

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE OF PAGES 2
2. AMENDMENT/MODIFICATION NO. AM-0002	3. EFFECTIVE DATE 06/14/01	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)	
6. ISSUED BY CODE	7. ADMINISTERED BY (If other than Item 6) CODE			
US ARMY ENGINEER DISTRICT, HONOLULU CORPS OF ENGINEERS, BUILDING S-200 FORT SHAFTER, HAWAII 96858-5440 CONTRACT SPECIALIST: RENEE M. HICKS				

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	<input checked="" type="checkbox"/>	9A. AMENDMENT OF SOLICITATION NO. DACA83-01-B-0003
		9B. DATED (SEE ITEM 11) 05/11/01
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE	FACILITY CODE	

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting and Appropriation Data (If required)

**13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS,
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

<input checked="" type="checkbox"/>	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc). SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

FY01 MCP KNMD983001, UPGRADE HANGAR COMPLEX, HICKAM AIR FORCE BASE, OAHU, HAWAII

(See Page 2 of 2 Pages)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF SIGNER (Type or print)	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____	16C. DATE SIGNED
(Signature of person authorized to sign)		(Signature of Contracting Officer)	

1. CHANGES TO SPECIFICATIONS. Attached hereto are revised pages to the specifications. The revision mark (Am-0002) is shown on each page. Changes are indicated in bold. The following are revised pages and paragraphs to the specifications:

Section 00010 - BIDDING SCHEDULE: Revised item number e.
on page 00010-6.

Section 13280 paragraph 3.11.1

Section 13920 paragraph 2.6

Section 13945 paragraph 3.8.3

NOTE: A complete copy of Amendment No. 0002 (AM-0002) will be mailed out in it's entirety. This faxed copy reflects on pages/sections that are amended.

2. The bid opening date of June 18, 2001, is hereby extended to June 21, 2001, 2:00 p.m., Hawaiian Standard Time.

Invitation for Bids No. DACA83-01-B-0003

SECTION 00010
BIDDING SCHEDULE

UPGRADE HANGAR COMPLEX
HICKAM AIR FORCE BASE
OAHU, HAWAII

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	AMOUNT
<u>BASE SCHEDULE</u>				
1.	Upgrade Hangar Complex	1	JOB	\$ _____
	TOTAL BASE SCHEDULE			\$ _____

OPTIONS

- | | | | |
|-------------------------------------------------------------------------------------------------------------------|---|-----|----------|
| 2. 1-Hour Separation Between Hangars 34 and 35 (Option No. 1) | 1 | JOB | \$ _____ |
| 3. 1-Hour Separation Between Center Office Module and the Adjacent Hangar 35 Area (Aircraft Docks) (Option No. 2) | 1 | JOB | \$ _____ |
| 4. Upgrade Hangar 35 Electrical Systems (Option No. 3) | 1 | JOB | \$ _____ |
| 5. Compressed Air and Electrical Cable Utility Trenches in Hangar 35 (Option No. 4) | 1 | JOB | \$ _____ |
| 6. New Water Storage Tank (Option No. 5) | 1 | JOB | \$ _____ |

TOTAL OPTIONS \$ _____

TOTAL BASE SCHEDULE PLUS OPTIONS \$ _____

THE FOLLOWING WILL BE COMPLETED BY THE CONTRACTING OFFICER UPON AWARD:

TOTAL AWARD AMOUNT (Base Schedule plus Options Nos. _____) \$ _____

NOTES TO BIDDING SCHEDULE:

1. By submission of an offer under the OPTION, Bidder agrees that the Government may exercise the OPTION at the time of award, or at any time within 30 days following the date of the award of the basic contract. (See Provision No. 52.217-5, EVALUATIONS OF OPTIONS, in Section 00100).

2. Failure to bid on all the items in the Bidding Schedule may cause the bid to be considered nonresponsive.

PAYMENT(S)

Compensation for all work to be performed under this contract will be made under the payment item(s) listed herein. The principal features of the work to be included under the payment item(s) are noted. Work required by the drawings and specifications and not particularly mentioned shall be included in and be paid for under the contract price for the item to which the work pertains. Price(s) and payment(s) for the item(s) shall cover all work, complete and finished in accordance with the specifications, schedules, and drawings, and shall be full compensation for all work in connection therewith, including quality control and cost of performance-and payment-bond premiums as specified in the CONTRACT CLAUSES. Price(s) and payment(s) shall constitute full and final compensation for furnishing all materials, equipment, management, supervision, labor, transportation, fuel, power, water, and all incidental items necessary to complete the work, except as otherwise specified to be furnished by the Government. For the purpose of CONTRACT CLAUSE entitled "PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS", the term "designated billing office" and "designated payment office" are as follows:

a. Billing Office

U.S. Army Engineer District, Honolulu
Fort Shafter Resident Office, Bldg. 230
Fort Shafter, HI 96858-5440

b. Payment Office

U.S. Army Engineer District, Honolulu
Attn.: Accounts Payable Branch (CEPOH-RM-FA), Bldg. 230
Fort Shafter, HI 96858-5440

Item numbers mentioned herein after correspond to the item numbers in the BIDDING SCHEDULE.

a. Item No. 1, UPGRADE HANGAR COMPLEX, will be paid for at the contract price, complete in place and ready for use, including retrofitting the existing deluge system serving Hangar 35, providing a new wet pipe fire sprinkler system throughout Hangar 34, replacing the fire alarm system throughout the building, including all related work, testing, final connections, cleanup, and all incidental items necessary to complete the work.

b. Item No. 2, 1-HOUR SEPARATION BETWEEN HANGARS 34 AND 35 (Option No. 1), will be paid for at the contract price, complete in place and ready for use, including all architectural work, related mechanical and electrical work, final connections, cleanup, and all incidental items necessary to complete the work.

c. Item No. 3, 1-HOUR SEPARATION BETWEEN CENTER OFFICE MODULE AND THE ADJACENT HANGAR 35 AREA (AIRCRAFT DOCKS) (Option No. 2), will be paid for at the contract price, complete in place and ready for use, including all associated architectural work, mechanical ventilation upgrade, electrical improvements, testing, final connections, cleanup, and all incidental items necessary to complete the work.

d. Item No. 4, UPGRADE HANGAR 35 ELECTRICAL SYSTEMS (Option No. 3), will be paid for at the contract price, complete in place and ready for use, including all electrical retrofit work to upgrade existing electrical systems in Hangar 35 to comply with the hazardous location where they are located, related testing, final connections, cleanup, and all incidental items necessary to complete the work.

e. Item No. 5, COMPRESSED AIR AND ELECTRICAL CABLE UTILITY TRENCHES IN HANGAR 35 (Option No. 4), will be paid for at the contract price, complete in place and ready for use, including all retrofit work necessary to cut new utility cable/hose trenches in the existing hangar floor and install trench floor drains as indicated in Hangar 35 including all structural work, piping connections and related piping, clean-up, and all incidental items necessary to complete the work.

f. Item No. 6, NEW WATER STORAGE TANK (Option No. 5), will be paid for at the contract price, complete in place and ready for use, including structural foundation work, piping connections and related piping, control work, tank structure, and all related appurtenances, level indicators and panels, testing, final connections, cleanup, and all incidental items necessary to complete the work.

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SECTION 13280

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SECTION 13280

ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z9.2 (1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems
- ANSI Z87.1 (1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
- ANSI Z88.2 (1992) Respiratory Protection

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 732 (1995) Aging Effects of Artificial Weathering on Latex Sealants
- ASTM D 522 (1993a) Mandrel Bend Test of Attached Organic Coatings
- ASTM D 1331 (1989; R 1995) Surface and Interfacial Tension of Solutions of Surface-Active Agents
- ASTM D 2794 (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- ASTM D 4397 (1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
- ASTM E 84 (1998e1) Surface Burning Characteristics of Building Materials
- ASTM E 96 (1995) Water Vapor Transmission of Materials
- ASTM E 119 (1998) Fire Tests of Building Construction and Materials
- ASTM E 736 (1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

ASTM E 1368 (1997) Visual Inspection of Asbestos Abatement Projects

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

40 CFR 61 National Emissions Standards for Hazardous Air Pollutants

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (1990) Compressed Air for Human Respiration

CGA G-7.1 (1997) Commodity Specification for Air

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90-018 (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

EPA 340/1-90-019 (1990) Asbestos/NESHAP Adequately Wet Guidance

EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings

STATE OF HAWAII, OCCUPATIONAL SAFETY AND HEALTH STANDARDS (HIOSH)

HIOSH 12-145.1 Asbestos, Title 12, Subtitle 8, Part 3, Chapter 145

HAWAII REVISED STATUTES

HRS 16-77-19

Contractors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701

(1996; TIA 96-1, 96-2) Methods of Fire Tests for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100

(1984; Supple 1985, 1987, 1988 & 1990) NIOSH Manual of Analytical Methods

UNDERWRITERS LABORATORIES (UL)

UL 586

(1996) High-Efficiency, Particulate, Air Filter Units

1.2 DEFINITIONS

- a. Adequately Wet: A term defined in 40 CFR 61, Subpart M, and EPA 340/1-90-019 meaning to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos material, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.
- b. Aggressive Method: Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact asbestos material.
- c. Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.
- d. Asbestos: Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.
- e. Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.
- f. Asbestos Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.
- g. Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.
- h. Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- i. Certified Hazardous Materials Manager (CHMM): As used in this section, refers to a Hazardous Materials Professional who is certified by the Institute of Hazardous Materials Management.
- j. Certified Industrial Hygienist (CIH): An Industrial Hygienist

certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

- k. Certified Safety Professional (CSP): As used in this section, refers to a Safety Professional who is certified by the National Safety Council.
- l. Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.
- m. Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.
- n. Class III Asbestos Work: Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.
- o. Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction.
- p. Clean room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.
- q. Competent Person: In addition to the definition in 29 CFR 1926, Section .32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926, Section .1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- r. Contractor/Supervisor: Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- s. Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.
- t. Decontamination Area: An enclosed area adjacent and connected to

the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

- u. Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
- v. Disposal Bag: A 0.15 mm thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926, Section .1101, used for transporting asbestos waste from containment to disposal site.
- w. Disturbance: Activities that disrupt the matrix of asbestos material, crumble or pulverize asbestos material, or generate visible debris from asbestos material. Disturbance includes cutting away small amounts of asbestos material, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 1.5 m in length and width in order to access a building component.
- x. Doctor of Philosophy (PhD): As used in this section, refers to a person who has a Doctoral degree in Industrial Hygiene or Occupational Health and Safety from an accredited School of Public Health.
- y. Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.
- z. Employee Exposure: That exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.
- aa. Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.
- bb. Friable ACM: A term defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent, as determined by a method other than point counting by PLM, the asbestos content is verified by point counting using PLM.
- cc. High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
- dd. Homogeneous Area: An area of surfacing material or thermal system insulation that is uniform in color and texture.
- ee. Industrial Hygienist: A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.
- ff. Intact: Asbestos material which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no

longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the asbestos material non-intact simply by being separated into smaller pieces.

- gg. Master of Public Health (MPH): As used in this section, refers to a person who has a Masters degree in Public Health from an accredited School of Public Health.
- hh. Master of Science: As used in this section, refers to a person who has a Masters of Science degree from an accredited School of Public Health.
- ii. Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763, Subpart E, Appendix C.
- jj. Modification: A changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system.
- kk. Negative Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).
- ll. NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.
- mm. Nonfriable ACM: A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90-018 meaning any material containing more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.
- nn. Nonfriable ACM (Category I): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90-018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.
- oo. Nonfriable ACM (Category II): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90-018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using the methods specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- pp. Permissible Exposure Limits (PELs):
 - (1) PEL-Time weighted average(TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA), as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH Pub No. 84-100 analytical method 7400.

