

Inspector General

United States
Department of Defense



Non-Skid Materials
Used on Navy Ships

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Acronyms

DLA	Defense Logistics Agency
DoN	Department of the Navy
EPA	Environmental Protection Agency
GSA	General Services Administration
IG	Inspector General
MSDS	Material Safety Data Sheet
NAVSEA	Naval Sea Systems Command
NDAA	National Defense Authorization Act
NEHC	Naval Environmental Health Center
NHRC	Naval Health Research Center
NSM	Non-Skid Materials
NSTM	Naval Ships Technical Manual
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
QPL	Qualified Products List
SIMA	Shore Intermediate Maintenance Activity
TWA	Time Weighted Average
VA	Veteran Affairs



INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-4704

October 30, 2007

MEMORANDUM FOR NAVAL INSPECTOR GENERAL

SUBJECT: Report on Non-Skid Materials Used on Navy Ships (Report
No. TAD-2008-001)

We are providing this report for information and use. We performed this assessment in response to a congressional request. No written response to the draft report was required, and none was received. Therefore, we are publishing this report in final form.

We appreciate the courtesies extended to our staff. Questions should be directed to Mr. Kenneth H. Stavenjord at (703) 604-8952 (DSN 664-8952) or Mr. Chan P. Sankhla at (703) 604-8917 (DSN 664-8917). See Appendix D for the report distribution. The team members are listed inside the back cover.

A handwritten signature in blue ink, reading "Patricia A. Brannin", is centered below the text.

Patricia A. Brannin
Acting Deputy Inspector General
Policy and Oversight

Department of Defense Office of Inspector General

Report No. TAD-2008-001

October 30, 2007

(Project No. D2007-D000PT-0090.000)

Non-Skid Materials Used on Navy Ships

Executive Summary

Background. On September 28, 2006, the Chairman of the Military Personnel Subcommittee of the House of Representatives Committee on Armed Services requested that the DoD Inspector General determine whether allegations concerning non-skid materials (NSM) made in 1980 are substantiated and if substantiated, determine the extent to which the Navy used the materials on ships. NSMs are deck coverings (paint) that are wear- and skid-resistant, non-flammable, protect the deck from corrosion, and are easy to maintain. Types of NSMs relate generally to how they are applied to the deck and their durability. Qualified Products Lists identify names of the approved NSM suppliers and manufacturers who meet military specifications, including quality requirements. Occupational Safety and Health Administration (OSHA) established safety levels that apply to the dust generated when the NSM is removed. The Environmental Protection Agency sets standards for the contents of materials, but has not set any for silica in paints.

Objectives. Based on discussions with the congressional staff, our objectives were to determine the amount and type of NSMs that were used on Navy ships and whether the materials met OSHA standards.

Results. From 1998 through January 2007, the General Services Administration purchased 110,531 gallons of NSM for approximately \$3.6 million for the Naval Sea Systems Command using Qualified Products Lists. Various types of NSMs were purchased from a number of suppliers during the period. Procurement data from the 1960s through 1998 were not available. Since 1994, the Naval Sea Systems Command began procuring NSMs from the General Services Administration rather than the Navy supply system and the Defense Logistics Agency.

Since at least 1991, the Navy has mitigated the effects of the NSM dust with engineered processes and health and safety procedures, including personal protective gear that meets or exceeds OSHA requirements related to the dust generated from NSM removal techniques. There was no available documentation of mitigating procedures implemented prior to 1991. Tests show that NSM removal techniques generate dust that can exceed OSHA standards by as much as 29 times in certain circumstances.

Management Comments. We provided a draft of this report on September 28, 2007. No written response to this report was required, and none was received. Therefore, we are publishing this report in final form.

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Background

Deck coverings for naval ships are lightweight, wear- and skid-resistant, nonflammable, and possess the ability to protect the deck from corrosion, present an attractive appearance, and are easily maintained. Non-skid materials (NSM) can be applied to weather decks, flight decks, and hangar decks of air capable ships. Ease of painting and low cost are also important considerations in the purchase of NSMs. Most NSMs consist of a primer, non-skid top coat, and color topping. The primer is applied to provide a base for the topcoat and to protect the substrate from corrosion. Some non-skid systems have an intermediate coat that is applied after primer and before the non-skid topcoat.

