DRAFT

UFC 4-310-03
19 September 2016

UNIFIED FACILITIES CRITERIA (UFC)

DOD FUELS LABORATORY STANDARDS

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DOD FUELS LABORATORY STANDARDS

U.S. ARMY CORPS OF ENGINEERS MANDATORY CENTER OF EXPERTISE FOR PETROLEUM, OIL, AND LUBRICANTS (POL) MCX (Preparing Activity)

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER CENTER

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	Date	Location

This UFC is a new requirement.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD (AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Center (AFCEC) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request. The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site http://dod.wbdg.org/.

Refer to UFC 1-200-01, *General Building Requirements*, for implementation of new issuances on projects.

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UNIFIED FACILITIES CRITERIA (UFC)
NEW SUMMARY SHEET

Document: UFC 4-310-03, DOD FUELS LABORATORY STANDARDS, dated 19 September 2016

Superseding: None

Description: This new UFC, "DOD FUELS LABORATORY STANDARDS" provides general criteria and standard procedures for the design and construction of military land-based Laboratory Facilities which test liquid fuels.

Reasons for Document:

- This new UFC will provide guidance for planning, facility design, and construction documentation involved in the construction of new Fuel Laboratory Facilities. In addition, it will serve as guidance for modernization or expanding existing Fuel Laboratories, if improvements can be justified in terms of obsolescence, expanded operational requirements, safety, environmental compliance, or excessive maintenance costs.

Impact:

- The requirements in this UFC will provide for uniform requirements for construction of DOD Fuels Laboratories based on required fuel testing requirements.

TABLE OF CONTENTS

FIGURES

TABLES

CHAPTER 1 INTRODUCTION

1-1 SCOPE

This Standard contains general criteria and standard procedures for the design and construction of military land-based Laboratory (Lab) Facilities which test liquid fuels.

1-2 USE OF STANDARD

The guidance contained in this Standard is intended for use by facility planners, engineers, and architects for individual project planning and for preparing engineering and construction documentation. In addition, it is intended for use by operations and maintenance personnel as a guidance document for facility design, modifications, and improvements.

1-3 PURPOSE OF CRITERIA

These criteria are intended for new construction only and do not apply retroactively to facilities existing at the time this standard was issued. However, these criteria are applicable when modernizing or expanding existing facilities if the improvements can be justified in terms of obsolescence, expanded operational requirements, safety, environmental compliance, or excessive maintenance costs.

1-4 GENERAL BUILDING REQUIREMENTS

Comply with UFC 1-200-01, General Building Requirements. UFC 1-200-01 provides applicability of model building codes and government unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, high performance and sustainability requirements, and safety. Use this UFC in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

1-5 SERVICE HEADQUARTERS SUBJECT MATTER EXPERTS (SME)

It is recognized that the policies, obligations, and responsibilities of the military branches may vary on some minor points. Therefore, consult the Subject Matter Expert at the appropriate Service Headquarters for interpretation. For the purposes of interpretation of this UFC, the Subject Matter Expert at the appropriate Service Headquarters is defined as follows:

a. Army – Headquarters, U.S. Army Corps of Engineers, POL Facilities Proponent (CECW-EC)

b. Air Force - The Air Force Fuels Facilities Subject Matter Expert (SME) (HQ AFCEC/COS). Where a Regional (USAFE/PACAF) Fuels Engineer exists the request should go through them prior to the AF Fuels Facilities SME.

c. Navy/Marine Corps: NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, PW54).

1-5.1 Service Provider Subject Matter Expert (SME)

DLA Installation Support for Energy (DLA DS-FEI) is the Executive Agent as defined in DOD 4140.25M.

1-6 WAIVERS AND EXEMPTIONS

For specific interpretations, waivers or exemption, contact the appropriate Service Headquarters Subject Matter Experts (SME) and refer to MIL-STD-3007 for the waiver process. Substantial deviations from this UFC must first be presented to the appropriate Service Headquarters SMEs, and then reviewed / approved by the DoD Fuels Facility Engineering Panel.

Recommended UFC language generated from recurring waivers and exemptions will be considered by the DoD Fuel Facilities Engineering Panel (FFEP) with supporting rationale for inclusion on FFEP voting agendas. Recommended changes to this UFC are then reviewed/approved by the voting members of the DoD Fuels Facility Engineering Panel, preferably in a normal recurring meeting.

1-7 REFERENCES

Appendix A contains a list of references related to laboratory facilities as part of this document. The publication date of the code or standard is not included in this document. In general, the latest available issuance of the reference is used.

1-8 PROJECTS OUTSIDE OF CONTINENTAL UNITED STATES

For laboratory projects outside of the United States and its territories and possessions review and comply with all host nation regulations and this document. Where direct conflicts exist the host nation regulations must be met followed by this document.

1-9 GLOSSARY

Appendix B contains abbreviations and acronyms.

CHAPTER 2 TECHNICAL CRITERIA

2-1 BASIC LAB REQUIREMENTS

2-1.1 General

The Basic Lab Requirements apply to all labs. The requirements of each lab are determined by the tests performed in the lab. Requirements of counter space, ventilation, electrical, and so on are shown in Table 2-1, Fuels Laboratory Equipment Reference Table.

