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author: E. E. Lory

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CIVIL ENGINEERING LABORATORY

NAVAL CONSTRUCTION BATTALION CENTER
Port Hueneme, California 93043

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(2) nonfriable matrix-bonded composite products. This document defines the hazard and safe asbestos-containing product handling and disposal practices for Category I and Category II products.

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The potential health hazards to personnel from exposure to airborne asbestos fiber and the wide variety of asbestos-containing products used at Navy facilities prompted the Naval Facilities Engineering Command to task the Civil Engineering Laboratory to develop guidance on appropriate practices for handling and disposal of asbestos-containing products. Two categories of asbestos-containing construction materials have been identified as potential asbestos-fiber-releasing threats: (1) friable insulating products and woven products and (2) nonfriable matrix-bonded composite products. This document defines the hazard and safe asbestos-containing product handling and disposal practices for Category I and Category II products.

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FOREWORD

Executive Order 12088, Federal Compliance with Product Control Standards (Ref 1), requires that the operation and maintenance of federal facilities conform with all substantive federal, state, and local regulations governing Navy-generated pollution. Therefore, the user of this technical note is cautioned to refer to federal, state, and local regulations for applicable requirements concerning disposal of asbestos-containing products.

INTRODUCTION

Asbestos is a general term used to describe several fibrous hydrated silicate minerals known for their high tensile strength, high flexibility, durability, and heat and chemical resistance. Only six of these asbestiform silicates -- chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite -- are of major commercial importance. In the past decade, there has been an increasing awareness of the significance of environmental contamination as a cause of disease. The physical characteristics of asbestos fibers and the widespread and varied uses of asbestos-containing products have caused concern for human exposure to asbestos fibers during their collection and disposal.

Many types of asbestos products have been used in Navy construction in a variety of applications, ranging from spray-applied asbestos insulation to asbestos cement sheeting. This diversity has led to confusion in determining appropriate practices for disposal of asbestos-containing wastes. New Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations, reinforced by court decisions, have placed new burdens on facility and safety managers to insure proper practices for disposal of these wastes.

The Civil Engineering Laboratory (CEL) has been tasked by the Naval Facilities Engineering Command (NAVFAC) to provide guidance on appropriate practices for handling and disposing of the Navy's asbestos-containing hazardous wastes. The information assembled in this investigation was developed through a search of pertinent literature and through contacts with EPA. This type of information is essential to facility and safety managers to insure regulation compliance and cost-effective operations. Also, it provides a basis for decisions regarding the direction of further development in this area.

This technical note is one of a series of documents prepared by CEL on asbestos construction products found at Naval Shore Facilities. The primary guidance document is the Management Procedure for Assessment of Friable Asbestos Insulating Material (Ref 2). Supplementary technical notes to this guidance document will be prepared on subjects related to asbestos-containing products, such as encapsulation methods, thermal pipe insulation maintenance procedures, and applied insulation demolition techniques.

DEFENSE PROPERTY DISPOSAL OFFICE

Asbestos-containing items can normally be processed through the Defense Property Disposal Office (DPDO) if three criteria are met:

1. Processing of paperwork for disposal of asbestos-containing materials will be handled by DPDO. DPDO will not actually store asbestos-containing items.

2. Items to be disposed of after removal from asbestos abatement projects or demolition sites (such as ducts, lights, and steam pipes, etc.) must undergo friable asbestos decontamination; they are then sprayed with a sealer or binder.
3. DPDO processing must be cost effective. If the processing is not cost effective, landfill disposal should be used.

Navy activities requiring further guidance should refer to Appendix A or contact cognizant DPDO.

REGULATIONS ON ASBESTOS EMISSION

The national emission standard for asbestos is applicable to demolition and renovation of buildings or structures that have friable asbestos-containing products. These standards are based upon specific operations and physical conditions, and are relegated to emissions to the atmosphere. The principal considerations are health effects.