Objectives

On September 28, 2006, the Chairman of the Military Personnel Subcommittee of the House of Representatives Committee on Armed Services requested that the DoD Inspector General (IG) determine whether the allegations made in 1980 related to the adverse effects of NSMs are substantiated, and if substantiated, determine the extent to which the Navy used NSMs on ships. The Congressman stated that the underlying issue is whether Navy personnel were exposed to air concentrations of silica and other aerosolized particles in excess of Occupational Safety and Health Administration (OSHA) established safety levels. Subsequently, on November 3, 2006, the IG team and congressional staffers clarified objectives to determine the extent and type of NSMs used on Navy ships and whether the materials met OSHA standards.

Therefore, we addressed two overall assessment objectives. The first objective was to determine the extent and type of NSMs used on Navy ships between 1960 and the present and whether the materials met OSHA standards in effect at the applicable time. The second objective was to review the Navy health and safety procedures for material application and removal.

A. Type and Extent of Non-Skid Materials

Various types of NSMs were procured from a number of suppliers since the 1960s. Although the procurement data dating back to 1960s were not available, we determined that the General Services Administration (GSA) purchased 110,531 gallons of non-skid paint for approximately \$3.6 million for the Navy from 1998 through January 2007.

Non-Skid Material Type

Type of Non-Skid Materials. Deck coverings are classified on the basis of use aboard ships. The coating can be applied to steel, aluminum, reinforced plastic, and wooden decks by spraying, rolling, or troweling. *Performance Specification, MIL-PRF-24667A(NAVY), “Coating System, Non-Skid,”* August 14, 1992, covers non-skid systems for application to weather decks, flight decks, and hangar decks on aviation ships. Non-skid products qualifying to this specification are classified by type, composition, grade, class and use on metal or wood decks. The type defines the NSM’s durability and the application method used on ship decks. The composition of NSM is determined by the deck area where it is applied. The details of the types are provided in Appendix B.

Non-Skid Paint Criteria. Military Specification MIL-D-23003 (SHIPS) (Deck Covering Compound, Nonslip, Lightweight) was published on September 12, 1961. MIL-D-23003A (SH) superseded the 1961 specification on February 25, 1980. On September 11, 1986, DOD-C-24667 (NAVY) (Coating System, Non-skid, for Roll or Spray application [Metric]) replaced MIL-D-23003A (SH). This specification was superseded on August 14, 1992, by MIL-PRF-24667 and then again with the June 3, 2005, version. The table in Appendix B describes each of the types and applications of non-skid deck materials contained in each of the military and performance standards that were in effect from September 12, 1961, through June 3, 2005.

Non-Skid Material Procurement

Procurement Process. The Navy procured NSMs from Navy supply systems or Defense Logistics Agency (DLA) using QPLs until 1994, while GSA bought the same materials for the Coast Guard and other Government agencies. The Navy supply commands do not have the documentation that recorded the type and amount of the materials purchased prior to 1994. GSA procured materials at a better price because it bought paints including NSMs for most other Federal agencies in large quantities. Therefore, the Navy also decided to buy paint through the GSA’s Heartland Global Supply Office, Kansas City, Missouri. The Navy used qualified products lists (QPLs) to specify to GSA the names of the NSM suppliers and manufacturers who self-certified that the materials met the

Navy's specifications described in the applicable military specifications (MIL-D-23003, DoD-C-24667, or MIL-PRF-24667). The manufacturers also provided material safety data sheets (MSDS) for their products. The MSDSs contain information on product identification, physical properties, and chemical composition; and identify fire and explosion hazards, personal protection, and product disposal.