2-1.1.1 Petroleum Products

Petroleum products are hazardous due to toxic, explosive, flammable, and environmentally damaging properties.

2-1.2 Architectural

2-1.2.1 References

See Appendix A – References.

2-1.2.2 Floors for Labs

Floors for Laboratory rooms must be recessed a minimum of 6-inches (150 mm) or provide other for permanent spill control in the lab to retain any fuel spills. Floors in the Lab area will be required to be designed with a 150 pounds per square foot (7.18 kilopascals) loads requirements. Flooring should be a monolithic type without seams or joints or other type to resist spills of fuels. Flooring must incorporate a cove type of base of the same material as the flooring. Floors must be inspected and maintained on a regular basis to assure the floors reliability.

2-1.2.3 Cabinets

Cabinets must either be solid wood or metal construction that are provided by a manufacturer that is typically involved in the design and construction of laboratory fixtures. Cabinet selection must be coordinated with the customer as to the type of cabinets that will be required.

2-1.2.4 Countertops

All countertops where fuel or chemicals are present must include a standard 4 inch (100 mm) high backsplash and must be chemical and fuels resistant. Counters: must be an epoxy resin type of material or other that is typically used for Chemical Analysis. Countertops will need to support weights of 150 pounds per square (7.18 kilopascals) foot to support instrumentation. The color of the counter tops are typically black in color, Verify the countertop color requirements with the user to accommodate the types of testing required in the facility. Other colors may be selected depending on the type of test the customer would require. At some installations a white epoxy resin counter top maybe required for the visual test.

2-1.3 Mechanical

2-1.3.1 General

The following items are required for all lab types.

2-1.3.2 Heating, Ventilating and Air Conditioning (HVAC) System Design

HVAC system design for the lab air distribution must be designed to minimize turbulence around the hood.

The HVAC system must provide a minimum outdoor air ventilation rate in accordance with ASHRAE 62.1.

The HVAC system must work together seamlessly. When a lab hood is energized, make-up air must enter the lab to make up the air being exhausted. The design must take into account the various components to work together in various scenarios. Lab hoods are normally shut down when no longer in use. Fresh air would normally go to minimum volume when the building is unoccupied. All must be in accordance with UFC 3-410-01.

Lab rooms must be a slightly negative air pressure compared with the rest of the building (adjacent rooms) 24 hours per day, 7 days per week.

2-1.3.2.1 Lab Operating Temperature

Lab operating temperature must be maintained at 73 deg F +/- 5 deg F (23 +/- 2 deg C), 55 deg F (13 deg C) maximum dew point, and humidify if RH drops below 30%.

2-1.3.2.2 Recirculation of Air From the Laboratory

Recirculation of air from the laboratory to other portions (offices) of the building is prohibited per NFPA 45. Provide a dedicated HVAC (Heating, Ventilation, and Air Conditioning) system for the lab.

2-1.3.2.3 Exhaust

Lab must provide 24 hours per day 7 days per week exhaust from within 6 inches of the lab floor. For C type labs, maintain a minimum airflow of 50 cfm (25 liters/sec).

2-1.3.2.4 Energy Recovery Systems

The use of energy recovery systems must be considered. Energy recovery wheels must not be utilized with fume hoods as cross contamination may occur.

2-1.3.2.5 High Performance and Sustainable Building Requirements

UFC 1-200-02 High Performance and Sustainable Building Requirements must be followed.

2-1.3.3 Plumbing

Plumbing must be in accordance with UFC 3-420-01, Design: Plumbing Systems.

2-1.3.4 Sinks

Provide sink with hot and cold running water. Sink hot water supply must be 130 deg F (54 deg C) for cleaning lab glassware.

2-1.4 Electrical

2-1.4.1 General

These guidelines are targeted at facilities within the United States. Installations outside the United States may have location specific power requirements.

2-1.4.2 Primary Power Distribution

The Primary Power Distribution for the laboratory building must be by a dedicated service transformer. This transformer must step down the voltage from the installation primary voltage to 120/208V three phase power. HVAC and other mechanical loads typically require three phase power. If the laboratory is a part of a larger building, the laboratory must have its own distribution panel(s).

2-1.4.3 Stand-By Generator

This UFC does not create a specific requirement for a stand-by generator, nor does any specific service or installation have a requirement that the fuels laboratory have emergency power. However, the laboratory must be considered inoperable and possibly uninhabitable during a prolonged power outage. The facility must have ability for backup power using quick connection point through a manual transfer switch (MTS) at a minimum. A built-in stand-by generator with Automatic Transfer Switch (ATS) may be justified during programming based on the power reliability of a specific installation and the criticality of the laboratory mission. Lack of laboratory ability to support assigned missions during power outages may justify a built-in stand-by generator. In the absence of a built-in stand-by generator, emergency and egress lighting and fire alarm/mass notification must be provided by local battery back-up.