EPA has determined that no presently available techniques exist for the sampling and analysis of asbestos emissions in ambient air. This determination is partly based on technical difficulties involved in developing a measuring technique. Secondly, there is no apparent relationship between the sample results and actual health effects. As a result, no direct comparison can be made between the EPA standards for asbestos and the recommended criteria for occupational exposure. However, it may be correct to assume that the levels of exposure to the general public may be lower than occupational standards, based on exposure during an 8-hr day, 40-hr work week.

The regulations apply to asbestos-containing waste from manufacturing operations and the waste from renovation and demolition products. They are concerned only with waste materials that have a potential for ready-release of fibers; that is, friable items that can be crumbled, pulverized, or reduced to powder in the hand with minimal mechanical disturbance.

Those EPA regulations contained in Title 40, Code of Federal Regulations, part 61 (Ref 3) that apply to asbestos waste disposal are summarized in the following:

General Provisions

<u>Section Number</u>	<u>Content</u>
61.02	Definitions
61.04	Regional EPA office addresses
61.10	Waiver information
61.11	Other pertinent information

National Emission Standard for Asbestos

<u>Section</u>	<u>Content</u>
61.21 Definitions	Terms relating to visible emissions, demolition, friable asbestos products, wetting, and waste material are defined in this section.
61.22 Emission standard, work practice requirements	<p>Contains emission standards for manufacturing and fabricating operations. Contains emission standards and requirements for demolition and renovation requirements, including notification, wetting, removal, and applicability. Specifies the applicability of standard to removal of asbestos materials of more than 80 m (260 ft) of covered pipe, or 15 sq m (150 sq ft) of friable asbestos materials used to cover a structural member.</p> <p>Also, waste collection and disposal requirements are described for all sources. In general, regulations require that there be no visible emission during work and during waste collection and disposal. Specifically, the procedures to prevent emissions during demolition and renovation are described as the following: adequate wetting, proper movement and handling, and exceptions to wetting requirements.</p> <p>Waste disposal methods shall not produce visible emissions. Waste material may be placed in leak-tight containers while wet, processed into nonfriable forms, and disposed of in sites in accordance with provisions of Section 61.25.</p>
61.25 Waste disposal sites	This section contains regulations on emissions access restrictions, sign posting, and operating methods for asbestos waste disposal sites. In general, no visible emissions are permitted.

CATEGORIES OF ASBESTOS-CONTAINING PRODUCTS

Asbestos-containing construction products can generally be divided into two categories:

Category I - Friable insulating products and asbestos woven (textile-like) products

Category II - Nonfriable matrix-bonded composite products

Friable products are those that can readily release fibers with minimal mechanical disturbance. In textile-like products, raw asbestos fibers and fibers of numerous other materials (of organic or inorganic origin) are worked into rovings, yarns, and cords that can be woven, braided, or knitted. Binding agents usually are not used in these textile products. Additional information on products in both categories can be obtained from CEL Technical Note N-1576 (Ref 4). Table 1 presents information on the Category I types of products. Managers are cautioned to be particularly careful in identifying all friable asbestos sources in advance. Thermal pipe insulation must always be assumed to contain asbestos until proven otherwise by laboratory analysis or flagged/identified as being asbestos free.

Nonfriable matrix-bonded composite products are prepared by mixing fibers with various bonding agents (e.g., starch, glue, waterglass, plastics, cements, and asphalt). The degree of asbestos fiber immobilization covers a wide range. The immobilization also varies according to the use and environmental conditions to which the product is subjected. Table 2 presents information on the Category II types of products.

ASBESTOS WASTE HANDLING AND DISPOSAL

Fiber control containment and worker protection are necessary in asbestos waste handling and disposal because the environment will be contaminated regardless of the work method used. A potential exists not only for worker exposure, but also for contamination of the structure, the community, and the worker's home. Hence, asbestos-containing wastes must be treated with the same respect accorded asbestos products. Therefore, once the source of asbestos-containing waste has been identified, that waste should be separated when feasible into the two categories mentioned above; care must be taken to prevent exposure of the workers during the separation. Further guidance on occupational exposure during waste handling and disposal is offered by Industrial Hygiene Services, listed in Appendix B. Also, according to EPA regulations, there shall be no visible emissions to the outside air during the collecting, containerizing, transporting, or depositing of any asbestos-containing waste material.