- (2) PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH Pub No. 84-100 analytical method 7400.
- qq. Registered Professional Engineer (PE): As used in this section, refers to an Engineer who is licensed by the professional licensing board of one of the 50 states of the United States of America, to practice as a professional engineer.
- rr. Registered Architect (RA): As used in this section, refers to an Architect who is licensed by the professional licensing board of one of the 50 states of the United States of America to practice as a professional architect.
- ss. Regulated Area: An OSHA term defined in 29 CFR 1926, Section .1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.
- tt. Removal: All operations where asbestos material is taken out or stripped from structures or substrates, and includes demolition operations.
- uu. Repair: Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of asbestos material attached to structures or substrates. If the amount of asbestos so "disturbed" cannot be contained in 1 standard glovebag or waste bag, Class I precautions are required.
- vv. Spills/Emergency Cleanups: Cleanup of sizable amounts of asbestos waste and debris which has occurred, for example, when water damage occurs in a building, and sizable amounts of asbestos are dislodged. A Competent Person evaluates the site and asbestos to be handled, and based on the type, condition and extent of the dislodged material, classifies the cleanup as Class I, II, or III. Only if the material was intact and the cleanup involves mere contact of asbestos, rather than disturbance, could there be a Class IV classification.
- ww. Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.
- xx. Thermal system insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.
- yy. Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926, Section .1101, to include

EPA Model Accreditation Plan (MAP) "Worker" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 DESCRIPTION OF WORK

The work covered by this section includes the removal of asbestos materials which are encountered during alteration and renovation activities associated with this project and describes procedures and equipment required to protect workers and occupants of the regulated area from contact with airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class II work operations involving asbestos material. The work also includes containment, storage, transportation and disposal of the generated asbestos wastes. More specific operational procedures shall be detailed in the required Accident Prevention Plan and its subcomponents, the Asbestos Hazard Abatement Plan and Activity Hazard Analyses required in paragraph SAFETY AND HEALTH PROGRAM AND PLANS.

1.3.1 Abatement Work Tasks

The specific asbestos material to be abated is identified on the detailed plans and project drawings. A summary of work task data elements for each individual asbestos abatement work task to include the appropriate RESPONSE ACTION DETAIL SHEET (item to be abated and methods to be used) and SET-UP DETAIL SHEETS (containment techniques to include safety precautions and methods) is included in Table 1, "Individual Work Task Data Elements" at the end of this section.

1.3.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer (CO) who will have the option of ordering up to 6 bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM at no additional cost to the Government. Any additional components identified as containing asbestos that have been approved by the Contracting Officer for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling activities undertaken to determine the presence of additional asbestos material shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course required by 40 CFR 763, Subpart E, Appendix C.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The Contractor shall submit for review by the government all submittals designated "GA". No work shall begin until the Contractor has satisfactorily incorporated all government review comments and the government has provided written approval of the submittal to the Contractor. No payment will be granted to the Contractor for delays resulting from the Contractor's incorporation of review comments. Submittal of items requiring "GA" shall not be considered automatic approval by the government. The Government shall be provided 30 days to

review submittals from date of receipt of the submittal by the government. If subsequent submittals of the same document are required, the government shall be provided 30 days to review each submittal. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; FIO.

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

- a. High Efficiency Filtered Air (HEPA) local exhaust equipment
- b. Vacuum cleaning equipment
- c. Pressure differential monitor for HEPA local exhaust equipment
- d. Air monitoring equipment
- e. Respirators
- f. Personal protective clothing and equipment
 - (1) Coveralls
 - (2) Other work clothing
 - (3) Foot coverings
 - (4) Hard hats
 - (5) Eye protection
 - (6) Other items required and approved by Contractors Designated IH and Competent Person
- g. Duct Tape
- h. Disposal Containers
 - (1) Disposal bags
 - (2) Fiberboard drums
 - (3) Paperboard boxes
- i. Sheet Plastic
 - (1) Polyethylene Sheet - General
 - (2) Polyethylene Sheet - Flame Resistant
 - (3) Polyethylene Sheet - Reinforced
- j. Wetting Agent
 - (1) Amended Water
 - (2) Removal encapsulant
- k. Strippable Coating

- l. Prefabricated Decontamination Unit
- m. Other items
- n. Chemical encapsulant
- o. Material Safety Data Sheets (for all chemicals proposed)

SD-04 Drawings

Site Layout; GA.

Descriptions, detail project drawings, and site layout to include worksite containment area techniques as prescribed on applicable SET-UP DETAIL SHEETS, local exhaust ventilation system locations, decontamination units and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

SD-08 Statements

Qualifications; GA.

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

Training Program; FIO.

A copy of the written project site-specific training material as indicated in 29 CFR 1926, Section .1101 that will be used to train onsite employees. The training document shall be signed by the Contractor's Designated IH and Competent Person.

Medical Requirements; FIO.

Physician's written opinion.

Encapsulants; GA.

Certificates stating that encapsulants meet the applicable specified performance requirements.

SD-09 Reports

Air Monitoring; GA.

Air-monitoring results and documentation.

Local Exhaust Ventilation; FIO.

Pressure differential recordings.

Licenses, Permits and Notifications; GA.

Licenses, permits, and notifications.

SD-13 Certificates

Vacuum, Filtration and Ventilation Equipment; FIO.

Manufacturer's certifications showing compliance with ANSI Z9.2 for:

- a. Vacuums.
- b. Water filtration equipment.
- c. Ventilation equipment.
- d. Other equipment required to contain airborne asbestos fibers.

SD-18 Records

Respiratory Protection Program; FIO.

Records of the respirator program.

Cleanup and Disposal; GA.

Waste shipment records. Weigh bills and delivery tickets shall be furnished for information only.

1.5 QUALIFICATIONS

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications and training certification of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH (person assigned to project and firm name); independent testing laboratory (including name of firm, principal, and analysts who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, HIOSH 12-145.1 and the federal, state and local requirements specified in paragraph SAFETY AND HEALTH PROGRAM AND PLANS for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

- a. Designated Competent Person: The name, address, telephone number, and resume of the Contractor's Designated Competent Person shall be provided. Evidence that the full-time Designated Competent Person is qualified in accordance with HIOSH 12-145.1, 29 CFR 1926, Sections .32 and .1101, has valid and current EPA (AHERA) Model Accreditation Plan (MAP) "Contractor/Supervisor" training

accreditation required by 40 CFR 763, Subpart E, Appendix C, and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, asbestos material generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The duties of the Competent Person shall include the following: controlling entry to and exit from the regulated area; supervising any employee exposure monitoring required by 29 CFR 1926, Section .1101 and HIOSH 12-145.1; ensuring that all employees working within a regulated area wear the appropriate personal protective equipment (PPE), are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified; and ensuring that engineering controls in use are in proper operating conditions and are functioning properly. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan and Asbestos Hazard Abatement Plan. The Designated Competent Person shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

- b. Project and Other Supervisors: The Contractor shall provide the name, address, telephone number, and resume of the Project Supervisor and other supervisors who have responsibility to implement the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses, the authority to direct work performed under this contract and verify compliance, and have valid and current EPA (AHERA) Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C. The Project Supervisor and other supervisors shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 year on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.
- c. Designated Industrial Hygienist: The Contractor shall provide the name, address, telephone number, resume and other information specified below for the Industrial Hygienist (IH) selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform training, direct air monitoring and assist the

Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is a CIH, CSP, CHMM, PE, RA, PhD in Industrial Hygiene or Occupational Safety and Health, MPH or a Master of Science and meets all education and experience requirements as determined and documented by applicable certification/registration; has EPA (AHERA) Model Accreditation Plan (MAP), Project Designer, Inspector and Contractor/Supervisor training accreditation required by 40 CFR 763, Subpart E, Appendix C, NIOSH 582 training, and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. The Designated IH shall provide, and the Contractor shall submit, the Project Designer, Inspector and Contractor/Supervisor course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. A copy of the Designated IH's current valid certification/registration or diploma shall be included. The Designated IH or IHT shall be onsite at all times for the duration of asbestos activities and shall be available for emergencies. In addition, the Designated IH shall prepare, and the Contractor shall submit, the name, address, telephone numbers and resumes of additional IH's and industrial hygiene technicians (IHT) who will be assisting the Designated IH in performing onsite tasks. IHs and IHTs supporting the Designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience and NIOSH 582 training. The IHT shall have currently attended and passed EPA and/or State Accreditation Program approved AHERA Contractor/Supervisor and Inspector courses; and Project Monitoring courses as specified in EPA 40 CFR 763. The formal reporting relationship between the Designated IH and the support IHs and IHTs, the Designated Competent Person, and the Contractor shall be indicated.

- d. Asbestos Abatement Workers: Asbestos abatement workers shall meet the requirements contained in 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, HIOSH 12-145.1, and other applicable federal, state and local requirements. Workers shall have current and valid AHERA worker training. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment" in this paragraph.
- e. Worker Training and Certification of Worker Acknowledgment: Training documentation will be required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.
- f. Physician: The Contractor shall provide the name, medical

qualifications, address, telephone number and resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926, Section .1101, HIOSH 12-145.1, and paragraph MEDICAL REQUIREMENTS. The physician shall be familiar with the site's hazards and the scope of this project.

- g. First Aid and CPR Trained Persons: The names of at least 2 persons who are currently trained in first aid and CPR by the American Red Cross or other approved agency shall be designated and shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030 and shall be included in the Contractor's Bloodborne Pathogen Program. These persons may perform other duties but shall be immediately available to render first aid when needed. A copy of each designated person's current valid First Aid and CPR certificate shall be provided.
- h. Independent Testing Laboratory: The Contractor shall provide the name, address and telephone number of the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

(1) Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926, Section .1101, OSHA method ID-160, the most current version of NIOSH Pub No. 84-100 Method 7400, and (when necessary) NIOSH Pub No. 84-100 Method 7402, transmission electron microscopy (TEM); the laboratory is currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program; the names of the selected microscopists who will analyze airborne samples by PCM with verified documentation of their proficiency to conduct PCM analyses by being judged proficient in counting samples as current participating analysts in the AIHA PAT Program, and having successfully completed the Asbestos Sampling and Analysis course (NIOSH 582 or equivalent) with a copy of course completion certificate provided; when the PCM analysis is to be conducted onsite, documentation shall be provided certifying that the onsite analyst meets the same requirements.

(2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts (names shall be provided) with demonstrated proficiency to conduct PLM to include

its application to the identification and quantification of asbestos content.

(3) (When necessary) Transmission electron microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts (names shall be provided) that are currently evaluated as competent with demonstrated proficiency under the NIST NVLAP for airborne sample analysis of asbestos by TEM.

- i. Disposal Facility, Transporter: The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the USEPA, State and local regulatory agencies. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated during the performance of this contract shall be provided. Qualifications shall be provided for each subcontractor or transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections .154 or .155, as required in 40 CFR 61, Section .150(b), and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with EM 385-1-1, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. This includes, but is not limited to, HIOSH 12-145.1, OSHA standards, 29 CFR 1926, especially Section .1101, 40 CFR 61, Subpart M and 40 CFR 763. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup,

housekeeping, handling, storing, transporting and disposing of asbestos material apply: HIOSH 12-145.1 and HRS 16-77-19.

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor shall develop and submit a written comprehensive site-specific Accident Prevention Plan at least 30 days prior to the preconstruction conference. The Accident Prevention Plan shall address requirements of EM 385-1-1, Appendix A, covering onsite work to be performed by the Contractor and subcontractors. The Accident Prevention Plan shall incorporate an Asbestos Hazard Abatement Plan, and Activity Hazard Analyses as separate appendices into 1 site specific Accident Prevention Plan document. Any portions of the Contractor's overall Safety and Health Program that are referenced in the Accident Prevention Plan, e.g., respirator program, hazard communication program, confined space entry program, etc., shall be included as appendices to the Accident Prevention Plan. The plan shall take into consideration all the individual asbestos abatement work tasks identified in Table 1. The plan shall be prepared, signed (and sealed, including certification number if required), and dated by the Contractor's Designated IH, Competent Person, and Project Supervisor.

1.7.1 Asbestos Hazard Abatement Plan Appendix

The Asbestos Hazard Abatement Plan appendix to the Accident Prevention Plan shall include, but not be limited to, the following:

- a. The personal protective equipment to be used;
- b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);
- c. Initial exposure assessment in accordance with 29 CFR 1926, Section .1101;
- d. Level of supervision;
- e. Method of notification of other employers at the worksite;
- f. Abatement method to include containment and control procedures;
- g. Interface of trades involved in the construction;
- h. Sequencing of asbestos related work;
- i. Storage and disposal procedures and plan;
- j. Type of wetting agent and asbestos encapsulant to be used;
- k. Location of local exhaust equipment;
- l. Air monitoring methods (personal, environmental and clearance);
- m. Bulk sampling and analytical methods (if required);
- n. A detailed description of the method to be employed in order to control the spread of asbestos wastes and airborne fiber

concentrations;

- o. Fire and medical emergency response procedures;
- p. The security procedures to be used for all regulated areas.