Qualified Products List Program. The purpose of the QPL program is to reduce acquisition and procurement lead time, reduce test cost, improve readiness through continuous availability of reliable products from viable suppliers, and establish the requirements for evidence of manufacturers' capability in advance of acquisition. DoD Manual 4120.24-M, *Defense Standardization Program (DSP), Policies, and Procedures*, March 2000, that replaced DoD Manual 4120.3-M, January 1972, provides guidance on QPLs. The manual states that a QPL is appropriate for items of supply that have a stable design or composition and will be continually available for an extended period. These criteria make it practicable to qualify individual products for the QPL without incurring prohibitive testing costs. The primary benefit of the QPL is that it can improve the availability of products and shorten the procurement process because long or highly complex evaluations and tests of products are completed before the contract award. A QPL also allows the manufacturer to provide, and the purchaser to obtain, satisfactory pre-contractual evidence that a product or a family of products has been tested and has met the requirements of the applicable specifications. The supplier is responsible for performing all inspection requirements specified in MIL-D-23003 and MIL-PRF-24667. Products and manufacturers that successfully pass the qualification process are then identified on a list of qualified products or qualified manufacturers. Criteria to retain qualification are applied periodically to ensure continued integrity of the qualification status.

Procurement Cost and Quantity. The GSA NSMs procurement data from 1998 through January 2007 for 24 national stock numbers provided the following information. The GSA data showed that 3,620 requisitions were generated to purchase 110,531 gallons of non-skid paint for approximately \$3.6 million.

Conclusion

During the 1960s to mid-1990s, the Navy supply system and the DLA procured NSMs for the Naval Sea Systems Command (NAVSEA) using QPLs derived from military specifications (MIL-D-23003, DoD-C-24667, or MIL-PRF-24667). Since 1994, the GSA has been procuring NSMs for NAVSEA. Procurements were made using QPLs that identified names of the approved NSM suppliers and manufacturers who met the Navy's specifications and quality requirements. The specifications require contractors to perform all inspection requirements, examinations, and tests at their facilities or other Government-approved laboratories. Procurement data dating back to the 1960s were not available,

however GSA provided data that indicated that GSA purchased 110,531 gallons of non-skid paint for approximately \$3.6 million for the Navy from 1998 through January 2007.

B. Occupational Safety and Health Act Compliance

The Navy has mitigated dust exposure since at least 1991 with requirements contained in *Naval Ships Technical Manual*, chapter 634, “Deck Coverings.” The Navy did not provide documentation that mitigating procedures were implemented in its grinding procedures prior to 1991.

Occupational Safety and Health Administration Standards

Occupational Safety and Health Administration Act. OSHA provides regulatory limits or standards for the exposure of workers to the amount or concentration of a substance in the air. OSHA was established by Public Law 91-596, December 29, 1970, also cited as the Occupational Safety and Health Act 1970. The OSHA mission is to assure safe and healthful working conditions for working men and women. It authorizes enforcement of standards developed under the act by assisting and encouraging employers’ efforts to assure safe and healthful conditions and by providing for research, information, education, and training in the field of occupational safety and health. OSHA also provides requirements for mitigating controls for limiting workers’ exposure to harmful environments. These requirements are met by engineering processes, administrative controls, or personal protective gear. The OSHA standards provide permissible exposure limits (PEL) for air contaminants including mineral dusts and a formula for calculating respirable fraction and total nuisance dust limits.

OSHA does not regulate the content of materials. The EPA regulates the manufacturers’ content of the products including paints. However, an EPA Solid Waste Program Manager indicated that EPA has set no standard for the silica content in paint.

Respirator Standard. An operator working in a hazardous dust environment is required to comply with mitigating controls. Title 29 of the Code of Federal Regulations part 1910, “Occupational Safety and Health Standards,” section 134, “Respiratory Protection,” states in part:

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

Section 134 further explains that respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators, which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program. This section also requires the employer to provide training to employees who are required to use respirators.

Executive Order for Federal Government Compliance with OSHA.

Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees," February 26, 1980, ordered all agencies of the Executive Branch to comply with the Occupational Health and Safety Act of 1970. The executive order requires all Executive Branch agencies to establish a safety and health program for their employees. Although the scope of Executive Order 12196 did not include military personnel and uniquely military equipment, systems, and operations, both the Department of Defense and the Department of the Navy created occupational safety and health programs that incorporated OSHA standards such as those set forth in Title 29 of the Code of Federal Regulations (C.F.R.). The specific language in 29 C.F.R. § 1910.15, "Shipyard Employment," provides that the standards prescribed by 29 C.F.R. § 1915 shall apply to every employment and place of employment of every employee engaged in ship repair, shipbreaking, and shipbuilding, or a related employment. A definition of "shipyard employment" is provided at 29 C.F.R. § 1915.4(i) that states, "The term shipyard employment means ship repairing, shipbuilding, shipbreaking and related employments." Therefore, the term "shipyard employment" is not limited to labor that is physically performed within a shipyard. The protection standards that cover mechanical paint removers are set forth at 29 C.F.R. § 1915.34, "Mechanical Paint Removers." Paragraph (a)(4) of 29 C.F.R. § 1915.34 requires that:

In a confined space, mechanical exhaust ventilation sufficient to keep the dust concentration to a minimum shall be used, or employees shall be protected by respiratory protective equipment in accordance with the requirements of subpart I of this part.