Category I Products

Waste Handling. Handling and disposal of Category I asbestos waste require special procedures (refer to Ref 3 and 5). There are three accepted methods for handling applied friable insulation: (1) placing

the wet bulk waste into a transport vehicle, (2) placing the wet waste into sealable leak-tight containers, or (3) processing the waste into a nonfriable form. Sealable leak-tight containers usually are more efficient and economical for handling this type of waste.

Preformed thermal insulating products should be handled in a wet state. They are generally handled by either of two methods: (1) plastic bags or sealant covering damaged or open ends, or (2) plastic sheets which containerize section lengths. Textiles are generally used as lagging for thermal insulating products and are disposed of intact with the insulation.

Friable asbestos-containing waste is handled wet because water lowers both the friability and the aerodynamic properties of released fibers, thus reducing airborne asbestos levels. Because of the additional weight, released wet fibers settle rapidly. Penetration of water into a fiber matrix is significantly increased with a wetting agent or surfactant that reduces the surface tension of water droplets. Water treated with a wetting agent is commonly used by fire departments, industry, and agriculture. This wetting technique reduces the amount of water needed for saturation, increases cohesiveness of the fiber matrix, and increases the probability of individual fiber wetting. A friable asbestos-containing product must be repeatedly wetted with a fine low-pressure spray to sufficiently saturate the material. The treated water can be applied with a hand pump garden sprayer. Airless spraying techniques and large pump systems have also been employed; however, the treated water may bypass certain types of seals with these two types of equipment.

Some manufacturers and distributors of commercially available wetting agents* are listed as follows:

Aquatrols Corp. of America
1400 Suckle Highway
Pennsauken, NJ 08110

Leffingwell Chemical Co.
Box 188
Brea, CA 92921

Occidental Chemical Co.
Institutional Division
Box 198
Lathrop, CA 95330

Rohm and Haas Co.
Ag. Chemical Dept.
Independence Mall
W. Philadelphia, PA 19105

Target Chemical Co.
1280 N. 10th St.
San Jose, CA 95112

Thompson-Hayward Chemical Co.
Box 2383
Kansas City, KS 66110

Vineland Chemical Co.
Box 745
Vineland, NJ 08360

NOTE

Wetting would be used until the temperature,
or wind chill factor, made it impossible.

*This information should not be construed as a product endorsement
by the Navy.

Bulk waste friable insulation can be transported for disposal in a specially constructed vehicle which containerizes and maintains the waste in a slurry. Some of these vehicles have a mounted vacuum system and are capable of transporting the insulation waste directly from the demolition site to the disposal site. With this method, decontamination of the transport vehicle must be considered.

Another suggested method is to pack the moist bulk asbestos friable insulation products in fiber or metal drums lined with sealable 6-mil or thicker plastic bags. The drums should be sealed with a lid and retaining ring. If the bulk asbestos waste will not fit into drums, the material should be put in 6-mil or thicker plastic bags and loaded into a skip for transport to an EPA-approved disposal site. The outside of each drum and the skip must be decontaminated before transport. The drums and skip must be marked with approved OSHA labels printed with waterproof ink. The signs should contain the following warning:

CAUTION
DO NOT OPEN
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY CAUSE
SERIOUS BODILY HARM

The dump trucks and skips hauling the asbestos waste drums should be covered to prevent loss or damage to drums en route to the disposal site.

The sealed plastic bags can be dumped from the drums into the burial site unless the bags have been broken or damaged. Damaged bags should be left in the drum, and the entire sealed, contaminated drum buried. Uncontaminated drums can be recycled. Workers unloading sealed drums should wear respirators and appropriate personal protective equipment when handling the material at the disposal site.