1.7.2 Activity Hazard Analyses Appendix

Activity Hazard Analyses, for each major phase of work, shall be submitted and updated during the project. The Activity Hazard Analyses format shall be in accordance with EM 385-1-1 (Figure 1-1). The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analyses has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The Activity Hazard Analyses shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE AND ONSITE SAFETY

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses appendices. Deficiencies in the Accident Prevention Plan will be discussed and the Accident Prevention Plan shall be revised to correct the deficiencies and resubmitted for acceptance. Any variance to or changes required in the specification as a result of the Accident Prevention Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer, prior to the start of work. Onsite work shall not begin until the Accident Prevention Plan has been accepted. A copy of the written Accident Prevention Plan shall be maintained onsite. Changes and modifications to the accepted Accident Prevention Plan shall be made with the knowledge and concurrence of the Designated IH, the Project Supervisor, Designated Competent Person, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Designated IH shall bring such hazard to the attention of the Project Supervisor, Designated Competent Person, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Once accepted by the Contracting Officer, the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses will be enforced as if an addition to the contract. Disregarding the provisions of this contract or the accepted Accident Prevention Plan will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

1.9 SECURITY

Ensure that unauthorized persons do not enter the regulated area and waste is secured until it is disposed of. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the Contracting

Officer. Personnel authorized to enter regulated areas shall be trained, be medically evaluated, and wear the required personal protective equipment for the specific regulated area to be entered.

1.10 MEDICAL REQUIREMENTS

Medical requirements shall conform to 29 CFR 1926, Section .1101.

1.10.1 Medical Examinations

Before being exposed to airborne asbestos fibers, workers shall be provided with a medical examination as required by 29 CFR 1926, Section .1101 and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

1.10.1.1 Information Provided to the Physician

The Contractor shall provide the following information in writing to the examining physician:

- a. A copy of HIOSH 12-145.1, 29 CFR 1926, Section .1101 and Appendices D, E, G, and I;
- b. A description of the affected employee's duties as they relate to the employee's exposure;
- c. The employee's representative exposure level or anticipated exposure level;
- d. A description of any personal protective and respiratory equipment used or to be used;
- e. Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1.10.1.2 Written Medical Opinion

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

- a. Summary of the results of the examination.
- b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.
- c. The ability of the individual to wear personal protective equipment, including respirators, while performing strenuous work tasks under cold and/or heat stress conditions.
- d. A statement that the employee has been informed of the results of the examination, provided with a copy of the results, informed of the increased risk of lung cancer attributable to the combined

effect of smoking and asbestos exposure, and informed of any medical condition that may result from asbestos exposure.

1.10.2 Medical and Exposure Records

Complete and accurate records shall be maintained of each employee's medical examinations, medical records, and exposure data, as required by HIOSH 12-145.1, 29 CFR 1910, Section .1910.20 and 29 CFR 1926, Section .1101 for a period of 30 years after termination of employment. Records of the required medical examinations and exposure data shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee. A copy of the required medical certification for each employee shall be maintained on file at the worksite for review, as requested by the Contracting Officer or the representatives.

1.11 TRAINING PROGRAM

1.11.1 General Training Requirements

The Contractor shall establish a training program as specified by EPA Model Accreditation Plan (MAP), training requirements at 40 CFR 763, Subpart E, Appendix C, the State of Hawaii regulation no., HIOSH 12-145.1, OSHA requirements at 29 CFR 1926, Section .1101(k)(9), and this specification. Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the Contracting Officer as specified in paragraph QUALIFICATIONS.

1.11.2 Project Specific Training

Prior to commencement of work, each worker shall be instructed by the Contractor's Designated IH and Competent Person in the following project specific training:

- a. The hazards and health effects of the specific types of asbestos material to be abated;
- b. The content and requirements of the Contractor's Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses and site-specific safety and health precautions;
- c. Hazard Communication Program;
- d. Hands-on training for each asbestos abatement technique to be employed;
- e. Heat and/or cold stress monitoring specific to this project;
- f. Air monitoring program and procedures;
- g. Medical surveillance to include medical and exposure record-keeping procedures;
- h. The association of cigarette smoke and asbestos-related disease;
- i. Security procedures;

- j. Specific work practice controls and engineering controls required for each Class of work in accordance with 29 CFR 1926, Section .1101 and HIOSH 12-145.1.

1.12 RESPIRATORY PROTECTION PROGRAM

The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926, Section .1101, 29 CFR 1910, Section .134, ANSI Z88.2, CGA G-7, CGA G-7.1 and DETAIL SHEET 12. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

- a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.
- b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.
- c. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.
- d. Training in the proper use and limitations of respirators.
- e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.
- f. Regular cleaning and disinfection of respirators.
- g. Routine inspection of respirators during cleaning and after each use when designated for emergency use.
- h. Storage of respirators in convenient, clean, and sanitary locations.
- i. Surveillance of regulated area conditions and degree of employee exposure (e.g., through air monitoring).
- j. Regular evaluation of the continued effectiveness of the respiratory protection program.
- k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; contact lenses usage; etc.).
- l. Proper training in putting on and removing respirators.

1.12.1 Respiratory Fit Testing

A qualitative or quantitative fit test conforming to 29 CFR 1926, Section 1101, Appendix C shall be conducted by the Contractor's Designated IH for each Contractor worker required to wear a respirator, and for the

Contracting Officer and authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed for each worker wearing a negative-pressure respirator prior to initially wearing a respirator on this project and every 6 months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, or of full-facepiece air purifying respirators where they are worn at levels at which half-facepiece air purifying respirators are permitted. If physical changes develop that will affect the fit, a new fit test for the worker shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by 29 CFR 1926, Section .1101 and in accordance with the manufacturer's recommendations. Respirators shall be approved by the National Institute for Occupational Safety and Health (NIOSH), under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. Personnel who handle asbestos material or ACM, enter regulated areas that require the wearing of a respirator, or who are otherwise carrying out abatement activities that require the wearing of a respirator, shall be provided with approved respirators that are fully protective of the worker at the measured or anticipated airborne asbestos concentration level to be encountered. For air-purifying respirators, the particulate filter portion of the cartridges or canister approved for use in airborne asbestos environments shall be high-efficiency particulate air (HEPA). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered. Recommendations made by the Contractor's Designated IH to downgrade respirator type shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person in consultation with the Designated IH, shall have the authority to take immediate action to upgrade or downgrade respiratory type when there is an immediate danger to the health and safety of the wearer. Respirators shall be used in the following circumstances:

- a. During all Class II work.
- b. During all Class II and III work which is not performed using wet methods.
- c. During all work where employees are exposed above the PEL-TWA or PEL-Excursion Limit.
- d. In emergencies

1.12.3 Class II and III Work

The Contractor shall provide an air purifying respirator, other than a disposable respirator, equipped with high-efficiency filters whenever the employee performs Class II and III asbestos jobs.

1.12.4 Sanitation

Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent

skin irritation associated with respirator use.

1.13 HAZARD COMMUNICATION PROGRAM

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, Section .59. Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the worksite. One copy shall be provided to the Contracting Officer and 1 copy shall be included in the Contractor's Hazard Communication Program.

1.14 LICENSES, PERMITS AND NOTIFICATIONS

1.14.1 General Legal Requirements

Necessary licenses (C-19, as prescribed by HRS 16-77-19), permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Regional Office of the USEPA, local air pollution control district/agency and the Contracting Officer in writing, at least 10 working days prior to the commencement of work, in accordance with 40 CFR 61, Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Contracting Officer, in writing, prior to the commencement of work. Local fire department shall be notified 3 days before fire-proofing material is removed from a building and the notice shall specify whether or not the material contains asbestos. A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph RENTAL EQUIPMENT. For licenses, permits, and notifications that the Contractor is responsible for obtaining, the Contractor shall pay any associated fees or other costs incurred.

1.14.2 Litigation and Notification

The Contractor shall notify the Contracting Officer if any of the following occur:

- a. The Contractor or any of the subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this contract;
- b. Proceedings are commenced which could lead to revocation of related permits or licenses; permits, licenses or other Government authorizations relating to this contract are revoked;
- c. Litigation is commenced which would affect this contract;
- d. The Contractor or any of the subcontractors become aware that their equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.15 PERSONAL PROTECTIVE EQUIPMENT

Three complete sets of personal protective equipment shall be made available to the Contracting Officer and authorized visitors for entry to the regulated area. Contracting Officer and authorized visitors shall be

provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment to be used.

1.15.1 Respirators

Respirators shall be in accordance with paragraph RESPIRATORY PROTECTION PROGRAM.

1.15.2 Whole Body Protection

Personnel exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work, shall be provided with whole body protection and such protection shall be worn properly. The Contractor's Designated IH and Competent Person shall select and approve the whole body protection to be used. The Competent Person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Whole body protection used for asbestos abatement shall not be removed from the worksite by a worker to be cleaned.

Recommendations made by the Contractor's Designated IH to downgrade whole body protection shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.15.2.1 Coveralls

Disposable-breathable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles. See DETAIL SHEET 13.

1.15.2.2 Gloves

Gloves shall be provided to protect the hands. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable glove shall be provided and used.

1.15.2.3 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Rubber boots shall be used in moist or wet areas. Reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste. Disposable protective foot covering shall be disposed of as ACM waste. If rubber boots are not used, disposable foot covering shall be provided.

1.15.2.4 Head Covering

Hood type disposable head covering shall be provided. In addition,

protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.15.2.5 Protective Eye Wear

Eye protection provided shall be in accordance with ANSI Z87.1.

1.16 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall ensure that employees enter and exit the regulated area through the decontamination area.

1.16.1 Shower Facilities

Shower facilities, when provided, shall comply with 29 CFR 1910, Section .141(d)(3).

1.16.2 3-Stage Decontamination Area

A temporary negative pressure decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided as described in SET-UP DETAIL SHEET Numbers 22 and 23. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910, Section .141 (unless the Contractor can demonstrate that such facilities are not feasible). Equipment and surfaces of containers filled with asbestos material shall be cleaned prior to removing them from the equipment room or area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. Should sufficient hot water be unavailable, the Contractor shall provide a minimum 160 L electric water heater with minimum recovery rate of 80 L per hour and a temperature controller for each showerhead. The Contractor shall provide a minimum of 1 shower. Instantaneous type in-line water heater may be incorporated at each shower head in lieu of hot water heater, upon approval by the Contracting Officer. Flow and temperature controls shall be located within the shower and shall be adjustable by the user. The wastewater pump shall be sized for 1.25 times the showerhead flow-rate at a pressure head sufficient to satisfy the filter head loss and discharge line losses. The pump shall supply a minimum 1.6 L/s flow with 10.7 m of pressure head. Used shower water shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material, per DETAIL SHEETS 9A, 9B, 9C and 14. Filtered water shall be discharged to the sanitary system with approved City and County of Honolulu, Water Quality Division User Permit. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Water from the shower shall not be allowed to wet the floor in the clean room. Surfaces of the clean room and shower shall be wet-wiped 2 times after each shift change with a disinfectant solution. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as asbestos material waste in accordance with 29 CFR 1926, Section .1101.

1.16.3 Load-Out Unit

A temporary load-out unit that is adjacent and connected to the regulated area and shall be provided as described in DETAIL SHEET Number 20 and 25 as applicable. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The load-out unit shall be attached in a leak-tight manner to each regulated area. Surfaces of the load-out unit and access tunnel shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.4 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class II and Class III asbestos work operations where exposures exceed the PELs. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which is contaminated with asbestos. The equipment room or area shall consist of an area covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.5 Decontamination Requirements for Class IV Work

The Contractor shall ensure that employees performing Class IV work within a regulated area comply with the hygiene practice required of employees performing work which has a higher classification within that regulated area.