2-1.4.4 Service Entrance Conductors

Service entrance conductors must be extended from the service transformer or MTS to a Main Distribution Panel (MDP) in the mechanical room. The MDP must be service entrance rated and must be equipped with molded case circuit breakers. Feeders must be extended from the MDP to feed the large mechanical loads and 208Y/120V panel boards. The 208Y/120V panel boards must be utilized to feed lighting, small mechanical loads, receptacle loads and other 120V or 208V equipment. Laboratory equipment utilizing 208V needs to be identified for disconnect placement.

2-1.4.5 Lab Equipment Transformer

A second transformer must be provided with a 120/240V single phase secondary. Some of the required lab equipment may only be available as 240V. Laboratory equipment utilizing 240V needs to be identified for disconnect placement.

2-1.4.6 Lighting

Lighting must be designed to meet the lighting intensities recommended in UFC 3-530-01. In general, laboratory lighting will be non-hazardous, but specific areas/locations may require special lighting. Specifically, the hazardous storage area must have explosion proof fixtures.

Provide occupancy sensor controls and manual override switches throughout the facility. LED lighting throughout the facility, in place of fluorescent, would also be acceptable.

The exit signs and some light fixtures will be backed up with battery for emergency egress lighting. Exit lights will be LED lamp sources.

2-1.4.7 Electrical Outlets and Switches

All electrical outlets and switches must be located above counter or table top height. Regular duplex outlets (120V) will be provided every 4 foot along laboratory countertops for use by various pieces of laboratory equipment. Dedicated 208V and 240V outlets must be placed for those pieces of laboratory equipment that require power other than 120V. Information must be obtained from the end user for these specific power requirements. As a minimum for each laboratory, two 240V outlets located near the end of counters (to allow use by either countertop or floor standing equipment) must be provided.

2-1.4.8 Lighting Building Exterior Walls

Building exterior walls will be lighted using full cut-off wall pack LED fixtures. Lights must be controlled via photocell mounted on the exterior of the building but not on the roof. Site lighting with poles is not within the scope of this document.

2-1.4.9 Facility Grounding

Facility must be grounded in accordance with NFPA 70. Underground connections will be by exothermic process. Existing systems must be tested and supplemented as needed to obtain a ground resistance of 25 ohms or less.

2-1.4.10 Personnel and Equipment Grounding Bar

A personnel and equipment grounding bar must be provided for all laboratory countertops. A personnel grounding touch pad or bar must be provided at laboratory entrances.

2-1.4.11 Lightning Protection

Lightning protection must be provided per UFC 3-575-01 and NFPA 780.

2-1.4.12 Exterior Raceways

Rigid steel conduit or Intermediate Metal Conduit (IMC) will be used in exposed locations. Electric Metallic Tubing (EMT) will be installed where concealed in walls and above finished ceilings. All exposed exterior conduits or exposed conduits in hazardous classified areas will be rigid galvanized steel. PVC will be used underground. PVC conduit will transition to PVC coated rigid steel conduit for all below grade elbows and where conduits rise through concrete slabs.

2-1.4.13 Non-Hazardous Area

The laboratory itself must not be considered a Hazardous area due to mitigating factors of:

Procedural limits on fuel quantity to be tested or stored within the laboratory.

Storage of fuel samples in ventilated cabinets or otherwise approved containers.

Training of operators and the area being off limits to non-essential personnel.

Reasonable expectation that any fuel spills will be cleaned up immediately.

Physical separation of the hazardous storage area (a hazardous area) from the laboratory.

Required fire sprinklers.

Combustible gas monitors in larger labs with piped in Hydrogen, Oxygen, Acetylene or other gases which would increase the fire potential.

Use of fume hood(s) and dedicated HVAC system to remove any fuel vapors.

Elevating all electrical outlets to at or above counter-top height. The test equipment itself is not hazardous area rated, therefore requiring the rest of the electrical system to be hazardous area rated would not increase safety.

Open flame tests are required in the laboratory, but would be prohibited in a hazardous area.

Specific locations within the laboratory will be considered hazardous locations as defined under each laboratory type.

2-1.5 Fire Protection Requirements

All lab buildings must be provided with a fire sprinkler system per UFC 3-600-01 and NFPA 45.

All labs must have a minimum of 1-hour fire rated walls that separate lab space from adjoining space and meet UL fire resistant construction.

All chemical/sample storage rooms must be considered hazardous and must have a minimum of 1-hour fire rated walls that separate this space from adjoining space and meet UL fire resistant construction.

Chemical/sample storage rooms must be classified as Class 1, Division 2, and Group D in accordance with NFPA 70.

All lab buildings are to be considered Industrial Occupancy per NFPA 101.

All lab buildings must be provided with a fire alarm and mass notification system powered by battery backup if stand-by generator is not installed.

Lab buildings must be Type I or Type II construction (IBC Classification).

A life safety design analysis must be provided for every lab and be professionally sealed by a registered fire protection engineer.

Provide design plans to the local Fire Prevention Department for review prior to construction. Local Fire Prevention Department at the local fire department needs to be contacted at the end of construction. They must review the facility after construction for a final inspection and for occupancy certification.