Waste Disposal. Category I asbestos-containing waste, properly contained for transportation, should be disposed of in a sanitary landfill which is state- or local-approved for disposal of asbestos. Special high-cost hazardous waste material disposal services are unnecessary if the sanitary landfill disposal area, generally Class 1 landfill, is state-approved and if procedures are performed in accordance with guidelines established in Title 40, Code of Federal Regulations, part 61. The waste disposal site should have warning signs along the perimeter of those fenced sections where asbestos-containing waste is deposited. The asbestos waste should be covered with a minimum of 6 in. of nonasbestos-containing material at the end of each operating day. Problems can occur when an asbestos slurry is dumped or pumped into a landfill. If dust is created, it is necessary to consider it as containing asbestos fibers. Therefore, appropriate dust suppression methods should be used at the landfill.

For guidance concerning specific environmental questions, or for applicable local regulations, consult the Navy Environmental Support Office's Hazardous Waste Disposal Guide (Ref 6).

Category II Products

Waste Handling. Category II asbestos waste material is not normally handled in a wet condition unless the material has been mechanically disturbed enough to cause release of fibers. These fibers can be released into the environment as a result of cutting, grinding, or abrading.

Waste Disposal. All Category II products can be disposed of in a sanitary landfill, provided that dust from these products is not visible.

DEMOLITION OF ASBESTOS-CONTAINING FACILITIES

Facilities constructed with Category II asbestos-containing products can be demolished without removing these products as long as the material is not cut, ground, or abraded. Any facility scheduled for demolition (torching, wrecking) that was constructed with any product from Category I must have that product removed and properly disposed of prior to demolition of the facility.

RECOMMENDATIONS

Further investigation into asbestos-containing products is required to clarify the extent of fiber release, conditions under which it occurs, and procedures for controlling its release. Methods for controlling fiber release are available today for new construction and remodeling projects. However, controlling fiber release during demolition of facilities is a problem which can be alleviated with continued research.

With the vast diversity of existing asbestos building products and the difficulties of assessment in the field, a device for rapid detection and assessment should be developed as stricter regulations are implemented by the Department of Labor Occupational Safety and Health Administration. A standardized asbestos-containing product or asbestos-free product coding system should be considered for shore activities as well as a flagging system for Public Works Department maintenance files.

REFERENCES

1. Executive Order 12088: Federal compliance with product control standards, Oct 1978.
2. Civil Engineering Laboratory. Management procedure for assessment of friable asbestos insulating material, by D. Coin and E. E. Lory. Port Hueneme, Calif. (in preparation)
3. Environmental Protection Agency. 40 CFR 61: National emission standards for hazardous air pollutants: Asbestos, Federal Register, Apr 1973 and Jun 1978.
4. Civil Engineering Laboratory. Technical Note N-1576: Characterization of asbestos construction products at Naval Shore Facilities, by E. E. Lory. Port Hueneme, Calif., May 1980.

5. Chief of Naval Operations. OPNAVINST 6260.1A: Control of asbestos exposure to Naval personnel and environs. Washington, D.C., 8 Aug 1978.

6. Navy Environmental Support Office. NESO 20.2-011: Hazardous waste disposal guide, Directory of contacts for disposal assistance. Port Hueneme, Calif., Dec 1976.

Table 1. Description of Category I Asbestos Materials and Products^a

Typical Use	Generic Name	Asbestos (%)	Binder/Sizing
Applied Friable Insulating Products	spray-applied insulation	5-95	sodium silicate, portland cement, organic material
Preformed Thermal Insulating Products	batts, blocks and pipe coverings 85% magnesia calcium silicate	15 6-8	magnesium carbonate calcium silicate
Textiles	cloth		
	blue stripe	>80	cotton
	red stripe	>90	cotton
	green stripe	>95	cotton
	sheet	95→50 ^b	cotton/wool
	cord/rope/yarn	80-100	cotton/wool
	tubing	80-85	cotton/wool
	tape/strip	90	cotton/wool
	curtains (theatre)	60-65	cotton
	blankets	100	none
	felts	90-95	cotton/wool

^a Current NAVFAC policy on asbestos-containing products is to substitute durable and economical asbestos-free material that meets the physical and technical qualities of the asbestos-containing products whenever feasible. The use of substitutes for asbestos-containing products will be judged case-by-case, based on certification or other acceptable procedures. Testing to determine asbestos-free substitute materials will be the responsibility of industry.