1.16.6 Decontamination Area Entry Procedures

The Contractor shall ensure that employees entering the decontamination area through the clean room or clean area:

- a. Remove street clothing in the clean room or clean area and deposit it in lockers.
- b. Put on protective clothing and respiratory protection before leaving the clean room or clean area.
- c. Pass through the equipment room to enter the regulated area.

1.16.7 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

- a. Before leaving the regulated area, respirators shall be worn while employees remove all gross contamination and debris from their work clothing using a HEPA vacuum.
- b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers (see Detail Sheets 9A, 9B, 9C, and 14) for disposal.
- c. Employees shall not remove their respirators in the equipment room.

- d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.
- e. After showering, employees shall enter the clean room before changing into street clothes.

1.16.8 Lunch Areas

The Contractor shall provide lunch areas in which the airborne concentrations of asbestos are below 0.01 f/cc. Lunch areas shall be located outside the regulated area.

1.16.9 Smoking

Smoking, if allowed by the Contractor, shall only be permitted in designated areas approved by the Contracting Officer.

1.17 REGULATED AREAS

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.18 WARNING SIGNS AND TAPE

Warning signs and tape printed in English shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs, as shown and described in DETAIL SHEET 11, shall be in vertical format conforming to 29 CFR 1910 and 29 CFR 1926, Section .1101, a minimum of 500 by 350 mm , and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided as shown and described on DETAIL SHEET 11. Decontamination unit signage shall be as shown and

described on DETAIL SHEET 15.

1.19 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall be as described in DETAIL SHEET 14, shall conform to 29 CFR 1926, Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1.20 LOCAL EXHAUST VENTILATION

Local exhaust ventilation units shall conform to ANSI Z9.2 and 29 CFR 1926, Section .1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.21 TOOLS

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the asbestos waste material. Power tools shall not be used to remove asbestos unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system, or has otherwise been approved for use by the Contracting Officer. Residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.22 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.23 AIR MONITORING EQUIPMENT

The Contractor's Designated IH shall approve air monitoring equipment to be used to collect samples. The equipment shall include, but shall not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow

rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926, Section .1101 for personal air sampling.
- d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH Pub No. 84-100 Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).
- e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.
- f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 20 to plus 60 degrees C and traceable to a NIST primary standard.

1.24 EXPENDABLE SUPPLIES

1.24.1 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container shall be provided.

1.24.2 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for asbestos wastes as required by 29 CFR 1926 Section .1101, HIOSH 12-145.1, and DETAIL SHEETS 9A, 9B, 9C and 14.

1.24.3 Disposal Bags

Leak-tight bags, 0.15 mm thick, shall be provided for placement of asbestos generated waste as described in DETAIL SHEET 9A.

1.24.4 Fiberboard Drums

Fiberboard drums shall be heavy duty and leak tight.

1.24.5 Cardboard Boxes

Heavy-duty corrugated cardboard boxes, coated with plastic or wax to retard deterioration from moisture, shall be provided as described in DETAIL SHEET 9C, if required by state and local requirements. Boxes shall fit into selected ACM disposal bags. Filled boxes shall be sealed leak-tight with duct tape.

1.24.6 Sheet Plastic

Sheet plastic shall be polyethylene of 0.15 mm minimum thickness and shall be provided in the largest sheet size necessary to minimize seams ,as indicated on the project drawings. Film shall be clear, frosted, or black and conform to ASTM D 4397, except as specified below:

1.24.6.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of NFPA 701.

1.24.6.2 Reinforced

Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

1.24.7 Amended Water

Amended water shall meet the requirements of ASTM D 1331.

1.24.8 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 60 degrees C.

1.24.9 Leak-tight Wrapping

Two layers of 0.15 mm minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags as described in DETAIL SHEET 9B. Upon placement of the asbestos material component or material, each layer shall be individually leak-tight sealed with duct tape.

1.24.10 Viewing Inspection Window

Where feasible, a minimum of 1 clear, 3 mm thick, acrylic sheet, 450 by 610 mm , shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows shall be sealed leak-tight with industrial grade duct tape.

1.24.11 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the asbestos material and retarding fiber release during disturbance of the asbestos material greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

1.24.12 Strippable Coating

Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work. This work

shall only be done in well ventilated areas.

1.25 MISCELLANEOUS ITEMS

A sufficient quantity of other items, such as, but not limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of containments, UL approved temporary electrical equipment, material and cords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc., shall be provided.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

ALL ENCAPSULANTS

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Combustion Toxicity Zero Mortality	Univ. of Pittsburgh Protocol
Life Expectancy, 20 yrs Accelerated Aging Test	ASTM C 732
Permeability, Min. 23 ng per Pa-sec-square m	ASTM E 96

Additional Requirements for Bridging Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Penetrating Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	ASTM E 736
Fire Resistance, Negligible affect on fire resistance	ASTM E 119

ALL ENCAPSULANTS

Requirement	Test Standard
rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Lockdown Encapsulant

Requirement	Test Standard
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E 119
Bond Strength, 1.5 kN/m (Tests compatibility with cementitious and fibrous fireproofing)	ASTM E 736

2.2 ENCASUREMENT PRODUCTS

Encasement shall consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the Contracting Officer.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks shall be performed as shown on the detailed plans and drawings, as summarized in paragraph DESCRIPTION OF WORK and including Table 1 and the Contractor's Accident Prevention Plan, Asbestos Hazard Abatement Plan, and the Activity Hazard Analyses. The Contractor shall use the engineering controls and work practices required in 29 CFR 1926, Section .1101(g) and HIOSH 12-145.1 in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as specified. The Contractor shall not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under controlled conditions in conformance with 29 CFR 1926, Section .352, Fire Prevention. Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of

the Contracting Officer, including visual inspection and air sampling. Work shall resume only upon notification by the Contracting Officer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government, as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the Contracting Officer, work shall proceed.

3.3 OBJECTS

3.3.1 Removal of Mobile Objects

Mobile objects and furnishings shall be precleaned using HEPA filtered vacuum followed by wet wiping.

3.3.2 Stationary Objects

Stationary objects, furniture, and equipment shall remain in place and shall be precleaned using HEPA vacuum followed by adequate wet wiping as applicable. Stationary objects and furnishings shall be covered with 2 layers of polyethylene and edges sealed with duct tape.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Building ventilating systems supplying air into or returning air out of a regulated area shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910, Section .147. and isolated by airtight seals to prevent the spread of contamination throughout the system. Air-tight critical barriers shall be installed on building ventilating openings located inside the regulated area that supply or return air from the building ventilation system or serve to exhaust air from the building. The critical barriers shall consist of air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement and 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape. Critical barriers shall be installed as shown on drawings and appended SET-UP DETAIL SHEETS.

3.5 PRECLEANING

Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment as applicable.

3.6 METHODS OF COMPLIANCE

3.6.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with HIOSH 12-145.1, 29 CFR 1926 and 40 CFR 61, Subpart M, and the specified

requirements. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing asbestos.
- b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.
- d. Inspection and repair of polyethylene in work and high traffic areas.
- e. Cleaning of equipment and surfaces of containers filled with asbestos material prior to removing them from the equipment room or area.

3.6.2 Control Methods

The Contractor shall use the following control methods to comply with the PELs:

- a. Local exhaust ventilation equipped with HEPA filter dust collection systems;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;
- d. Use of other work practices and engineering controls;
- e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.6.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs asbestos material, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

- b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing asbestos material.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

- a. A Competent Person shall supervise the work.
- b. For indoor work or where interior surfaces will be affected, critical barriers shall be placed over all openings to the regulated area.
- c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.6.5 Specific Control Methods for Class II Work

In addition to requirements of paragraph Class II Work, Class II work shall be performed using the following methods:

3.6.5.1 Other Class II Jobs

The Contractor shall use the following work practices when performing Class II removal of ceiling tiles, drywall, paint and asphaltic coatings containing asbestos including roofing material. The material shall be thoroughly wetted with amended water prior and during its removal. The material shall be removed in an intact state. Cutting, abrading or breaking the material is prohibited. The asbestos material removed shall be immediately bagged or wrapped.

3.6.6 Cleaning After Asbestos Removal

After completion of all asbestos removal work, surfaces from which asbestos has been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. Run-off water shall be collected and filtered through a dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger, and a final filter provided that removes fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans, and HEPA vacuum cleaners as appropriate to maintain the integrity of the regulated area. When TSI and surfacing material has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Surfaces or locations which could harbor accumulations or residual asbestos dust shall be checked after vacuuming to verify that no asbestos-containing material remains; and shall be re-vacuumed as necessary to remove the asbestos contaminated debris.

3.6.7 Class II Asbestos Work Response Action Detail Sheets

The following Class II Asbestos Work Response Action Detail Sheet is specified on Table 1 for each individual work task to be performed:

- a. Interior Asbestos Cement, Fiberboard and Drywall Panels: See Sheet 48
- b. Suspended Acoustical Ceiling Tile: See Sheet 54
- c. Miscellaneous Asbestos-Containing Materials: See Sheet 45
- d. Built-Up Roofing and Flashing: See Sheet 74

3.7 FINAL CLEANING AND VISUAL INSPECTION

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination; see SET-UP DETAIL SHEETS 9, 14 and 20. A final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring and recleaning, as necessary. Upon completion of the final cleaning, the Contractor and the Contracting Officer shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection as specified on the SET-UP DETAIL SHEET 19. If the Contracting Officer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting Officer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 AIR MONITORING

3.9.1 General Requirements For Exposure

Air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with HIOSH 12-145.1, 29 CFR 1926, Section .1101, the Contractor's air monitoring plan, and as specified. Personal exposure air monitoring (collected at the breathing zone) that is representative of the exposure of each employee who is assigned to work within a regulated area shall be performed by the Contractor's Designated IH. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section. The Contractor shall provide an onsite independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in HIOSH 12-145.1, 29 CFR 1926, Section .1101, to include NIOSH Pub No. 84-100 Method 7400. Preabatement and abatement environmental air monitoring shall be performed by the Contractor's

Designated IH. Final clearance environmental air monitoring, shall be performed by the Contractor's Designated IH. Environmental and final clearance air monitoring shall be performed using NIOSH Pub No. 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH Pub No. 84-100 Method 7402 (TEM). For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc. Confirmation of asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples collected and analyzed by NIOSH Pub No. 84-100 Method 7400 (total f/cc) may be conducted using TEM in accordance with NIOSH Pub No. 84-100 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH Pub No. 84-100 Method 7400 PCM analysis. For all Contractor required environmental or final clearance air monitoring, confirmation of asbestos fiber concentrations, using NIOSH Pub No. 84-100 Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. Results of breathing zone samples shall be posted at the job site and made available to the Contracting Officer. The Contractor shall maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the Contracting Officer to determine the cause. At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the Contracting Officer.

3.9.2 Preabatement Environmental Air Monitoring

Preabatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH Pub No. 84-100 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. One sample shall be collected for every 185 square meters of floor space. At least 2 samples shall be collected outside the building: at the exhaust of the HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH Pub No. 84-100 Method 7402 (TEM).

3.9.3 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the Contracting Officer, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions

having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; preabatement sampling locations; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the Contracting Officer.

3.9.4 Final Clearance Air Monitoring

Prior to conducting final clearance air monitoring (as applicable for interiors), the Contractor and the Contracting Officer shall conduct a final visual inspection of the regulated area where asbestos abatement has been completed. The final visual inspection shall be as specified in SET-UP DETAIL SHEET 19. Final clearance air monitoring shall not begin until acceptance of the Contractor's final cleaning by the Contracting Officer. The Contractor's Designated IH shall conduct final clearance air monitoring using aggressive air sampling techniques as defined in EPA 560/5-85-024 or as otherwise required by federal or state requirements. The sampling and analytical method used will be NIOSH Pub No. 84-100 Method 7400 (PCM) and Table 3 with confirmation of results by NIOSH Pub No. 84-100 Method 7402 (TEM).