Dust from Grinding

NSM Removal Methods. In order for the new paint to bond tightly, the steel deck must be cleaned of all old paint and any rust. Several mechanical methods are available for NSM removal including abrasive blast cleaning (open blasting), abrasive vacuum blasting (vacublasting), or using a combination of grinders, chippers, or sanders. The open blast process poses difficulties in containing the blast medium (aluminum oxide or garnet) and requires significantly longer clean-up time compared with the use of vacublast. Also, an open blast requires that a full protective suit with fresh air source be worn because of the debris in the air, whereas when vacublasting is performed, only safety glasses, ear protection, and a dust mask as specified by the safety officer, need be worn. The primary advantage of vacublast cleaning is that it saves time in large open areas, since the blast track is large and the shot is contained and recirculated. Further, for bigger

jobs the ship yards can use a new self-propelled horizontal shot blast machine that can produce near-white steel surface for priming with minimum dust and debris accumulation on surrounding areas.

Sampling Tests. Navy industrial hygienists conduct sampling tests on ships. Navy's Sampling Test Procedures describe the sampling that is conducted to quantify occupational exposures to workplace environmental contaminants. For environmental contaminants, personal exposure is determined by collecting breathing zone samples. To obtain the samples, air is collected from within the breathing zone of the worker. A sampling device is attached to the worker and worn continuously during the work shift or operation. Low flow and high flow sampling pumps, combined with filter, impingers, and solid sorbent media, are used to collect longer duration samples, generally 15 minutes to 8 hours. Samples collected for as close as possible to 100 percent of the time period for which the Navy occupational exposure limit (OEL) is defined provide the best estimate of time weighted average (TWA) worker exposure. These samples are then analyzed in laboratories.

OSHA PELs are based on an 8-hour TWA exposure. Navy's OELs are based on many sources; including standards set by OSHA, professional association guidelines (for example, American Conference of Governmental Industrial Hygienists, Threshold Limit Values), and from National Institute for Occupational Safety and Health recommended exposure limits.

Navy Occupational Exposure Data. A senior industrial hygienist at Shore Intermediate Maintenance Activity (SIMA) in Portsmouth, Virginia, stated that in order to comply with the OSHA standards, in 1982 the Navy began hiring industrial hygienists for conducting various sampling tests on ships including NSM removal operation. In 1984, the Navy Environmental Health Center (NEHC) created a database for the industrial hygienists working on ships to input sample test results in the database. Initially, the input to the database was voluntary so the information provided was incomplete. Therefore, in 1986 the data collected voluntarily between 1984 and 1986 were deleted and a new database was created mandating complete data input.

The NEHC provided the information on sample tests performed on the NSM grinding operations on ships from 1986 through 2005. We reviewed all 875 sample test results of NSM removal operation and found that in 13 tests the dust generated during NSM grinding operations exceeded the OSHA PELs and/or Navy OELs. These results stand individually and demonstrate that removal techniques can exceed allowable exposure limits but are not statistically projectable.

In nine of the 13 tests, the total nuisance dust exceeded the OSHA PEL and the Navy OEL that are the same for the total nuisance dust. In two of these nine failed tests, the amount of total nuisance dust generated from grinding operations was approximately 29 times the exposure limits.

In four of the 13 tests, crystalline silica exceeded the Navy OEL but not the OSHA PEL. The Navy OEL for crystalline silica is 100 times stricter than the OSHA PEL. The Navy OEL was exceeded by as much as four times, while test results were only 1/23 of the corresponding OSHA PEL.