^b Arrow indicates a reduction of asbestos content from the original to present formulations.

Table 2. Description of Category II Nonfriable,
Matrix-Bonded, Composite Products^a

Typical Use	Generic Name	Asbestos (%)	Binder/Sizing
Cementitious Products	extrusions	8	portland cement
	panels		
	corrugated	20-45	portland cement
	flat	40-50	portland cement
	flexible	30-50	portland cement
	flexible, perforated	30-50	portland cement
	laminated		
	(outer surface)	35-50 ^b	portland cement
	roof tiles	30-20 ^b	portland cement
	clapboard and shingles		
	clapboard	12-25	portland cement
	siding shingles	12-14 ^b	portland cement
roofing shingles	32-20 ^b	portland cement	
pipe	20-15 ^b	portland cement	
Paper Products	corrugated		
	high temperature	>90	sodium silicate
	moderate temperature	>70-35 ^b	starch
	indented	>98	cotton & organic binder
	millboard	80-85	starch, lime, clay
Roofing Felts	smooth surface	10-15	asphalt
	mineral surface	10-15	asphalt
	shingles	1	asphalt
	pipeline	10	asphalt
Asbestos-Containing Compounds	caulking putties	30	linseed oil
	adhesive (cold applied)	5-25	asphalt
	joint compound	1-5	asphalt
	roofing asphalt	<5	asphalt
	mastics	5-25	asphalt
	asphalt tile cement	13-25	asphalt
	roof putty	10-25	asphalt
	plaster/stucco	2-10	portland cement
	spackles	3-5	starch, casein, synthetic resins
	sealants fire/water	50-55	castor oil or polyisobutylene
	cement insulation	20-100	clay
	cement finishing	55	clay
	cement magnesia	15	magnesium carbonate

(continued)

Table 2. Continued

Typical Use	Generic Name	Asbestos (%)	Binder/Sizing
Asbestos Ebony Products		50	portland cement
Flooring Tile and Sheet Goods	vinyl/asbestos tile	21	poly(vinylchloride) asphalt dry oils
	asphalt/asbestos tile	26-33	
	sheet goods/resilient sheet	30	
Wallcovering Paints and Coatings	vinyl wallpaper	6-8	asphalt asphalt
	roof coating	4-7	
	air tight	15	

^a Current NAVFAC policy on asbestos-containing products is to substitute durable and economical asbestos-free material that meets the physical and technical qualities of the asbestos-containing products whenever feasible. The use of substitutes for asbestos-containing products will be judged case-by-case, based on certification or other acceptable procedures. Testing to determine asbestos-free substitute materials will be the responsibility of industry.

^b Arrow indicates a reduction of asbestos content from the original to present formulations.

Appendix A

TECHNICAL ASSISTANCE DIRECTORY

Field Problem Inquiry

1. General. Navy Environmental Support Office (NESO) Code 25 personnel are available to provide consultation on disposal of asbestos-containing products.

Navy Environmental Support Office, Code 25
Naval Construction Battalion Center
Port Hueneme, CA 93043
Mr. William J. Powers
Autovon: 360-4821 or Commercial: (805) 982-4821

2. General. Civil Engineering Laboratory (CEL) Code L52 personnel are available to provide consultation on asbestos-containing products.

Civil Engineering Laboratory, Code L52
Naval Construction Battalion Center
Port Hueneme, CA 93043
Mr. Ernest E. Lory
Autovon: 360-5555 or Commercial: (805) 982-5555

Appendix B

INDUSTRIAL HYGIENE SERVICES

1. General. Industrial hygiene personnel at BUMED activities are available to provide consultation on occupational health matters and specific assistance in monitoring personnel exposure levels to asbestos to recommend personal protective gear required to control personnel exposures to asbestos.