3.9.4.1 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH Pub No. 84-100 Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, shall be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) shall be confirmed from that same filter using NIOSH Pub No. 84-100 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning shall be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

3.9.4.2 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, the Contractor shall pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.9.5 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 24 hours (environmental/clearance monitoring) after completion of a sampling period. The Contracting Officer shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's Designated IH. The air sampling results

shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

- a. Sampling and analytical method used;
- b. Date sample collected;
- c. Sample number;
- d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental, C = Abatement Clearance;
- e. Location/activity/name where sample collected;
- f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);
- g. Calibration date, time, method, location, name of calibrator, signature;
- h. Sample period (start time, stop time, elapsed time (minutes));
- i. Total air volume sampled (liters);
- j. Sample results (f/cc and S/mm square) if EPA methods are required for final clearance;
- k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, asbestos waste is removed from the regulated areas, and final clean-up is completed, the Contracting Officer will certify the areas as safe before allowing the warning signs and boundary warning tape to be removed. After final clean-up and acceptable airborne concentrations are attained (for interior abatement), but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC, mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the Contracting Officer shall visually inspect all surfaces within the containment for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to Waste Materials

The waste material resulting from abatement work on Government facility shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

3.11.2 Collection and Disposal of Asbestos

All asbestos-contaminated waste shall be collected and including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in leak-tight containers such as double plastic bags (see DETAIL SHEET 9A); sealed double wrapped polyethylene sheet (see DETAIL 9B); sealed fiberboard boxes (see DETAIL SHEET 9C); or other approved containers. Waste within the containers shall be wetted in case the container is breached. Asbestos contaminated waste shall be disposed of at an EPA, state and local approved asbestos landfill off Government property. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Contracting Officer. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

3.11.3 Scale Weight Measurement

Scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales shall be standard truck scales of the beam type; scales shall be equipped with the type registering beam and an "over and under" indicator; and shall be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Hawaii. Scales shall be calibrated and resealed as often as necessary and at least once every three months to ensure continuous accuracy. Vehicles used for hauling asbestos material shall be weighed empty daily at such time as directed and each vehicle shall bear a plainly legible identification mark.

3.11.4 Weigh Bill and Delivery Tickets

Copies of weigh bills and delivery tickets shall be submitted to the Contracting Officer during the progress of the work. The Contractor shall furnish the Contracting Officer scale tickets for each load of asbestos material weighed and certified. These tickets shall include tare weight; identification mark for each vehicle weighed; and date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all asbestos material actually disposed by the Contractor for this contract.

3.11.5 Asbestos Waste Shipment Record

The Contractor shall complete and provide the Contracting Officer final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the Contractor, the Designated Industrial Hygienist, the waste transporter and disposal facility operator.

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet 1 of 4

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER 1
2. LOCATION OF WORK TASK: Various locations within Building 1052 (Hangars 34 and 35)
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Paint, asphaltic coating on metal
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: <1% to 60%
4. ABATEMENT TECHNIQUE TO BE USED: Wet, containment
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: Class II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable _____ Non-friable Category I _____
Non-friable Category II X
7. FORM and CONDITION OF Asbestos Material: GOOD X FAIR POOR
8. QUANTITY: METERS _____, SQUARE METERS _____
- 8a. QUANTITY: LINEAR FT. _____, SQUARE FT. _____
9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK: 45
10. SET-UP DETAIL SHEET NUMBERS
FOR WORK TASK: 8, 9A, 9B, 9C, 11, 13, 14, 19, 20, 22, 23.

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of asbestos material for each work task in meters or square meters.
- (8a) Quantity of asbestos material for each work task in linear feet or square feet.
- (9) Response Action Detail Sheet specifies the material to be abated and the methods to be used. There is only one Response Action Detail Sheet for each abatement task.
- (10) Set-up Detail Sheets indicate containment and control methods used in support of the response action (referenced in the selected Response Action Detail Sheet).

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet 2 of 4

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER 2
2. LOCATION OF WORK TASK: Various locations within Building 1052 (Hangars 34 and 35)
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Drywall system
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: <1% to >1-2%
4. ABATEMENT TECHNIQUE TO BE USED: Wet, containment
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: Class II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable X Non-friable Category I _____
Non-friable Category II _____
7. FORM and CONDITION of Asbestos Material: GOOD X FAIR POOR
8. QUANTITY: METERS _____, SQUARE METERS _____
- 8a. QUANTITY: LINEAR FT. _____, SQUARE FT. _____
9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK: 48
10. SET-UP DETAIL SHEET NUMBERS
FOR WORK TASK: 8, 9A, 9B, 9C, 11, 13, 14, 19, 20, 22, 23.

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of asbestos material for each work task in meters or square meters.
- (8a) Quantity of asbestos material for each work task in linear feet or square feet.
- (9) Response Action Detail Sheet specifies the material to be abated and the methods to be used. There is only one Response Action Detail Sheet for each abatement task.
- (10) Set-up Detail Sheets indicate containment and control methods used in support of the response action (referenced in the selected Response Action Detail Sheet).

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet 4 of 4

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER 4
2. LOCATION OF WORK TASK: Building 1052 - Fire Pump Building
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: 3 layers of built-up roofing material on metal decking
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: 10 - 20%
4. ABATEMENT TECHNIQUE TO BE USED: Manual cut and wet methods. No power cutting.
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: Class II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable _____ Non-friable Category I _____
Non-friable Category II X
7. FORM and CONDITION of Asbestos Material: GOOD X FAIR POOR
8. QUANTITY: METERS _____, SQUARE METERS: 92
- 8a. QUANTITY: LINEAR FT. _____, SQUARE FT. _____
9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK: _____
10. SET-UP DETAIL SHEET NUMBERS
FOR WORK TASK: 9A, 9B, 9C, 11, 13, 14, 19.

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of asbestos material for each work task in meters or square meters.
- (8a) Quantity of asbestos material for each work task in linear feet or square feet.
- (9) Response Action Detail Sheet specifies the material to be abated and the methods to be used. There is only one Response Action Detail Sheet for each abatement task.
- (10) Set-up Detail Sheets indicate containment and control methods used in support of the response action (referenced in the selected Response Action Detail Sheet).

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400)

$$\text{Fibers/cc(01.95 percent CL)} = X + [(X) * (1.645) * (CV)]$$

Where: $X = ((E)(AC))/((V)(1000))$

$$E = ((F/Nf) - (B/Nb))/Af$$

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

$$\text{TWA} = C1/T1 + C2/T2 = Cn/Tn$$

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3
 NIOSH METHOD 7400
 PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	0.5/140 Square Meters (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.
3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).
4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 4

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Location Sampled	Minimum No. of Samples	Filter Pore Size	Min. Vol. (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	5	0.45 microns	1500	2-16
Outside Abatement Area	5	0.45 microns	1500	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____
 PROJECT ADDRESS _____
 CONTRACTOR FIRM NAME _____
 EMPLOYEE'S NAME _____, _____, _____,
 (Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

_____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:

_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (3) For OSHA Class II work (there will only be abatement of one type of Class II material):

_____ (a) I have completed an 8-hour training class on the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926, Section .1101(g) and hands-on training.

_____ (b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101, and hands-on training.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:

_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:

_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:

_____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

MEDICAL EXAMINATION:

_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.
_____ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ date _____
Contractor's Industrial Hygienist Signature _____ date _____

-- End of Section --

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SECTION 13920
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SECTION 13920

FIRE PUMPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47M	(1999) Ferritic Malleable Iron Castings (Metric)
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 193/A 193M	(1999) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 194/A 194M	(1998b) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 536	(1999e1) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM B 135M	(1996) Seamless Brass Tube (Metric)
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM F 436M	(1993) Hardened Steel Washers (Metric)

ASME INTERNATIONAL (ASME)

ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA EWW	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(2001) Approval Guide Fire Protection
FM P7825b	(2001) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 20	(1999) Installation of Sanitary Pumps
NFPA 24	(1995) Installation of Private Fire Service Mains
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1999) National Electrical Code
NFPA 1963	(1998) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout
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UNDERWRITERS LABORATORIES (UL)

UL 80	(1996) Steel Inside Tanks for Oil-Burner Fuel
UL 142	(1993; Rev Jul 1998) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(1994; Rev thru Dec 1998) Gate Valves for Fire-Protection Service
UL 448	(1994; Rev thru May 1999) Pumps For Fire-Protection Service
UL 1247	(1995; Rev thru May 1997) Diesel Engines For Driving Centrifugal Fire Pumps
UL Fire Prot Dir	(2001) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Except as modified in this Section or on the drawings, fire pumps shall be installed in conformance with NFPA 20, including all recommendations and advisory portions, which shall be considered mandatory. All reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer.

1.3 SEQUENCE OF OPERATION

Sequence of operation for the fire pumps and pressure maintenance pumps shall be as indicated on the drawings.

1.3.1 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.4 COORDINATION OF TRADES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.7 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to fire pumps, auxiliary equipment, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The Fire Protection Specialist shall review and approve all submittals. All submittals shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government. All submittals designated "GA" shall be reviewed by Transatlantic Programs Center, P. O. Box 2250, Winchester, Virginia 22604 (Mr. KC Kohhar) phone number (540) 665-3907. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fire Pump Installation Related Submittals; FIO.

A list of the Fire Pump Installation Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Components and Equipment; GA.

Manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

- a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.
- b. Pressure maintenance pump and controller.
- c. Piping components.
- d. Valves, including gate, check, globe and relief valves.
- e. Gauges.
- f. Hose valve manifold test header and hose valves.
- g. Flow meter.
- h. Restrictive orifice union.
- i. Associated devices and equipment.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings

Fire Pump Installation Drawings; GA.

Three copies of the Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20 . Drawings shall indicate equipment, piping, and associated pump equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Seismic design and calculations shall be stamped by a registered Professional Structural Engineer. All shop drawings shall also bear the stamp of a registered Fire Protection Engineer. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the pressure maintenance pump.
- c. Engine fuel system for diesel driven pumps.
- d. Engine cooling system for diesel driven pumps.
- e. Pipe hangers and sway bracing including support for diesel muffler

and exhaust piping.

- f. Restraint of underground water main at entry-and exit-points to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.
- g. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.
- h. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings; FIO.

As-built drawings, no later than 14 days after completion of the Final Tests. The Fire Pump Installation Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-06 Instructions

Preliminary Test Procedures; GA.

Proposed procedures for Preliminary Tests, at least 14 days prior to the proposed start of the tests.

Final Test Instructions; GA.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

System Diagrams; GA.

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

SD-07 Schedules

Field Training Schedule; GA.

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Preliminary Tests; GA.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Test; GA.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least

14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements

Fire Protection Specialist Qualifications; GA.

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

Manufacturer's Representative Qualifications; GA.

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-09 Reports

Preliminary Test Report; GA.

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

Final Acceptance Test Report; GA.

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-13 Certificates

Fire Protection Specialist Inspection; GA.

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-19 Operation and Maintenance Manuals

Fire Pumps; FIO.

Six manuals listing step-by-step procedures required for system startup,

operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Pumps and motors shall have standard nameplates securely affixed in a

conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe and Fittings

Underground piping and piping under the building slab shall be ductile iron with a rated working pressure of 1034 kPa (150 psi) conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510 WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation. Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 133 mm in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.4.4 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 300 mm below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm and Larger

2.5.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm and greater in diameter), Type E or Type S, Grade A; galvanized steel pipe. In lieu of galvanizing, piping may be provided with an anti-corrosion coating. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 galvanized flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 193/A 193M, Grade B8 and Type 316 stainless steel. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 194/A 194M, Grade 8 and Type 316 stainless steel.

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436M. Flat circular washers shall be provide under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Copper tubing shall be ASTM B 88M, Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.5.4.2 Tamper Switch

The suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

Relief valve shall be pilot operated or spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.6 FIRE PUMP

Fire pump shall be diesel engine driven. Each pump capacity shall be as scheduled on the drawings. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. **Pump shall be centrifugal horizontal split case fire pump. Horizontal pump shall be equipped with automatic air release devices.** The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.7 DIESEL ENGINE DRIVER

Diesel engine driver shall conform to the requirements of UL 1247 and shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Driver shall be of the make recommended by the pump manufacturer. The engine shall be closed circuit, liquid-cooled with raw water heat exchanger. Anti-freeze with corrosion inhibitor shall be used in the engine cooling system. Diesel engine shall be electric start type taking current from 2 battery units. Engine shall be equipped with a fuel in-line filter-water separator. Engine conditions shall be monitored with engine instrumentation panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, and ammeter gauge. Engine shall be connected to horizontal-shaft pump by

flexible couplings. For connections to vertical-shaft fire pumps, right-angle gear drives and universal joints shall be used. An engine jacket water heater shall be provided to maintain a temperature of 49 degrees C in accordance with NFPA 20.