2-2 TYPE A TESTING LAB

2-2.1 General

The requirements of each lab are determined by the tests performed in the lab. Requirements of counter space, ventilation, electrical, and so on are shown in Table 2-1, Fuels Laboratory Equipment Reference Table.

2-2.2 Facility Description

A facility capable of performing a Type A Test as described in MIL-STD-3004. A Type A Test consists of a complete conformance specification acceptance test. For a list of tests see Table 2-1, Fuels Laboratory Equipment Reference Table.

Sample size must include 1 gallon (3.8 liters) with 5 gallons (18.9 liters) for special tests, as indicated in paragraph 4.2.1.7 of MIL-STD-3004.

These facilities are the largest of the DOD Laboratories, very expensive, and very few of them exist in comparison to the Type B and C labs. The requirements for each of these labs are project specific, so the need for an encompassing standard is less compelling. At the very least the requirements of the smaller labs must be followed.

Examples of Type A labs include Wright Patterson AFB, Vandenberg AFB, RAF Mildenhall, Kadena Air Base, Patuxent River, and New Cumberland.

See Figure 2-1 Bubble Diagram for Type A Laboratory.

2-2.3 Architectural

2-2.3.1 Architectural Design

Architectural design must conform to all applicable criteria and guidance, including all applicable local and federal code requirements, Military documents, and DD Form 1391, Design Requirements Documents, Installation standards and design criteria, and user requirements as provided during criteria review conference to provide a complete and usable facility. Building size must be based on space requirements indicated in Table 2-1, Fuels Laboratory Equipment Reference Table or as approved to provide the user with a complete operational facility. Finishes of the exterior of buildings for these projects must follow installation standards for the exterior materials.

2-2.3.2 Codes, Standards and Regulations

The Codes, Standards, and Regulations listed in Appendix A – References must be used in the design and construction of this project. All applicable local standards and codes must also be followed. The publications must be the most recent editions being used at the time of the design. Standards other than those mentioned may be accepted provided they meet the minimum requirements of the Type A Testing Lab. The Designer and Contractor submit proof of meeting these requirements.

2-2.3.3 Life Safety / Fire Protection / Handicapped Accessibility

These facilities must be designed in accordance with recognized industry standards for life safety and building egress. Apply most recent codes and standards for new designs (Refer to Basic Lab Requirements). Fire extinguisher cabinets and fire extinguisher brackets including fire extinguishers must be provided.

Handicapped accessibility requirements will be incorporated into the building design, the design must follow the ADA-ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities.

2-2.3.4 Building Requirements

Space layout must be designed using Table 2-1, Fuels Laboratory Equipment Reference Table for the type of tests required. Multiple test stations may be added as required to perform the number of tests for each station. The functional areas for a large size laboratory facility as a minimum must include the following spaces:

2-2.3.4.1 Laboratory Rooms

Approximate size of 2,000 to 3,200 square feet (185 to 298 net square meters) Size maybe adjusted as required for a larger lab with rooms or areas being added for additional requirements.

This lab must be sized to handle all required testing for the Basic Lab Requirements, including fuels and lubricating oils.

Fuels and lubricants that are typically tested inside the lab includes:

- Aviation Gasoline (AVGAS)
- Biofuels
- Biomass fuel
- Biodiesel
- Diesel fuel
- Ethanol, fuel grade
- Gasoline
- Heavy distillates
- Aviation Turbine Fuel (JP-5, JP-8, Jet A, F-24, etc)
- Kerosene
- LNG, LPG
- Natural gas
- Petroleum and crude oil feedstocks
- Petroleum coke and fly-ash
- Lube Oil

For typical fuel tests inside the lab, see Table 2-1, Fuels Laboratory Equipment Reference Table.

Laboratory for the above items must be set up to allow for individual testing and can be separated into two testing rooms. The first laboratory must be a large room approximately 1,800 square feet (167 square meters), with a Flash room and Balance room located adjacent to this laboratory. The second lab must be a minimum of 500 square feet (47 square meters), this lab must be adjacent to the larger laboratory. Each lab area must be set up for the above testing areas and must be laid out to allow for separate areas for each test, refer to table 2-1. Several testing stations could be combined into one. Walls must be fire resistant and meet UL fire rated construction. Allow room in each laboratory for either a filtration room or equipment that could be required.

2-2.3.4.2 Non Hazardous Storage Room

Approximate size of 400 net square feet (37 net square meters)

This room or rooms must consist for the storage of chemicals including storage compartments and work tables. Flooring for the Non-hazardous storage room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm). Walls must be steel studs at a maximum of 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard or concrete masonry type of wall, provided with a back splash or wainscot at all casework.

Backsplash or wainscot must be provided that is chemical and fuels resistant. Counters: must be an epoxy resin type of material that is typically used for a Chemical Analysis. Counters must be resistant to chemical and fuel spills and must be easily cleanable. Color of the counter must be selected by the using agency and selected for

each operations, typically color for most counters is black. Ceilings must consist of 5/8 inch (16 mm) gypsum wallboard over steel studs mounted at 16 inches (400 mm) on center, minimum ceiling mounting height must be 8 feet (2400 mm) above the finish floor. Ceilings must be painted with one coat of primer and two coats of semi-gloss paint. Color must be selected from manufacturer standard paint samples.