Navy's Mitigating Controls

Navy's Compliance With OSHA. In compliance with OSHA policy, the Department of the Navy (DoN) issued OPNAVINST 5100.8G, "Navy Safety and Occupational Safety and Health Program," July 2, 1986, to establish an occupational safety and health program to reduce occupational injuries, illnesses, or deaths and material losses or damage. The Navy provided documentation from 1991 showing mitigating controls for NSM removal to comply with OSHA respiratory requirements that are contained in *Naval Ships Technical Manual* (NSTM) chapter 634, "Deck Coverings." The 1991 NSTM included health and safety instructions and warnings for deck painting and paint removal operations. The manual stated that:

Potential hazards are encountered in most deck covering applications. Therefore, a continuing safety program during installation is mandatory. Adherence to prescribed safety procedures provides protection against major hazards such as fire, explosion, and toxicity. ... Vapors from some of the solvents used may have harmful and irritating effect on the human system, particularly in confined spaces. Air respirators and eye protectors are worn depending on the application. Container labels shall be read and followed for specific safety instructions concerning flammability and toxicity.

The Advance Change Notice to the NSTM, chapter 634, October 17, 1995, added another general safety precaution warning that:

Dust created during grinding operation of existing deck covering materials may present a possible risk of carcinogenicity. ... Many deck coverings underlay materials, and latex concrete, mastic, terrazzo, and cosmetic polymeric deck coverings contain crystalline silica from the sand or quartz components contained therein. During the removal of deck covering materials it is imperative that dust control measures be implemented. The use of personal protective equipment, including respiratory protection is required.

Navy Grinding Operations Training. A Navy captain from the Navy Bureau of Medicine and Surgery stated that although there is no formal training given to sailors for the grinding operation, the first-line supervisor provides training in grinding operation to the sailor. Safety instructions including the use of respiratory masks are also provided by the first-line supervisor prior to the grinding operation.

Mitigating Controls Documentation. The Navy provided copies of Revision 1, April 1, 1991; Revision 2, September 1, 1999; and Revision 3, December 1, 2001, of the *Naval Ships' Technical Manual*, chapter 634, "Deck Coverings." Navy

officials indicated that they do not have the original manual dated May 15, 1976, or its prior editions. We also tried to obtain the older manuals by contacting the Navy shipyards at Philadelphia and Norfolk, the Historical Naval Ships Association, the Naval Historical Center, and the Naval Archives.

We obtained a copy of the OPNAV Instruction 5100.19C, Volume II, January 19, 1994, "Navy Occupational Safety and Health Program Manual for Forces Afloat, Safety Precautions for Paint Removal," that stated "mechanical grinding and sanding shall be kept to the absolute minimum with primary reliance on impact tools and authorized chemical paint strippers for paint removal. Personal protective equipment contained in AEL 2-330024045, asbestos rip-out kit, may be used for paint removal operations." The Navy did not provide the earlier versions of this document.

NAVSEA was able to provide three pages of the NSTM, NAVSEA 0901-LP-190-0002, chapter 9190, "Preservation of Ships in Service (Paints and Cathodic Protection)," November 1, 1976, that described the precautions and procedures prior to a blasting operation that could be used for NSM removal. The excerpts from the manual included the requirement for protective gear. The excerpts further specified the use of proper protective equipment and required blasters to wear hoods and airline respirators or air helmets of the positive pressure type. Other mandatory clothing included rubber or leather gauntlet gloves, safety shoes, and coveralls. Personnel, other than blasters, including machine operators and personnel engaged in work in the vicinity of abrasive blasting operations were required to wear full eye protection and Navy Industrial Occupational Safety and Health-approved dust respirators. Although the requirement was for blasting, not grinding, the document did demonstrate that the Navy was requiring personal protective gear in the 1976 time frame.

Conclusion

OSHA standards require that no employee suffer material impairment of health or functional capacity from exposure to health hazards. OSHA sets enforceable standards and procedures to protect workers against the health effects of exposure to hazardous substances. NSM removal techniques generate dust that can exceed OSHA standards by as many as 29 times in certain circumstances. The Navy has mitigated dust exposure since at least 1991 with requirements contained in Naval Ships Technical Manual, chapter 634, "Deck Coverings." The OSHA standards can be met by incorporating engineered processes and establishing health and safety procedures, including the use of personal protective gear. The Navy did not provide documentation that mitigating procedures were implemented in its grinding procedures prior to 1991.