2.7.1 Engine Capacity

Engine shall have adequate wattage to drive the pump at all conditions of speed and load over the full range of the pump performance curve. The wattage rating of the engine driver shall be as recommended by the pump manufacturer and shall be derated for temperature and elevation in accordance with NFPA 20. Ambient temperature at the pump location shall be 38 degrees C. Site elevation shall be 1.5 meters above mean sea level (MSL).

2.7.2 Exhaust System External to Engine

Exhaust system shall comply with the requirements of NFPA 20 and NFPA 37. An exhaust muffler shall be provided for each diesel engine driver to reduce noise levels less than 95 dBA. A flexible connector with flange connections shall be provided at the engine. Flexible sections shall be stainless steel suitable for diesel-engines exhaust gas at 538 degrees C.

2.7.2.1 Steel Pipe and Fittings

ASTM A 53, Schedule 40, black steel, welding end connections. ASME B16.9 or ASME B16.11 welding fittings shall be of the same material and weight as the piping.

2.7.2.2 Flanges

ASME B16.5, Class 300. Flanges shall be provided at connections to diesel engines, exhaust mufflers, and flexible connections. Gaskets shall be ASME B16.21, composition ring, 1.5875 mm. ASTM A 193/A 193M, Grade B8 bolts and ASTM A 194/A 194M, Grade 8 nuts shall be provided.

2.7.2.3 Piping Insulation

Products containing asbestos will not be permitted. Exhaust piping system including the muffler shall be insulated with ASTM C 533 calcium silicate insulation, minimum of 75 mm. Insulation shall be secured with not less than 9.525 mm width Type 304 stainless steel bands spaced not more than 200 mm on center. An aluminum jacket encasing the insulation shall be provided. The aluminum jacket shall have a minimum thickness of 0.406 mm, a factory-applied polyethylene and kraft paper moisture barrier on the inside surface. The jacket shall be secured with not less than 13 mm wide stainless steel bands, spaced not less than 200 mm on centers. Longitudinal and circumferential seams of the jacket shall be lapped not less than 75 mm. Jackets on horizontal line shall be installed so that the longitudinal seams are on the bottom side of the pipe. The seams of the jacket for the vertical lines shall be placed on the off-weather side of the pipe. On vertical lines, the circumferential seams of the jacket shall overlap so the lower edge of each jacket overlaps the upper edge of the jacket below.

2.8 FIRE PUMP CONTROLLER (SKID MOUNTED WITH FIRE PUMP)

Controller shall be selected by the fire pump manufacturer and packaged with the fire pump unit. The controller shall be the automatic type and UL

listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be completely terminally wired, ready for field connections, and mounted in a NEMA Type 4X watertight and dust tight enclosure arranged so that controller current carrying parts will not be less than 300 mm above the floor. Controller shall be provided with voltage surge arresters installed per NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 5 degrees C Controller shall be equipped with a sequential start timer/relay feature to start multiple fire pumps in sequence. The controller shall be factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.

2.8.1 Controller for Diesel Engine Driven Fire Pump

Controller shall require the pump to run for 30 minutes prior to automatic shutdown. Controller shall be equipped with two battery chargers; two ammeters; two voltmeters, one for each set of batteries. Controller shall automatically alternate the battery sets for starting the pumps. Controller shall be equipped with the following supervisory alarm functions:

- a. Engine Trouble (individually monitored)
 - (1) Engine overspeed
 - (2) Low Oil Pressure
 - (3) High Water Temperature
 - (4) Engine Failure to Start
 - (5) Battery
 - (6) Battery Charger/AC Power Failure
- b. Main Switch Mis-set
- c. Pump Running
- d. Pump Room Trouble (individually monitored)
 - (1) Low Fuel
 - (2) Low Pump Room Temperature
 - (3) Low Reservoir Level

Alarms shall be individually displayed in front of panel by lighting of visual lamps, except that individual lamps are not required for pump running and main switch mis-set. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour back-up mounted inside the controller. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa, time, and date. The controller shall be

equipped with an audible alarm which will activate upon any engine trouble or pump room trouble alarm condition and alarm silence switch. Controller shall be equipped with terminals for field connection of a remote alarm for main switch mis-set, pump running, engine trouble and pump room trouble; and terminals for remote start. When engine emergency overspeed device operates, the controller shall cause the engine to shut down without time delay and lock out until manually reset.

2.9 BATTERIES

Batteries for diesel engine driver shall be sealed lead calcium batteries. Batteries shall be mounted in a steel rack with non-corrosive, non-conductive base, not less than 300 mm above the floor.

2.10 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 15 mm H58 brass tubing complying with ASTM B 135M. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm. Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 15 mm globe valves and 8 mm gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 1380 kPa water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.11 PRESSURE MAINTENANCE PUMP

Pressure maintenance pump shall be electric motor driven, UL listed for use as pressure maintenance pump in-line vertical shaft, centrifugal type with a rated discharge as indicated and scheduled on the drawings. Pump shall draft as indicated and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.11.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be UL listed for jockey pump service, arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for 2 minutes.

2.12 DIESEL FUEL SYSTEM EXTERNAL TO ENGINE

Fuel system shall be provided that meets all requirements and advisory provisions of NFPA 20 and NFPA 37. The fuel tank vent piping shall be equipped with screened weatherproof vent cap. Vents shall be extended to the outside. Each tank shall be equipped with a fuel level gauge. Flexible bronze or stainless steel piping connectors with single braid shall be provided at each piping connection to the diesel engine. Supply, return, and fill piping shall be steel piping, except supply and return piping may be copper tubing. Fuel lines shall be protected against mechanical damage. Fill line shall be equipped with 16 mesh removable wire screen. Fill lines shall be extended to the exterior. A weatherproof tank gauge shall be mounted on the exterior wall near each fill line for each tank. The fill cap shall be able to be locked by padlock. The engine supply (suction) connection shall be located on the side of the fuel tank so that 5 percent of the tank volume provides a sump volume not useable by the engine. The elevation of the fuel tank shall be such that the inlet of the fuel supply line is located so that its opening is no lower than the level of the engine fuel transfer pump. The bottom of the tank shall be pitched 21 mm per meter to the side opposite the suction inlet connection, and to an accessible 25 mm plugged globe drain valve. Equip tanks with ladder or steps to access fill nozzle. Tanks shall be provided with a corrosion resistant finish for use in an exterior salt-laden environment. Provide urethane coating as recommended by the manufacturer of the tank and all connected appurtenances.

2.12.1 Steel pipe

ASTM A 53, hot-dipped zinc-coated, Schedule 40, threaded connections. Fittings shall be ASME B16.3, zinc-coated, threaded malleable iron fittings. Unions shall be ASME B16.39 zinc-coated, threaded unions.

2.12.2 Copper Tubing

ASTM B 88M, Type K, soft annealed, with ASME B16.26 flared fittings.

2.12.3 Diesel Fuel Tanks

UL 80 or UL 142 for aboveground tanks.

2.12.4 Valves

An indicating and lockable ball valve shall be provided in the supply line adjacent to the tank suction inlet connection. A check valve shall be provided in fuel return line. Valves shall be suitable for oil service. Valves shall have union end connections or threaded end connections.

- a. Globe valve: MSS SP-80 Class 125
- b. Check valve: MSS SP-80, Class 125, swing check
- c. Ball valve: Full port design, copper alloy body, 2-position lever handle.

2.13 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of

cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 25 mm galvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall be mounted on a raised 100 mm reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.14 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 65 mm American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 900 mm and no less than 600 mm above grade.

2.15 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825bas flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-2-14.2.1 of NFPA 20. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-2-14.2.1 of NFPA 20. The flow meter calibration shall be verified by actual flow test through the test header at churn, 50, 75, 100, 125, and 150 percent flow requirement for each pump.

2.16 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. The space between the exterior surface of the pipe and the interior surface of the sleeve shall be firmly packed with mineral wool insulation and caulk at both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07840 FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel, ductile-iron, or cast-iron. Other sleeves shall be galvanized steel sheet pipe not less than 4.4 kg per square meter.

2.17 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be polished stainless steel or chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.18 DISINFECTING MATERIALS

2.18.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.18.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.19 SURGE SUPPRESSORS

Provide surge suppressors (arrestors) of capacities indicated. The surge suppressor shall be constructed of a carbon steel ASME pressure vessel containing a rubber bladder separating the gas pre-charge from the water. The vessel shall be rated at 1379 kPa (200 psig). The fluid connection shall be a 1000 kPa (150 pounds) ANSI RF flange. Within the fluid connection shall be an orifice screen. The gas pre-charge in the bladder shall be dry nitrogen. The surge arrestor shall be UL listed and FM approved and rated for not less than 3448 kPa per ETL 98-7, Section A4.3.9.

2.20 CORROSION PROTECTION

All fire protection equipment, piping, tanks, and appurtenances shall be corrosion resistant or provided with a corrosion resistant coating or hot-dipped galvanized.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the fire pump installation periodically assure that the installation conforms to the contract requirements. The Fire Protection Specialist shall perform a thorough inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used. All piping shall be painted as specified in Section 09900 PAINTING, GENERAL.

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes. The seismic design shall be provided for a Zone 2A seismic zone. The seismic protection design shall be reviewed and stamped by a licensed Structural Engineer.

3.4.2 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.3 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm.

3.4.4 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.4.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters intervals.

3.4.4.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows and as shown on the drawings for larger piping:

MAXIMUM SPACING (METERS)

Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Copper Tube	1.8	2	2.4							
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

3.4.5 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 900 mm.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415 ELECTRICAL WORK, INTERIOR.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 percent of their rated capacities. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 1551 kPa for a period of 2-hours, or at least 345 kPa in excess of the maximum pressure, when the maximum pressure in the system is in excess of 1207 kPa.

3.8.2 Preliminary Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Final Acceptance Test

The final acceptance test shall be witnessed and approved by the Transatlantic Programs Center, P. O. Box 2250, Winchester, Virginia 22604; Mr. KC Kochhar; (540) 665-3907. The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.3.1 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 149 kW shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic

starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.8.3.4 Alarms

All pump alarms, both local and remote, shall be tested. Supervisory alarms for diesel drivers shall be electrically tested for low oil pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.8.3.5 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.3.6 Alternate Power Source

On installations with an alternate source of power and an automatic transfer switch, loss of primary power shall be simulated and transfer shall occur while the pump is operating at peak load. Transfer from normal to emergency source and retransfer from emergency to normal source shall not cause opening of overcurrent devices in either line. At least half of the manual and automatic starting operations listed shall be performed with the fire pump connected to the alternate source.

3.8.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 65 mm diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Government will furnish water for the tests.

3.8.6 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic test(s) are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 16 hours of normal working time and shall start after the fire pump installation is functionally complete but prior to the start tests specified herein. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

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SECTION 13945

PREACTION AND DELUGE SPRINKLER SYSTEMS, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47M	(1999) Ferritic Malleable Iron Castings (Metric)
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1999c) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1999e1) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015 (1993) Double Check Backflow Prevention Assembly

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA EWW (1995) Standard Methods for the Examination of Water and Wastewater

AWWA B300 (1992) Hypochlorites

AWWA B301 (1992) Liquid Chlorine

AWWA M20 (1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (2001) Approval Guide Fire Protection

FM P7825b (2001) Approval Guide Electrical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71 (1997) Cast Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1999) Installation of Sprinkler Systems

NFPA 24 (1995) Installation of Private Fire Service Mains

NFPA 70 (1999) National Electrical Code

NFPA 72 (1999) National Fire Alarm Code

NFPA 1963 (1998) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2001) Building Materials Directory

UL Fire Prot Dir (2001) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

The deluge system serving Hangar 35 (Aircraft Bay) currently consists of an automatic deluge sprinkler system and shall be re-used as indicated. New deluge system and piping shall be provided in areas indicated on the drawings. The existing and new sprinkler systems shall provide fire sprinkler protection for the entire Hangar 35 floor area. Except as modified herein, the system shall meet the requirements of NFPA 13 and NFPA 72. The sprinkler system shall be a single interlocked system that requires the actuation of an alarm initiating device to open the water control (deluge) valve. Pipe sizes which are not indicated on the drawings shall be determined by hydraulic calculations.