2-2.3.4.3 Hazardous Storage Room

The Hazardous Storage Room provides space for the storage of chemicals, flammable and hazardous materials. Refer to the list of potential chemicals that may be stored in this room (Table 2-2). This room must have direct access to the exterior. A pressurized bottle storage area that will be located on the exterior of the building with exterior access and adjacent to the hazardous storage room. Flooring for the hazardous storage room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm). Walls must be steel studs at a maximum of 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard, or concrete masonry type of walls. Provide a backsplash or wainscot at all casework. Walls must be fire resistant and meet UL fire rated construction.

2-2.3.4.4 Filtration Room

Approximate size of 250 net square feet (23 square meters).

Filtration room or area will need to be adjacent to the laboratory areas to provide filtered air into the laboratory area. Dependent on the requirements this room or area can be within the laboratory or located in a support area.

2-2.3.4.5 Balance Room and Flash room

Approximate size of 150 net square feet (13 square meters) each.

Balance and flash room should be located next to and access into the laboratory areas.

Backsplash or wainscot must be provided that is chemical and fuels resistant. Counters: must be a black epoxy resin type of material that is typically used for a Chemical Analysis. Counters must be resistant to chemical and fuel spills and must be easily cleanable. Ceilings; ceilings must consist of 5/8 inch (16 mm) gypsum wallboard over steel studs mounted at 16 inches (400 mm) on center, minimum ceiling mounting height must be 8 foot (2400 mm) above the finish floor. Ceilings must be painted with one coat of primer and two coats of semi-gloss paint. Color must be selected from manufacturer standard paint samples.

2-2.3.4.6 Administrative Office Spaces

Provide a minimum of one open office approximate size of 375 net square feet (35 net square meters) and one single office approximately 150 net square feet (12 net square meters) Administration offices must be separate from the lab area but must be adjacent to the lab area for ease of access into the lab area. This room must consist of office equipment including desk, copy equipment, file cabinets, visitor chairs. Walls must be

steel studs at 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard. Flooring for this space can be resilient tile type or porcelain tile flooring. Ceilings for this space must consist of acoustical tile type of ceiling. Size of the administration office shall be coordinated with the number of staff that will be assigned to this facility.

2-2.3.4.7 Break Room Spaces

Provide a break area approximate size of 300 square foot (28 net square meters), room must be adjacent to office areas and away from the hazardous storage and Laboratory areas. This room must consist of counter area, table, and refrigerator space. Walls must be steel studs at 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard. Flooring for this space can be resilient tile type or porcelain tile flooring. Ceilings for this space must consist of acoustical tile type of ceiling.

2-2.3.4.8 Support Space

Provide Mechanical, Electrical, and Communication rooms. The approximate size of these spaces must be sized for required equipment for the building. Rooms must have access from the exterior of the building or comply with current security requirements. Walls must be steel studs at a minimum of 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard or painted Concrete Masonry Units. Flooring for this space can be resilient tile type or porcelain tile flooring or sealed concrete type of flooring. Ceilings for these spaces maybe be exposed to the underside of the metal decking or roof structure.

2-2.3.4.9 Toilet and Locker Rooms

Provide men's and women's toilet and locker rooms, size determined according to the number of people that will be using this space. This space will need to be located between the break room and laboratory to ensure proper industrial hygiene separations. Walls must be steel studs at a minimum of 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard covered with a porcelain tile wainscot in the toilet room and full height in the shower areas showers should include shower pans or porcelain type of flooring. Flooring for this space can be ceramic or porcelain tile type flooring. Ceilings for these spaces must be 5/8 inch (16 mm) gypsum wallboard. In toilet rooms and locker areas provide a wainscot of ceramic tile or porcelain tile with backer board.

2-2.4 Mechanical

The items of a Type B lab are required, see paragraph 2-3.4.

2-2.5 Electrical

In addition to the Basic Lab Requirements of paragraph 2-1.4, Type A labs must be equipped with combustible gas monitors with alarms, as indication of either a HVAC failure or piped natural gas (or other gas) leak that is allowing a dangerous build-up of potentially explosive gases.

Type A labs will also have certain Hazardous Areas, that will require electrically explosion proof treatment. These areas must be considered Hazardous (Classified) Locations, Class 1 Division 1: Hazardous Storage Room, areas within 5 feet (1524 mm) of Hazardous storage cabinets (or refrigerator), the interior of lab fume hoods, and 5 feet (1524 mm) around any fuel waste containers in excess of 5 gallons (18.9 liters).

2-2.6 Fire Protection

Provide a design analysis at the start of the project and provide a list of chemicals and fuels that will be tested in the lab. Document client requirements and provide in the design analysis. Provide a list of expected chemicals and fuels that will be stored in the lab building. Table 2-2 has a list of some typical chemicals and fuels.