C. Other Matters of Interest

1980 DuPont Employee Complaint

On August 1, 1980, a DuPont employee wrote to the Department of Labor, Occupational Safety and Health Administration Regional Office, Philadelphia, requesting protection under OSHA Section 11(c) from discrimination. The employee alleged that DuPont would not permit him to report his calculated amorphous silica concentration in their titanium dioxide compound MSDS and he was unwilling to report the levels of concentration DuPont asked him to report. Due to this disagreement, he stated that he was re-assigned to another job. The employee alleged that the DuPont MSDS was misleading and would permit exposure of workers to air concentrations of amorphous silica 6 to 10 times the OSHA-regulated level.

On January 4, 1982, the OSHA regional office in Philadelphia filed the complaint without further action.

To confirm our analysis of the 1980 complainant calculations, we consulted an OSHA industrial hygienist who stated that:

The assumptions made in calculating the exposure limit of amorphous silica were incorrect. The complainant assumed the Titanium dioxide was completely covered by the Alumina, and Silica, and therefore made his calculations assuming 50 percent silica. The complainant should have used the percentage of silica obtained from actual air sampling tests. The exposure limit calculated by the complainant could be significantly different. Therefore, his claim that the titanium dioxide exposure level or the nuisance dust level will permit exposures of workers to air concentrations of amorphous silica 6 to 10 times the OSHA regulated level may or may not be correct.

1998 Complaint From a Veterans Outreach Foundation

The Navy IG received a complaint in February 1998, via the Navy Judge Advocate General, from the “Veterans Outreach Foundation.” The complainant’s concerns were regarding the exposure of Navy personnel aboard naval ships to silica, titanium, and aluminum. The complainant alleged the ingredient, DuPont’s Ti-Pure R-933, used in the NSMs was responsible for the sailors’ injuries. Since 1994, the General Services Administration (GSA) has been buying NSMs for the Navy. Therefore, the Naval IG forwarded the complainant’s letter and supporting documentation to the IGs of the GSA and Environmental Protection Agency (EPA) for information and action deemed appropriate.

The National Defense Authorization Act of 2006

The National Defense Authorization Act (NDAA) for Fiscal Year 2006, Section 746, “Cooperative Outreach to Members and Former Members of the Naval Service Exposed to Environmental Factors Related Sarcoidosis,” requires the Secretary of the Navy, in coordination with the Secretary of Veteran Affairs (VA), to conduct an outreach program. The purpose was to contact as many members and former members of the naval service as possible who, in connection with service aboard Navy ships, may have been exposed to aerosolized particles resulting from the removal of non-skid coatings used on those ships. The Secretary of the Navy is required to provide a report on the results of the outreach program 1 year after the enactment of the Act.

On September 27, 2006, in order to comply with the Act, the Surgeon General of the Navy wrote a letter to current and former active duty Service members. He urged the current active duty members to contact their military healthcare provider for an evaluation and asked veterans to visit a VA health eligibility Web site before enrollment for healthcare from the VA. According to the Deputy Director for Occupational Medicine, Navy Environmental Health Center the Sarcoidosis Outreach Working Group was tasked to generate a program including targeted, general, and informational outreach efforts to inform former service members and providers of information pertaining to NDAA Section 746. The working group targeted its outreach mailing to 1,162 former service members identified in the 2004 Navy Lung Disease Assessment Program study, of which 836 have confirmed receipt. In addition, web-based resources for the education of former service members and medical providers have been provided and an outreach information line for inquiries regarding the outreach program has been established. The report on the results is complete and is expected to be signed by the Secretary of the Navy by the end of October 2007.

Appendix A. Scope and Methodology

The assessment was conducted at Commander, Naval Sea Systems Command organizations, the U.S. Navy Bureau of Medicine and Surgery, the Naval Environmental Health Center, and the Occupational Safety and Health Administration headquarters. We reviewed Navy records related to the procurement, selection criteria, and types of non-skid materials used from 1960 to present. We reviewed the GSA procurement data from 1998 through January 2007 to determine the quantity and amount spent to buy the NSMs. We reviewed OSHA standards and the MSDSs for the chemical composition and properties of the NSMs. We reviewed the Navy standards and procedures for applying and removing NSMs on ship decks dating back to 1991. The Navy did not provide the technical manuals for the 1960 to 1990 time period. We contacted Navy shipyards at Philadelphia and Norfolk, the Historical Naval Ships Association, the Naval Historical Center, and the Naval Archives to obtain copies of the manuals published prior to 1991. We also reviewed the Navy's Occupational Exposure Data collected from the sample tests performed on NSMs removed from ship decks.