This section shall also apply to the new preaction sprinkler system being installed for the computer room areas indicated on the drawings. This system shall also meet the requirements of NFPA 13 and NFPA 72. The preaction system shall be a closed-head system and Contractor designed by hydraulic calculations.

1.2.1 Hydraulic Design

The system shall be hydraulically designed in accordance with the area/density requirements indicated on the drawings and shall bear the stamp and signature of a registered Fire Protection Engineer.

1.2.1.1 Hose Demand

An allowance for exterior hose streams will not be required since the system is served by the fire pumps only and hose outlets are not connected to the interior system.

1.2.1.2 Basis for Calculations

The design of the system shall be based on a water supply provided by the fire pump system (3 pumps in parallel). Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for galvanized steel piping and 140 for new cement-lined ductile-iron piping.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for the applicable occupancy. Deluge sprinkler spacing shall not exceed 12 sq meters (130 sf) /head and shall be spaced no farther than 3.65 meters (12 feet) apart.

1.2.3 Control System

The control system shall meet the requirements of NFPA 72. The control panel shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b for "Releasing Device Service". The control panel and the solenoid valve which activates the water control valves shall be compatible with each other. Compatibility shall be per specific UL listing or FM approval of the control equipment.

1.2.3.1 Power Supply

The primary operating power shall be provided from two single phase 120 VAC circuits. Transfer from normal to backup power and restoration from backup to normal power shall be fully automatic and not cause a false alarm. Loss of primary power shall not prevent actuation of the respective automatic water control valve upon activation of any alarm initiating device. Backup power shall be provided through use of rechargeable, sealed, lead calcium storage batteries.

1.2.3.2 Circuit Requirements

Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D or to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification or indicating appliances shall be connected to indicating appliance circuit (IAC), Style X in accordance with NFPA 72. A separate circuit shall be provided for actuation of each individual automatic water control valve. The circuits that actuate the water control valves shall be fully supervised so that the occurrence of a single open or a single ground fault condition in the interconnecting conductors shall be indicated at the control panel.

1.3 SYSTEM OPERATIONAL FEATURES

The system shall include a heat detection system, manual actuation stations, supervisory and alarm switches, alarm notification appliances, control panel and associated equipment. Preaction sprinkler system piping shall be provided with supervisory air pressure not to exceed 210 kPa.

1.3.1 System Actuation

Activation of any single heat detector or a single manual actuation station shall actuate alarm zone circuits of the control panel which, in turn, shall actuate the respective automatic water control valve. For the preaction system serving the computer rooms, actuation of the automatic water control valve shall cause water to fill the preaction system piping and be discharged from fused sprinklers. Actuation of the deluge automatic control valve shall cause water to discharge from the open sprinklers of the deluge system.

1.3.2 Alarm Functions

Activation of any heat detector or sprinkler pressure alarm switch or manual actuation station shall cause the illumination of the respective zone annunciator, and activation of the building fire alarm system and transmission of the alarm to the base-wide fire reporting system. Valve tamper alarm shall be monitored by the system control panel and transmitted to the building fire alarm system as a trouble alarm.

1.3.3 Supervisory Functions

The reduction of supervisory air pressure within the preaction sprinkler system piping to less than 70 kPa or the occurrence of a single open or a single ground fault in any alarm initiating device circuit, in the automatic water control valve actuation circuit, in any alarm indicating appliance circuit or in other electrically supervised circuit shall cause the individually labelled control panel trouble light to be illuminated, the audible trouble alarm to be activated, and a trouble alarm to be transmitted to the building fire alarm control panel and to base-wide fire reporting system.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. Submittals designated "GA" shall be reviewed by the U.S. Army Engineer District Fire Protection Engineer and the Transatlantic Programs Center, P. O. Box 2250, Winchester, Virginia 22604; Mr. KC Kochhar, phone (540) 665-3907. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Load Calculations for Sizing Sway Bracing; GA.

For systems that are required to be protected against damage from earthquakes, load calculations for sizing of sway bracing. Seismic protection design and calculations shall be stamped by a professional Structural Engineer.

General Equipment Requirements; GA.

Manufacturer's Catalog Data for each piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; GA.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Storage Batteries; GA.

Calculations to substantiate the total requirements for supervisory and alarm power. Ampere-hour requirements for each system component and each control panel component or module, under both normal and alarm conditions shall be included. The battery recharging period shall be provided.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings

Sprinkler System Shop Drawings; GA.

Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. All shop drawings shall bear the stamp and

signature of a registered Fire Protection Engineer. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
- e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building.
- f. Complete point-to-point wiring diagram of the detection and control system. Indicate the detailed interconnection of control panel modules to the devices, the number and size of conductors in each conduit, and size of conduit. Connection points shall be indicated and coordinated with the terminal identification marked on the devices. Complete internal wiring schematic of the control panel and each electrical device shall be provided. Detailed description of the functions of the control panel and each module shall be provided.

As-Built Drawings; FIO.

As-built drawings, no later than 14 days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after all associated work is completed and shall be submitted on reproducible full-size mylar film.

SD-06 Instructions

Test Procedures; GA.

Proposed test procedures for piping hydrostatic test, detection and control system tests, and trip-tests of automatic water control valve, at least 14 days prior to the start of related testing.

SD-07 Schedules

Preliminary Tests; GA.

A schedule of preliminary tests, at least 14 days prior to the proposed start of tests.

Final Test; GA.

Upon successful completion of tests specified in paragraph PRELIMINARY TESTS, written notification of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the final test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements

Installer Qualifications; GA.

Qualifications of the sprinkler installer.

Submittal Preparer's Qualifications; GA.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

SD-13 Certificates

Contractor's Material & Test Certificates; GA.

Certificates, as specified in NFPA 13, completed and signed by the Contractor's representative performing required tests for both underground and aboveground piping.

SD-19 Operation and Maintenance Manuals

Sprinkler System; FIO.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.5 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source or to the point where flow test data was measured. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculations. A summary sheet listing all sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall

be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For grid systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for grid systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.6 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.7 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.8 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.9 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. All piping, components, equipment, and appurtenances shall be provided with a hot-dipped galvanized finish, anti-corrosion coating, or Type 316 stainless steel.

2.1.2 Requirements for Fire Protection Service

Unless otherwise specified, equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, voltage and current rating and catalog number on a metal plate permanently affixed to the equipment.

2.2 ABOVEGROUND PIPING SYSTEMS

2.2.1 Piping Systems

Sprinkler piping shall be galvanized steel pipe. In lieu of galvanizing, the piping can be provided with a corrosion resistant coating. The inside wall of the pipe shall be galvanized in addition to the exterior. Steel piping shall be Schedule 40 or Schedule 10 for sizes less than 200 mm (8 inches) in diameter and Schedule 30 or 40 for sizes 200 mm (8 inches) and larger in diameter. Piping shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.2.2 Fittings for Non-Grooved Piping

Fittings shall be cast iron conforming to ASME B16.4, galvanized steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.2.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa (175 psi) service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gaskets shall be of silicon compound and approved for dry fire protection systems. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.2.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thick, and full face or self-centering flat ring type. Bolts shall conform to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.2.5 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and be of the type suitable for the application, construction, and size pipe involved.

2.2.6 Valves

2.2.6.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) gate valves and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.2.6.2 Check Valves

Check valves 50 mm (2 inches) and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm (4 inches) and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.3 AUTOMATIC WATER CONTROL VALVE (DELUGE VALVE)

Automatic water control valve (deluge valve) shall be electrically-actuated and rated for a working pressure of 1207 kPa (175 psi). Valve shall be capable of being reset without opening the valve. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer. Solenoid valve shall be rated at 24 volts direct current, and shall be normally closed type which operates when energized. Solenoid valves shall be rated for a maximum pressure differential of 1207 kPa (175 psi). Water control valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Each assembly shall include an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device shall be a standard accessory component of the valve manufacturer and shall be labeled as to its function and method of operation. Valves located in hazardous locations shall be approved for the hazard classification of the area where located. All deluge valves shall be externally resettable.

The preaction valve shall be similar, but provided with appropriate trim for use with a preaction system and supervised with compressed air as described in the following paragraphs.

2.4 SUPERVISORY AIR SYSTEM (PREACTION SYSTEM)

2.4.1 Air Compressor

Air compressor shall be single stage oilless type, air cooled,

electric-motor driven, equipped with a check valve, centrifugal pressure and moisture unloader, dehydrator, and pressure switch for automatic starting and stopping. Pressure switch shall be set to start the compressor at 140 kPa and stop it at 200 kPa. A safety relief valve, set to operate at 450 kPa, shall be provided. The compressor shall be sized to pressurize the system to 200 kPa within 30 minutes.

2.4.2 Air Pressure Maintenance Device

Device shall be a pressure regulator which automatically reduces supply air pressure to the minimum pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1.6 mm (1/16 inch) restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing maximum inlet pressure of 680 kPa to a fixed outlet pressure adjustable to 70 kPa.

2.4.3 Air Supply Piping System

Each preaction system shall be equipped with a separate pressure maintenance device, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795 or ASTM A 53.

2.4.4 Low Air Pressure Switch

Each preaction system shall be provided with an air pressure switch connected to the control panel. Upon reduction of supervisory air pressure to approximately 70 kPa, the pressure switch shall actuate the trouble alarm device and low-air alarm light on the control panel annunciator.

2.5 FIRE DEPARTMENT CONNECTION

Connection shall be projecting type with cast brass body, a polished brass finish, and matching wall escutcheon lettered "Auto Spkr". The connection shall have two inlets with individual self-closing clappers, caps with drip drains, and chains. Female inlets shall have 65 mm (2-1/2 inch) diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.6 SPRINKLERS

Sprinklers for preaction systems shall be automatic, fusible solder or glass bulb type, with a temperature classification of ordinary hazard. Closed-head sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Sprinklers for deluge systems shall be open type without the fusible element. Sprinklers shall be used in accordance with their listed spacing limitations. Sprinklers with internal O-rings shall not be used.

2.6.1 Upright Sprinkler

Upright sprinkler shall be brass. Closed-head sprinklers shall be quick response type which incorporates a fast acting heat responsive heat element. Sprinkler shall have an orifice of 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) in diameter. Preaction closed sprinkler heads shall be listed dry type head per NFPA 13.

2.6.2 Pendent Sprinkler

Pendent sprinkler shall be semi-recessed type. Pendent sprinkler shall be chrome-plated. Closed-head sprinkler shall be quick response type which incorporates a fast acting heat responsive heat element. Sprinkler shall have an orifice of 13.5 mm (17/32 inch) in diameter. Preaction closed sprinkler head shall be listed dry type head per NFPA 13.

2.6.3 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be listed in UL Fire Prot Dir. Sprinkler shall be upright type and shall be installed in the Hangar 35 Bay only for the deluge system. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer. Corrosion head shall be used in the aircraft service bays (Hangar 35) only.

2.7 DISINFECTING MATERIALS

2.7.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.7.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.8 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure test gauge ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1034 kPa. The maximum pressure loss shall be 40 kPa at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required, shall be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish of white enamel.

2.9.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set-screw.

2.9.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located as indicated. Sprinkler guards shall be provided on all sprinkler heads located in electrical rooms, mechanical rooms, or in areas where the sprinkler head is less than 2450 mm above the finished floor.

2.9.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm (18 gauge) steel or 0.6 mm (0.024 inch) aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.10 CONTROL PANEL

Panel shall be UL listed or FM approved for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain all components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a surface-mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

2.10.1 Zone Annunciator

Visual annunciators shall be provided for each active zone and spare zone. A separate alarm and trouble lamp shall be provided for each zone and shall be located on exterior of cabinet door or be visible through the cabinet door. A minimum of two spare alarm zones that are fully operational shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised or engraved letters. Zone identification shall consist of a unique zone number as well as a word description of the zone.