Maximum allowable volume of fuel to be in lab: NFPA 45, Table 9.1.1 (b) – Maximum Quantities of Flammable and Combustible Liquids in Laboratory Units Outside of Inside Liquid Storage Areas. Maximum allowable volume of fuel must follow the guidelines for a Class A Lab.

Maximum allowable single container size: NFPA 45, Table 9.1.2 – Maximum Allowable Container Capacity.

Refer to Paragraph 2-1.5 under Basic Lab Requirements for further Fire Protection Requirements.

Lab must be designed to meet Class A classification per National Fire Protection Association (NFPA) 45.

2-3 TYPE B TESTING LAB

2-3.1 General

The requirements of each lab are determined by the tests performed in the lab. Requirements of counter space, ventilation, electrical, and so on are shown in Table 2-1, Fuels Laboratory Equipment Reference Table.

2-3.2 Facility Description

A facility capable of performing Type B Tests as described in MIL-STD-3004. A Type B-1 Test consists of a partial analysis comprising the checking of principal characteristics most likely to have been affected in the course of moving the product. Type B-2 Test consists of a partial analysis to check characteristics susceptible to deterioration because of age. A Type B-3 Test consists of partial analysis for contaminations; in particular, for controlling the return (or reintroduction) of pipeline interface products. For a minimum list of tests see Table 2-1, Fuels Laboratory Equipment Reference Table.

Sample size must include 1 gallon (3.8 liters), 5 gallons (18.9 liters) for special tests, as indicated in paragraph 4.2.1.7 of MIL-STD-3004.

Examples of Type B Labs include Hunter Army Airfield, Ft Rucker, Ft Campbell, Chibana, FLC Norfolk, FLC Jacksonville, Naval Station Rota, FLC Point Loma.

See Figure 2-2 Bubble Diagram Type B Laboratory.

2-3.3 Architectural

2-3.3.1 Architectural Design

Architectural design must conform to all applicable criteria and guidance, including all applicable local and federal codes requirements, Military documents, and DD Form 1391, Design Requirements Documents, Installation standards and design criteria, and user requirements as provide during criteria review conference to provide a complete and usable facility. Size of building must be based on tests as indicated in Table 2-1, Fuels Laboratory Equipment Reference Table, as approved to provide the user with a complete operational facility. Size of this type of facility may be increased as mission at each installation is developed. Minor modifications to the configuration maybe developed during review conferences. Finishes of the exterior of buildings for this project must follow base standards for the exterior materials.

2-3.3.1.1 Code, Standards and Regulations

The Codes, Standards, and Regulations listed in Appendix A – References must be used in the construction of this project. All applicable local standards and codes must also be followed. The publications must be the most recent editions. Standards other than those mentioned may be accepted provided they meet the minimum requirements of Type B Testing Lab and the Designer and the Contractor submit proof of meeting these requirements.

2-3.3.1.2 Life Safety / Fire Protection / Handicapped Accessibility

These facilities must be designed in accordance with recognized industry standards for life safety and building egress. The most recent versions of codes and standards must apply for the new designs (Refer to Basic Lab Requirements). Fire extinguisher cabinets and fire extinguisher brackets including fire extinguishers must be provided.

Handicapped accessibility requirements will be incorporated into the building design, the design must follow the ADA-ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities.

2-3.3.2 Building Requirements

The functional areas for a medium size laboratory facility must include the following spaces:

2-3.3.2.1 Laboratory Room

Approximate size of 1,200 to 2,000 square feet (112 to 186 net square meters)

Fuels and lubricants that are typically tested inside the lab includes:

- Aviation Gasoline (AVGAS)
- Biofuels
- Biodiesel
- Diesel fuel
- Ethanol, fuel grade
- Fuel oil, gas oil, bunker fuel
- Gasoline
- Aviation Turbine Fuel (JP-5, JP-8, Jet A, F-24, etc.)
- Kerosene
- Lube Oil

For typical fuel testing done inside the lab, see Table 2-1, Fuels Laboratory Equipment Reference Table.

This room will consist of testing supplies, laboratory casework, laboratory counters tops, and small storage cabinets. Room finish materials such as flooring, walls, casework, and counter tops must be a type that will resist flammable and combustible liquids.

Laboratory casework must be designed and installed to provide an efficient working environment. Counter heights must be adjusted to allow for a proper working height with required equipment from a standing position. Cabinets must be constructed using metal or wood that will resist rusting and must conform to industry standards for Scientific Laboratory Equipment. All cabinets must be flush front type of construction with interior of cabinets be constructed for storage of equipment, flammable and combustible liquids. Upper storage cabinets must have glass fronts.

Flooring for the fuels lab area must consist of a monolithic type of flooring without seams or joints and to be resistant to chemical and fuel spills.

Walls must be steel studs at 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard, provide a back splash or wainscot at casework. Backsplash or wainscot must be provided that is chemical and fuels resistant. Walls must be fire resistant and meet UL fire rated construction.

Laboratory Counters: must be a black epoxy resin type of material that is typically used for a laboratory type rooms. Counters must be resistant to chemical and fuel spills and must be easily cleanable.

Built-in equipment that will be required includes laboratory hoods, work tables, and laboratory casework.