2. Activities Located in NonBUMED Commands. Request industrial hygiene services from the regional medical center which will provide, or arrange for, the required services. Industrial hygiene services are available in the following centers:

<u>NAVRGHEDCEN</u>	<u>Autovon</u>	<u>Commercial</u>
Bethesda, MD	295-1202	(301) 295-1202
Bremerton, WA	439-2729	(206) 478-2729
Camp Pendleton, CA	993-3509	(714) 725-3509
Charleston, SC	794-6100	(803) 743-6100
Corpus Christi, TX	861-3465	(512) 939-3465
Jacksonville, FL	942-2841	(904) 772-2841
Camp LeJeune, NC	484-2707	(919) 451-2707
Long Beach, CA	360-7275	(213) 547-8236
New London, CT	241-4613	(203) 449-4613
Oakland, CA	253-2458	(707) 646-2458
Pearl Harbor, HI	430-0111 x4242	(808) 474-4242
Pensacola, FL	922-3639	(904) 452-3639
Philadelphia, PA	443-3734	(215) 755-3734
Portsmouth, NH	684-2398	(270) 439-1000 x398
Portsmouth, VA	961-3280	(804) 393-3280
San Diego, CA	957-3509	(714) 225-3506

3. All Other Shore Activities. Request industrial hygiene assistance from the nearest NAVENPVNTHEDU or the Navy Environmental Health Center, Naval Base, Bldg 353, Norfolk, VA 23511, Autovon: 690-4657 or Commercial: (804) 444-4657.

