacuate the entire building."

(2) At all entrances to a chamber, signs stating:

"No person shall work alone in this anechoic chamber if the operation poses an unusual fire hazard, or if the person is required to work at elevated heights or to perform some other type of work that exposes him/her to unusual safety hazards. In such situations, other personnel shall remain within voice and/or visual contact in order to summon help in the event of an emergency."

"Warning! This chamber is not designed for high-power density application."

"This anechoic chamber facility shall produce lethal gases when exposed to fire. In the event of fire, evacuate the entire building."

b. The following safety features and precautions shall apply:

(1) The annunciator panels for the fire protection system and the controls for the ventilation system (see paragraph 8b(3) below) shall be located outside the parent room so that Code 1250 personnel must not pass through heavy smoke to reach the panels or ventilation controls.

(2) All fire locator controls and evacuation pull stations shall be located outside the hazardous area and as close as possible to the emergency exits.

(3) Mechanical ventilation shall be provided to remove smoke in case of fire. The ventilation system should have the capability of removing smoke from the anechoic chamber or the parent room separately or at the same time. The objectives of providing ventilation are to remove smoke so that firefighters can see and to reduce smoke damage to the rest of the building.

(4) If an unusual odor is noticed in the vicinity of the chamber, call Code 1240 on 767-2232 for an evaluation. If smoke or fire is detected, call Code 1250 immediately on 767-3333; do not wait for an evaluation by Code 1240.

(5) Electrically operated doors to chambers should have a remote control switch located outside the parent room.

c. The following safety precautions shall be incorporated into the "Safety Procedures" developed by the anechoic chamber safety representative for each chamber:

(1) Equipment shall not be left operating in the chamber while the chamber is unattended unless required for operational needs. If equipment is required to be left operating, it must be kept at least 3 inches away from the polymer lining, it must be positioned so that air can circulate freely around it, and it must not generate enough heat to feel hot to the touch.

(2) Flammable or combustible liquids shall not be handled or stored inside the chamber unless absolutely required. Before starting repair operations using volatiles or solvents, or tests that involve the use of fuels, the chamber safety representative's approval must be obtained and Code 1250 must be notified. Alcohol, commonly used to clean electrical components, should be replaced by nonflammable, non-ozone-depleting materials such as Genesolv 2004 or Inonox MC. If the use of flammable liquids is approved, personnel shall wear electrically conductive shoes or grounding straps to bleed off static electricity.

(3) Sources of ignition shall not be permitted inside of or in the vicinity of the chamber except by special approval of the anechoic chamber safety representative. Extreme caution should be used when using soldering guns and high-intensity lights in the

chamber. Portable fluorescent lights are cooler and should be used when portable lights are required. Oxyacetylene and arc welding are prohibited inside anechoic chambers.

(4) All polymer materials (as defined in paragraph 6) that are not installed in anechoic chambers shall be protected from becoming ignited. Such materials shall be stored away from electrical equipment, flammable liquids, welding and soldering operations, and other such conditions that may promote ignition. Preferably, loose polymer materials should be stored in metal cabinets with signs posted reading: "WARNING. This cabinet contains polymer materials that produce lethal gases when ignited or exposed to flames. Keep all ignition sources and flammable liquids away. In the event of a fire involving this material, call the NDW Fire Department on 767-3333 and evacuate entire building." Storage of quantities of bulk polymer materials exceeding two cubic yards, such as new material in cartons awaiting installation, shall be approved by Code 1250.

(5) Polymer materials for new chambers shall be of the highest flame-retardant material available unless operational requirements call for a lower-rated material. Deviations from the design requirements specified in paragraph 8b may be authorized to meet operational requirements; requests for such deviations shall be reviewed carefully by all parties concerned.

(6) Before using electrical equipment in the chamber (including temporary flexible wiring or exposed power supply terminals), the voltage between the chamber ground and equipment chassis shall be measured across a 10 ohm resistor. The voltage shall not exceed 0.5 volts.

(7) If a current interruption device activates, all activity shall cease and the area shall be inspected before power is restored.

(8) In the event that fire or smoke is detected, the first concern is for personnel safety. If possible, steps should be taken to contain a fire within the chamber to prevent involvement of the entire building. However, personnel should take no actions that would seriously endanger their personal safety. All personnel arriving at the scene of the fire should be advised of the hazard of breathing toxic gases and of the dangers of absorption of smoke through the skin. In case of fire, the procedures below shall be followed, in the order listed, by the personnel near the fire who presumably set off the fire alarm:

(a) Notify Code 1250. Use automatic fire alarm if possible.

(b) Shut off all electrical power to the chamber, including lighting.

(c) Secure all ordinary doors to the chamber. (Any electrically operated door should be closed by the remote switch outside the hazardous area after determining that no one remains inside the chamber.)

(d) Evacuate all personnel from the building to a specified location to facilitate accounting for personnel and for providing information to Code 1250. Chamber procedures should specify the meeting area.

(e) Actuate CO₂ suppression system if available. Water deluge systems should be actuated only by order of the anechoic chamber safety representative or Code 1250.

(f) Evacuate all personnel from the building.

(g) Chamber ceiling vents should be opened only by Code 1250.

(9) After a fire, the chamber should not be entered until permission has been granted by Codes 1240 and 1250.

(10) Special precautions should be taken for some time after a fire since gases generated by the fire are readily absorbed on surfaces of the chamber. If the chamber has been closed for a period of time, toxic gas concentrations can build up inside. Chambers should therefore be ventilated continuously, and toxic gas levels should be measured before entering.

9. Forms Availability. Building Fire Bill (NAVFAC 11320/9 (4-67)) is available from the Occupational Safety and Health Section (Code 1241).