2-3.3.2.2 Chemical Analysis Room

Approximate size of 260 square feet (24 net square meters).

Adjust the size of this area as required for the number of personnel that will assigned to this area. Casework must be designed and installed to provide an efficient working environment. Counter heights must be adjusted to allow for a proper working height with required equipment from a standing position. Cabinets must be constructed using metal that will resist rusting and must conform to the best Scientific Laboratory Equipment industry. All cabinets must be flush front type of construction with interior of cabinets be constructed for storage of equipment, flammable and combustible liquids. Upper storage cabinets must have glass fronts.

Flooring for the Chemical Analysis room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm).

Walls must be steel studs at 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard, provide a back splash or wainscot at casework. Backsplash or wainscot must be provided that is chemical and fuels resistant.

Counters: must be a black epoxy resin type of material that is typically used for a Chemical Analysis. Counters must be resistant to chemical and fuel spills and must be easily cleanable.

2-3.3.2.3 Non Hazardous Storage Room

Approximate size of 200 net square feet (37 net square meters)

This room or rooms must consist for the storage of chemicals including storage compartments and work tables. Flooring for the Non-hazardous storage room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm). Walls must be steel studs at a maximum of 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard or concrete masonry type of wall, provided with a back splash or wainscot at all casework.

2-3.3.2.4 Hazardous Storage Room

Approximate size of 100 net square feet each (10 net square meters each).

This room consists of the storage of chemicals for both hazardous and nonhazardous chemicals, including storage compartments and work tables, Flooring for the Chemical storage room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm). Walls must be steel studs at 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard or a concrete masonry type of wall, provide a back splash or wainscot at casework. Walls must be fire resistant and meet UL fire rated construction.

Backsplash or wainscot must be provided that is chemical and fuels resistant. Counters: must be a black epoxy resin type of material that is typically used for a Chemical Analysis. Counters must be resistant to chemical and fuel spills and must be

easily cleanable. Ceilings; ceilings must consist of 5/8 inch (16 mm) gypsum wallboard over steel studs mounted at 16 inches (400 mm) on center, minimum ceiling mounting height must be 8 foot (2400 mm) above the finish floor. Ceilings must be painted with one coat of primer and two coats of semi-gloss paint. Color must be selected from manufacturer standard paint samples.

2-3.3.2.5 Filtration Room

Approximate size of 250 net square feet (23 square meters).

Filtration room or area will need to be adjacent to the laboratory areas to provide filtered air into the laboratory area. Dependent on the requirements this room or area can be within the laboratory or located in a support area.

2-3.3.2.6 Balance Room and Flash room

Approximate size of 150 net square feet (13 square meters) each.

Balance and flash room should be located next to and access into the laboratory areas. Balance area could be located within the laboratory area if only one table is required.

Casework must be designed and installed to provide an efficient working environment. Counter heights must be adjusted to allow for a proper working height with required equipment from a standing position. Cabinets must be constructed using metal that will resist rusting and must conform to the best Scientific Laboratory Equipment industry. All cabinets must be flush front type of construction with interior of cabinets be constructed for storage of equipment, flammable and combustible liquids. Upper storage cabinets must have glass fronts. Counters: must be an epoxy resin type of material that is typically used for a Chemical Analysis. Counters must be resistant to chemical and fuel spills and must be easily cleanable. Color of counters must be as selected from standard color of epoxy resin type of counters.

Flooring for the Filtration room must consist of a monolithic type of flooring without seams or joints and must resist chemical and fuel spills. Provide a cove base of the same material extending up approximately 8-inches (200 mm). Walls must be steel studs at 16 inches (400 mm) on center with 5/8 inch (16 mm) gypsum wallboard, provide a back splash or wainscot at casework. Backsplash or wainscot must be provided that is chemical and fuels resistant. Ceilings must consist of 5/8 inch (16 mm) gypsum wallboard over steel studs mounted at 16 inches (400 mm) on center, minimum ceiling mounting height must be 8 foot (2400 mm) above the finish floor. Ceilings must be painted with one coat of primer and two coats of semi-gloss paint. Color must be selected from manufacturer standard paint samples.

2-3.3.2.7 Administrative Office Spaces

Provide a minimum of one open office approximate size of 375 net square feet (35 net square meters) and one single office approximately 130 net square feet (12 net square meters). Size of the administration office shall be coordinated with the number of staff that will be assigned to this facility.

Administration offices must be separate from the lab area but must be adjacent to the lab area for ease of access into the lab area. This room must consist of office equipment including desk, copy equipment, file cabinets, visitor chairs. Walls must be steel studs at 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard. Flooring for this space can be resilient tile type or porcelain tile flooring. Ceilings for this space must consist of acoustical tile type of ceiling.

2-3.3.2.8 Support Spaces

Provide Mechanical, Electrical, and Communication rooms. The approximate size of these spaces must be sized for required equipment for the building. Rooms must have access from the exterior of the building. Walls must be steel studs at 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard or painted Concrete Masonry Units. Flooring for this space can be resilient tile type or porcelain tile flooring. Ceilings for these spaces maybe exposed to the underside of the metal decking or roof structure.