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 Chief. Petty Offr. PW/Self Help Div, Beeville TX; OIC, CBU 417, Oak Harbor WA; PW (J. Maguire),
 Corpus Christi TX; PWD Maint. Cont. Dir., Fallon NV; PWD Maint. Div., New Orleans, Belle Chasse LA.
 PWD, Maintenance Control Dir., Bermuda; PWD, Willow Grove PA; PWO Belle Chasse, LA; PWO Chase
 Field Beeville, TX; PWO Key West FL; PWO, Dallas TX; PWO, Glenview IL; PWO, Kingsville TX; PWO,
 Millington TN; PWO, Miramar, San Diego CA; PWO., Moffett Field CA; ROICC Key West FL; SCE Lant
 Fleet Norfolk, VA; SCE Norfolk, VA; SCE, Barbers Point HI; Security Offr. Alameda CA
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 NAVACT PWO, London UK
 NAVACTDET PWO, Holy Lock UK
 NAVAEROSPREGMEDCEN SCE, Pensacola FL
 NAVAVIONICFAC PWD Deputy Dir. D/701, Indianapolis, IN
 NAVCOASTSYSTCTR Code 423 (D. Good), Panama City FL; Code 713 (J. Quirk) Panama City, FL; Code
 715 (J. Mittleman) Panama City, FL, Library Panama City, FL
 NAVCOMMAREAMSTRSTA Code W-602, Honolulu, Wahiawa HI; PWO, Norfolk VA; PWO, Wahiawa HI;
 SCE Unit 1 Naples Italy
 NAVCOMMSTA Code 401 Nea Makri, Greece; PWO, Exmouth, Australia; PWO, Fort Amador Canal Zone
 NAVEDTRAPRODEVNEN Tech. Library
 NAVEDUTRACEN Engr Dept (Code 42) Newport, RI
 NAVENVIRHLTHCEN CO, Norfolk, VA
 NAVEOFAC Code 605, Indian Head MD
 NAVFAC PWO, Cape Hatteras, Buxton NC; PWO, Centerville Bch, Ferndale CA; PWO, Guam
 NAVFAC PWO, Lewes DE
 NAVFACENGCOM Code 043 Alexandria, VA; Code 044 Alexandria, VA; Code 0451 Alexandria, VA; Code
 0453 (D. Potter) Alexandria, VA; Code 0454B Alexandria, VA; Code 046; Code 0461D (V M Spaulding)
 Alexandria, VA; Code 04B3 Alexandria, VA; Code 04B5 Alexandria, VA; Code 09M54, Technical Library,
 Alexandria, VA; Code 100 Alexandria, VA; Code 1002B (J. Leimanis) Alexandria, VA; Code 1113 (M.
 Carr) Alexandria, VA; Code 1113 (T. Stevens) Alexandria, VA; Code 1113 Alexandria, VA; Morrison Yap,
 Caroline Is.
 NAVFACENGCOM - CHES DIV. Code 101 Wash, DC; Code 402 (D Scheesele) Washington, DC; Code 403
 (H. DeVoe) Wash, DC; Code 405 Wash, DC; Contracts, ROICC, Annapolis MD; FPO-1 (Spencer) Wash,
 DC
 NAVFACENGCOM - LANT DIV. Code 10A, Norfolk VA; Eur. BR Deputy Dir, Naples Italy; European
 Branch, New York; RDT&ELO 102, Norfolk VA
 NAVFACENGCOM - NORTH DIV. CO; Code 09P (LCDR A.J. Stewart); Code 1028, RDT&ELO,
 Philadelphia PA; Code 111 (Castranovo) Philadelphia, PA; Code 114 (A. Rhoads); Design Div. (R
 Masino), Philadelphia PA; ROICC, Contracts, Crane IN
 NAVFACENGCOM - PAC DIV. (Kyi) Code 101, Pearl Harbor, HI; Code 2011 Pearl Harbor, HI; Code 402,
 RDT&E, Pearl Harbor HI; Commander, Pearl Harbor, HI
 NAVFACENGCOM - SOUTH DIV. Code 90, RDT&ELO, Charleston SC; ROICC (LCDR R. Moeller),
 Contracts, Corpus Christi TX
 NAVFACENGCOM - WEST DIV. 102; 112; AROICC, Contracts, Twentynine Palms CA, Code 04B San
 Bruno, CA; O9P/20 San Bruno, CA; RDT&ELO Code 2011 San Bruno, CA
 NAVFACENGCOM CONTRACT AROICC, Point Mugu CA; AROICC, Quantico, VA; Code 05, TRIDENT,
 Bremerton WA; Dir. Eng. Div., Exmouth, Australia; Eng Div dir, Southwest Pac, Manila, PI, OICC,
 Southwest Pac, Manila, PI; OICC/ROICC, Balboa Canal Zone, ROICC AF Guam; ROICC LANT DIV.,
 Norfolk VA; ROICC, Diego Garcia Island; ROICC, Keflavik, Iceland; ROICC, Pacific, San Bruno CA
 NAVMAG SCE, Guam
 NAVMIRO OIC, Philadelphia PA
 NAVNUPWRU MUSE DET Code NPU-30 Port Hueneme, CA
 NAVOCEANO Code 1600 Bay St. Louis, MS; Code 3432 (J. DePalma), Bay St. Louis MS
 NAVOCEANSYSCEN Code 41, San Diego, CA; Code 5221 (R Jones) San Diego Ca, Code 6700, San Diego,
 CA
 NAVORDSTA PWO, Louisville KY