Limitations of Scope:

- Our review considered only purchases made through GSA. We did not determine the amount and type that may have been purchased separately through shipyards for ship construction and maintenance.
- Our review did not include a determination of whether the mitigation controls were implemented aboard ships.

Use of Computer-Processed Data. We did not use computer-processed data to perform this assessment.

Prior Coverage

No prior coverage has been conducted on the overall management of non-skid materials during the last 5 years.

Appendix B. Military Specifications/Performance for Non-Skid Materials

MIL-D-23003 (SHIPS)		MIL-D-23003A (SH)		DoD-C-24667 (NAVY)		MIL-PRF-24667A (NAVY)		MIL-PRF-24667B (SH)	
September 12, 1961		February 25, 1980		September 11, 1986		August 14, 1992		June 3, 2005	
Type I	Metal	Type I	Obsolete	Type IA/B	High volatile/Low volatile (general purpose deck coating)	Type I	High durability, rollable deck coating	Type I	High durability, rollable deck coating
Type II	Metal & Wood	Type II	Obsolete	Type IIA/B	High volatile/Low volatile (general purpose deck coating interior/exterior)	Type II	Standard durability, rollable/trowell deck coating	Type II	Standard durability, rollable deck coating
		Type III	General purpose exterior	Type IIIA/B	High volatile/Low volatile (wood deck coating)	Type II	Standard durability, rollable, resilient deck coating (exterior wooden deck)	Type III	Standard durability, rollable, resilient deck coating
		Type IV	Aircraft carrier landing and run-out area			Type IV	Standard durability, sprayable deck coating	Type IV	Standard durability, sprayable deck coating
		Type V	General purpose interior/exterior					Type V	Extended durability, rollable deck coating
								Type VI	High durability, fast cure, rollable deck coating
								Type VII	Fast cure, temporary repair, rollable deck coating
								Type VIII	Low temperature cure, rollable deck coating
								Type IX	High temperature resistance deck coating
								Type X	Submerged applications