2.10.2 System Zoning

The system shall be zoned as indicated on the drawings:

2.10.3 Primary Power Supply

Primary power and trouble alarm power to Control Panel shall be supplied

from two 120 VAC circuits. Power to the control panel shall be as indicated.

2.10.4 Emergency Power Supply

Emergency power shall be provided for system operation in the event of failure of the primary power supply and shall consist of rechargeable storage battery system. Transfer from normal to emergency power or restoration from emergency to normal power shall be automatic and shall not cause transmission of a false alarm.

2.10.4.1 Storage Batteries

Storage Batteries shall be sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the system for a period of 90 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all alarm indicating devices in the alarm mode for a minimum period of 15 minutes. Battery cabinet shall be a separate compartment at the bottom of the control panel. The battery cabinet shall have twice the volume of the batteries. Batteries shall sit on a noncorrosive and nonconductive base or pad.

2.10.4.2 Battery Charger

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel cabinet.

2.11 ALARM INITIATING DEVICES

2.11.1 Heat Detectors

Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined in NFPA 70 shall be approved for such locations. Detectors shall be listed or approved for 15.24 m (50 foot) spacing between detectors. The detector shall be equipped with an alarm indicating light in its base that lights when the detector is in an alarm condition. Five spare detectors of each type and temperature rating shall be provided.

2.11.1.1 Rate Compensation Detector

Detector shall be of the horizontal spot type with a temperature classification rating as defined by NFPA 72. Detectors listed or approved as "rate anticipation" type will be accepted. Detector shall automatically reset when temperature drops below detector temperature rating. Detector shall be hermetically sealed. Detector shall have a temperature classification rating of intermediate as defined by NFPA 72.

2.11.1.2 Combination Fixed-Temperature and Rate-of-Rise Heat Detector

Detector shall consist of two independently operated thermal elements. The rate-of-rise portion of the detector shall consist of an air chamber,

flexible metal diaphragm and a moisture-proof calibrated vent which will respond to a temperature rise exceeding 8.33 degrees C (15 degrees F) per minute. This portion of the detector shall be self-restoring after actuation. The fixed temperature portion of the detector shall consist of a fusible alloy which will melt and cause an alarm when the surrounding air rises above the temperature rating of the detector. The detector shall provide an external indication when the fixed temperature portion of the detector actuates. Detector shall have a temperature classification rating of intermediate as defined by NFPA 72.

2.11.1.3 Fixed-Temperature Heat Detector

Detector shall have a fusible alloy which will melt and cause an alarm when the surrounding air rises above the temperature rating of the detector. The detector shall provide an external indication upon actuation of the detector. Detector shall provide a temperature classification rating of intermediate as defined by NFPA 72.

2.11.2 Manual Actuation Station

Station shall be mounted at 1060 mm above the floor, unless otherwise shown. Station shall be arranged to activate the deluge system. Station shall be dual-action type requiring two separate operations in order to cause system discharge. Station shall be colored lime yellow. Station shall be provided with a positive visible indication of operation of the station. Station shall be weatherproof type and shall be provided with an engraved label indicating DELUGE SYSTEM.

2.11.3 Sprinkler Pressure Alarm Switch (Waterflow Alarm)

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches. The switch shall have a service pressure rating of 1207 kPa (175 psi). There shall be two SPDT (Form C) contacts factory adjusted to operate at 30 to 60 kPa. It shall be possible to mount the switch in any position in the alarm line trim piping of the automatic water control.

2.11.4 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.12 NOTIFICATION APPLIANCES

Notification appliances shall be suitable for connection to supervised alarm indicating circuits. Appliance shall have a separate screw terminal for each conductor. The surface of the appliance shall be red in color.

2.12.1 Alarm Horn

Horn shall be surface mounted, with the matching mounting back box surface mounted, grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall operate on nominal 24 VDC and have screw terminals for in-out wiring connection. Sound output shall be a minimum of 85 DBA at 3048 mm (10 feet). Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills. Locate horn adjacent to sprinkler riser.

See drawings for locations.

2.13 WIRING

Wiring for alternating current (AC) circuits shall be 12 AWG minimum. Wiring for low voltage direct current (DC) circuits shall be No. 14 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in electrical metallic tubing or in metallic conduit, except rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same function shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, alarm indicating, supervisory, and actuation circuits are prohibited.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of publications referenced herein.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be installed straight and bear evenly on hangers and supports.

3.2.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes for Seismic Zone 2A. The seismic protection design shall be reviewed and stamped by a licensed Structural Engineer.

3.2.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.2.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above in the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.2.4 Pendent Sprinklers

Sprinklers installed in the pendent position shall be of the listed dry pendent type, unless otherwise indicated. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee. Where pendent sprinklers are installed below suspended or dropped ceilings, sprinklers shall be of a uniform depth throughout the finished space. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the

ceiling shall not exceed 100 mm. Hangers shall be provided on arm-overs exceeding 300 mm in length. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area. Pendent sprinklers located in areas with suspended ceilings shall be positioned a minimum of 150 mm horizontally from the ceiling grid.

3.2.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.2.6 Pipe Joints

Pipe joints shall conform to NFPA 13. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed at the contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.2.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved end or rubber-gasket reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (1/2 inch).

3.2.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core drilled and provided with pipe sleeves. Each sleeve shall be of Schedule 40 galvanized steel pipe, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide the required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07840 FIRESTOPPING. In penetrations which are not fire-rated or are not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.9 Escutcheons

Escutcheons shall be provided for pipe penetrations of ceilings and walls in exposed areas. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.2.10 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13, except that drain valves shall be used where drain plugs are permitted. Velocity drip from fire department connection check valve shall drain to the outside. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

3.2.11 Installation of Fire Department Connection

Connection shall be mounted as shown. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 arranged to drain to the outside.

3.2.12 Identification Signs

Signs shall be affixed to each control valve, main drain, auxiliary drain, test valve, and similar valves. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.4 ELECTRICAL WORK

Unless otherwise specified herein, power supply equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

3.4.1 Overcurrent and Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. Cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.4.2 Grounding

Grounding shall be provided to building ground.

3.4.3 Wiring

System field wiring shall be installed in 20 mm minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and not installed in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts. Conductors shall be color-coded and shall be identified within each

enclosure where a connection or termination is made. Conductor identification shall be by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel.

3.4.4 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 600 mm nor more than 2000 mm above the finished floor.

3.4.5 Detectors

Detectors shall be ceiling-mounted per NFPA 72 and shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.

3.4.6 Manual Actuation Stations

Manual actuation stations shall be mounted readily accessible and 1060 mm above the finished floor.

3.4.7 Notification Appliances

Notification appliances shall be mounted a minimum of 2400 mm above the finished floor unless limited by ceiling height.

3.5 DISINFECTION

After all system components are installed and hydrostatic tests are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100

milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.6 COLOR CODE MARKING FIELD PAINTING AND FINISHING

Color code marking of piping, field painting and finishing shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 PRELIMINARY TESTS

The system including the underground water mains, the aboveground piping, detectors and control system and system components shall be tested to assure that equipment and components function as intended. Upon completion of specified tests, the contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.7.1 Flushing

Underground water mains shall be flushed in accordance with NFPA 13 and NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

3.7.2 Hydrostatic Tests

The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.3 Detection and Control System Tests

Upon completion of the installation, the detection and control system shall be subjected to functional and operational performance tests including tests of each installed initiating device, system actuation device and notification appliance. The control system tests specified in paragraph FINAL TEST shall be conducted to ensure that the system is completely functional and that wiring has been properly connected. If deficiencies are found, corrections shall be made and the system shall be retested to assure that the systems has no deficiencies.

3.7.4 Automatic Water Control Valve Test

Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective heat detector and a manual actuation station connected to the control panel and a manual actuation device which is part of the valve trim. A full-flow main drain test shall be made. For preaction systems with supervisory air, the air pressure shall be reduced to verify proper operation of the air supply system and associated supervisory alarm devices.

3.8 FINAL TEST

A complete test of the system shall be conducted to demonstrate that the

system is completely functional, that required supervisory and back-up features are provided, and that the system is correctly wired. A technician employed by the installing Contractor shall be present for tests and shall provide a complete demonstration of the operation of the system. The representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation will not be accepted until all identified discrepancies have been corrected and all test documentation is properly completed and received. The final acceptance test shall be witnessed and approved by the Transatlantic Programs Center, P. O. Box 2250, Winchester, Virginia 22604; Mr. KC Kochhar, phone (540) 665-3907.

3.8.1 Control System Test

Testing shall be in accordance with NFPA 72. The test shall include the following:

- a. Visual inspection of wiring connections.
- b. Opening the circuit at each alarm initiating device, solenoid valve, and notification appliance to test the wiring and supervisory features.
- c. Test of each function of the control panel.
- d. Test of each circuit in the normal, open and ground fault modes.
- e. Test of each initiating device in both normal and trouble conditions.
- f. Test of each control circuit and device.
- g. Test of each alarm notification appliance.
- h. Test of the battery charger and batteries.
- i. Operational tests under emergency power supply, including activation of connected alarm notification appliances for the specified time period.

3.8.2 Trip-tests of Automatic Water Control Valves

Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective heat detector, a manual actuation station connected to the system control panel and the manual release which is part of the valve trim. Each valve shall be returned to normal condition after each test. Prior to trip testing sprinkler deluge system, precautionary steps shall be taken to prevent water damage to the building and equipment from sprinkler discharge. Control valves on deluge systems shall remain open until open sprinklers have discharged for a minimum of 10 seconds.

3.8.2.1 Discharge Testing

When all of the initiating, alarm, actuation, and supervisory functions of the system operate to the satisfaction of the system manufacturer's technical representative and the District Fire Protection Engineer, a complete discharge test of each system shall be performed to demonstrate

satisfactory performance, mechanical operation and operation of valves, release devices, alarms, and interlocks which control the protected areas. These tests shall be conducted by experienced personnel according to the equipment and manufacturer's recommendations.

- a. Test each deluge system individually at their design flow rate for at least 60 seconds. Furnish all equipment required for tests.
- b. Test entire system of deluge systems design area at design flow rates simultaneously by full flow of water for at least 60 seconds.

The manufacturer's representative shall verify proper function of systems during tests. Provide protection for all electrical fixtures and equipment exposed to possible damage during tests and protect doors and other openings leading from the protected area(s), to prevent migration of water into other areas or spaces.

3.8.3 Tests of Supervisory Air System (Preaction System Only)

Preaction system supervisory air pressure shall be reduced from the normal system pressure to the point at which a low-pressure alarm is sounded. Air pressure shall be restored to verify trouble signal restoration. Automatic start/stop features of air compressor shall be tested. **All water shall be contained in the hangar and trap pit and manually disposed at the Contractor's cost. Water will not be allowed onto the apron area.**

3.8.4 Additional Tests

When deficiencies, defects or malfunctions develop during the tests required, all further testing of the system shall be suspended until proper adjustments, corrections or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Contracting Officer shall be notified when the additional work has been completed, to arrange a new inspection and test of the system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

3.8.5 Manufacturer's Representative

Provide the services of representatives or technicians from the manufacturers of the deluge system experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to provide instruction to Government personnel.

3.9 TRAINING REQUIREMENTS

Prior to final acceptance, the Contractor shall provide operation and maintenance training to the Fire Department and Facilities Engineering personnel. Training shall include emergency procedures, and unique maintenance and safety requirements. Training areas will be provided by the Government in the same building as the protected areas. The training conducted shall use operation and maintenance manuals specified in paragraph entitled "Operations and Maintenance Manuals". Training shall consist of a minimum 8 hours classroom training and 8 hours field training. Instruction shall be coordinated with instruction required under Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE, Section 13852 FIRE ALARM REPORTING SYSTEM, RADIO TYPE, Section 13920 FIRE PUMPS, and Section

13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, such that all of the required fire protection system training presented during a single 40 hour week. Dates and times of the training period shall be coordinated through the Contracting Officer not less than two weeks prior to the sessions.

Training shall also include pump operating and testing procedures, trouble shooting system problems, operation and use of trouble alarm panels associated with the system.

-- End of Section --