NAVPETOFF Code 30, Alexandria VA
 NAVPHIBASE CO, ACB 2 Norfolk, VA; Code S3T, Norfolk VA; Harbor Clearance Unit Two, Little Creek, VA
 NAVRADRECFAC PWO, Kami Seya Japan
 NAVREGMEDCEN Code 3041, Memphis, Millington TN; PWO Newport RI; PWO Portsmouth, VA; SCE (D. Kaye); SCE San Diego, CA; SCE, Camp Pendleton CA; SCE, Guam; SCE, Oakland CA
 NAVSCOLCECOFF C35 Port Hueneme, CA; CO, Code C44A Port Hueneme, CA
 NAVSEASYSKOM Code OOC (LT R. MacDougal), Washington DC; Code SEA OOC Washington, DC
 NAVSEC Code 6034 (Library), Washington DC
 NAVSECGRUACT Facil. Off., Galeta Is Canal Zone; PWO, Adak AK; PWO, Edzell Scotland; PWO, Puerto Rico; PWO, Torri Sta, Okinawa
 NAVSHIPREPFAC SCE Subic Bay
 NAVSHIPYD; Code 202.4, Long Beach CA; Code 202.5 (Library) Puget Sound, Bremerton WA; Code 380, (Woodroff) Norfolk, Portsmouth, VA; Code 400, Puget Sound; Code 404 (LT J. Riccio), Norfolk, Portsmouth VA; Code 410, Mare Is., Vallejo CA; Code 440 Portsmouth NH; Code 440, Norfolk; Code 440, Puget Sound, Bremerton WA; Code 450, Charleston SC; L.D. Vivian; Library, Portsmouth NH; PWD (Code 400), Philadelphia PA; PWO, Mare Is.; PWO, Puget Sound; SCE, Pearl Harbor HI; Tech Library, Vallejo, CA
 NAVSTA AROICC, Brooklyn NY; CO Naval Station, Mayport FL; CO Roosevelt Roads P.R. Puerto Rico; CO, Brooklyn NY; Code 4, 12 Marine Corps Dist, Treasure Is., San Francisco CA; Engr. Dir., Rota Spain; Long Beach, CA; Maint. Cont. Div., Guantanamo Bay Cuba; Maint. Div. Dir/Code 531, Rodman Canal Zone; PWD (LTJG P.M. Motolenich), Puerto Rico; PWO Midway Island; PWO, Guantanamo Bay Cuba; PWO, Keflavik Iceland; PWO, Mayport FL; ROICC Rota Spain; ROICC, Rota Spain; SCE, Guam; SCE, San Diego CA; SCE, Subic Bay, R.P.; Utilities Engr Off. (A.S. Ritchie), Rota Spain
 NAVSUBASE Bangor, Bremerton, WA
 NAVSUPACT CO, Seattle WA; Code 413, Seattle WA; LTJG McGarrah, SEC, Vallejo, CA; Plan/Engr Div., Naples Italy
 NAVSURFWPCEN PWO, White Oak, Silver Spring, MD
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 NAVWPNSUPPCEN Code 09 Crane IN
 NCBU 405 OIC, San Diego, CA
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 NOAA Library Rockville, MD
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 OCEANSYSLANT LT A.R. Giancola, Norfolk VA
 ONR (Dr. E.A. Silva) Arlington, VA; Central Regional Office, Boston, MA; Code 700F Arlington VA; Dr. A. Laufer, Pasadena CA
 PHIBCB 1 P&E, Coronado, CA
 PMTC Pat. Counsel, Point Mugu CA
 PWC (Lt E.S. Agonoy) Pensacola, FL, ACE Office (LTJG St. German) Norfolk VA; CO Norfolk, VA; CO, (Code 10), Oakland, CA; CO, Great Lakes IL; Code 10, Great Lakes, IL; Code 110, Oakland, CA; Code 120, Oakland CA; Code 120C, (Library) San Diego, CA; Code 128, Guam; Code 154, Great Lakes, IL.

Code 200, Great Lakes IL; Code 200, Guam; Code 220 Oakland, CA; Code 220.1, Norfolk VA; Code 300, San Diego, CA; Code 400, Great Lakes, IL; Code 400, Oakland, CA; Code 400, Pearl Harbor, HI; Code 400, San Diego, CA; Code 420, Great Lakes, IL; Code 420, Oakland, CA; Code 505A (H. Wheeler); Code 600, Great Lakes, IL; Code 601, Oakland, CA; Code 610, San Diego Ca; Code 700, Great Lakes, IL; Code 700, San Diego, CA; LTJG J.L. McClaine, Yokosuka, Japan; Library, Subic Bay, R.P.; Utilities Officer, Guam; XO (Code 20) Oakland, CA

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