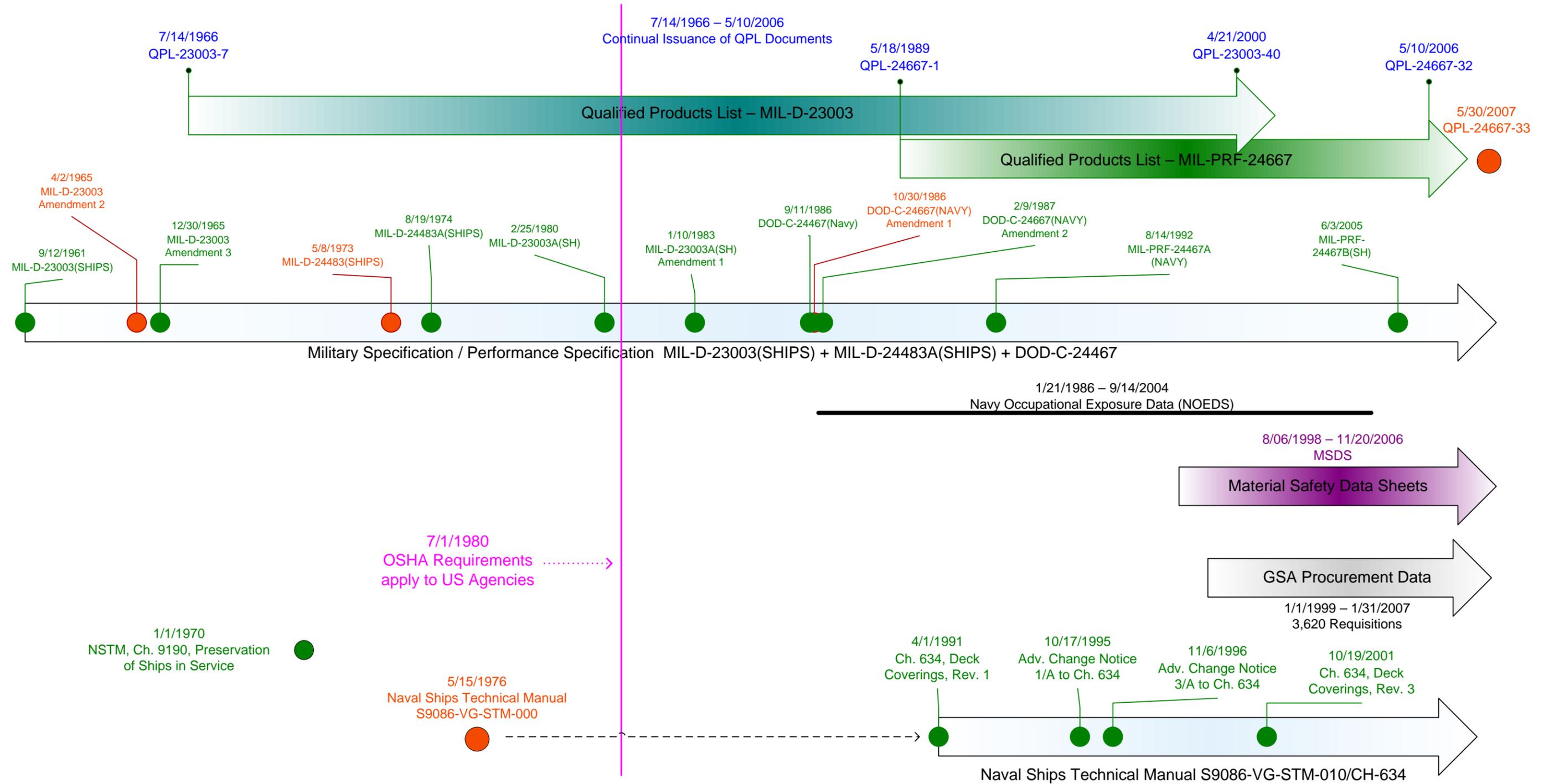
Appendix C. Non-Skid Materials Program Timeline of Events

The following chart provides a timeline of non-skid material documentation. It consists of six bars, each of which indicates a particular type of documentation and whether we have that document (green dot) or if we do not have the document but it is referenced by a document that we do have (red dot). The six bars are:

- Two Qualified Products Lists: Navy and GSA-qualified vendors for non-skid materials
- Military Specification (MilSpec) or Performance Specification (MilPrf) for non-skid materials: This is one document family, with various versions issued under different names/numbers – including MIL-D-23003, superseded by DOD-C-24467, and in turn superseded by MIL-PRF-24467. Another document in this series, MIL-D-24483A, was released in 1974, and was also superseded by DoD-C-24467.
- Navy Occupational Exposure Sampling Test Data: Test results from 875 sampling tests conducted on grinding operations performed on Navy ship decks.
- Material Safety Data Sheets (MSDS): We have two sets of these documents: one for product with silica, and one for product without silica. The dates are similar but not identical.
- GSA Procurement Data: We have information on 3,620 requisitions for non-skid material, usually including product and quantity.
- *Navy Ships Technical Manual*, Chapter 634: Deck Coverings

In addition to the above bars, we have a single instance of *Navy Ships Technical Manual*, chapter 910, “Preservation of Ships in Service,” January 1970. This is represented by a single green dot on the chart, near the lower left corner.

Non-Skid Materials Timeline



- We have document
- We do not have document, but it is referenced by other documents we do have

Appendix D. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition, Technology, and Logistics
 Director, Acquisition Resources and Analysis
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Department of the Navy

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The Bureau of Medicine and Surgery
Navy Environmental Health Center
Naval Medical Center Portsmouth, VA

Other Defense Organizations

Director, Defense Logistics Agency

Congressional Committees and Subcommittees, Chairman and Ranking Minority Member

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Homeland Security and Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Oversight and Government Reform
House Subcommittee on Government Management, Organization, and Procurement,
 Committee on Oversight and Government Reform
House Subcommittee on National Security and Foreign Affairs,
 Committee on Oversight and Government Reform

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