2-3.3.2.9 Toilet and Locker Rooms

Provide men's and women's toilet and locker rooms, size determined according to the number of people that will be using this space. Locate this space between the break room and laboratory to ensure proper industrial hygiene separations. Walls must be steel studs at a minimum of 16 inches (400 mm) on center and covered with 5/8 inch (16 mm) gypsum wallboard covered with a porcelain tile wainscot in the toilet room and full height in the shower areas. Flooring for this space can be ceramic or porcelain tile type flooring. Ceilings for these spaces must be 5/8 inch (16 mm) gypsum wallboard.

2-3.4 Mechanical

2-3.4.1 General

The following items are required in addition to Type C++ Requirements, see paragraph 2-4.4.

2-3.4.2 Lab Operating Temperature

Lab operating temperature must be maintained 24 hours a day, 7 days a week or as directed by project requirements.

2-3.4.3 Hazardous Storage Room

The Hazardous Storage Room is classified as a Class 1 Division 1 Hazardous space which requires all equipment associated with the room to be explosion proof. Room must be exhausted 24 hours per day, 7 days a week to remove vapors and assure room is slightly negative air pressure from the rest of the building (adjacent rooms).

2-3.5 Electrical

In addition to the Basic Lab Requirements of paragraph 2-1.4, type B labs must be equipped with combustible gas monitors with alarms, as indication of either a HVAC

failure or piped natural gas (or other gas) leak that is allowing a dangerous build-up of potentially explosive gases.

Type B labs will also have certain Hazardous Areas that will require electrically explosion proof treatment. These areas must be considered Hazardous (Classified) Locations, Class 1 Division 1: Chemical Storage Room, within and 5 feet (1524 mm) around Hazardous storage cabinets (or refrigerator), the interior of fume hoods, and 5 feet (1524 mm) around any fuel waste containers in excess of 5 gallons (18.9 liters).

2-3.6 Fire Protection

Provide a design analysis at the start of the project and provide a list of chemicals and fuels that will be tested in the lab. Document client requirements and provide in the design analysis. Provide a list of expected chemicals and fuels that will be stored in the lab building. Table 2-2 has a list of some typical chemicals and fuels.

Maximum allowable volume of fuel to be in lab: NFPA 45, Table 9.1.1(b) – Maximum Quantities of Flammable and Combustible Liquids in Laboratory Units Outside of Inside Liquid Storage Areas.

Maximum allowable single container size: NFPA 45, Table 9.1.2 – Maximum Allowable Container Capacity.

Refer to Paragraph 2-1.5 under Basic Lab Requirements for further Fire Protection Requirements.

Lab must be designed to meet Class A or Class B classification per National Fire Protection Association (NFPA) 45.

2-4 TYPE C TESTING LAB

2-4.1 General

The requirements of each lab are determined by the tests performed in the lab. Requirements of counter space, ventilation, electrical, and so on are shown in Table 2-1, Fuels Laboratory Equipment Reference Table.

2-4.2 Facility Description

A facility capable of performing a Type C Test as described in MIL-STD-3004. A Type C Test consists of a quick, simple, partial analysis for verification of product quality, and to ensure no change has taken place. Type C tests are sometimes referred to as identifications tests. A number of labs are referred to as C++ labs. The Air Force at many installations has C++ labs capable of all of the C level tests plus a couple of additional tests, see Table 2-1. In the case of the Air Force C++ labs this means a lab fume hood is required and additional counter space. For a list of tests see Table 2-1, Fuels Laboratory Equipment Reference Table.

Fuels and lubricants that are typically tested inside the lab includes: AVGAS, Aviation Turbine Fuel (JP-5, JP-8, Jet A, F-24, etc.), Gasoline, E85, Diesel, Kerosene, B20, Burner Fuel Oils, and Lube Oil.

Examples of C Type labs include Ft Polk, Ft Irwin, Quantico, Ft Drum. Typical Type C++ labs are found on Air Force Bases, examples include: Eglin, Grand Forks, Ellsworth, Holloman, etc.

See Figure 2-3 Typical C Laboratory Floor Plan.

See Figure 2-4 Typical C++ Laboratory Floor Plan.

2-4.3 Architectural

2-4.3.1 Codes, Standards and Regulations

The Codes, Standards, and Regulations listed under Appendix A - References must be used in the construction of this project. All applicable local standards and codes must also be followed. The publications must be the most recent editions. Standards other than those mentioned may be accepted provided they meet the minimum requirements of the Type C Testing Lab and the Designer and the Contractor submit proof of meeting these requirements.

2-4.3.2 Life Safety / Fire Protection / Handicapped Accessibility

These facilities must be designed in accordance with recognized industry standards for life safety and building egress. The most recent versions of codes and standards must apply for the new designs (refer to the Basic Lab Requirements). Fire extinguisher cabinets and fire extinguisher brackets including fire extinguishers must be provided.

Handicapped accessibility requirements will be incorporated into the building design, the design must follow the ADA-ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities.

2-4.4 Mechanical

2-4.4.1 General

The following items are required in addition to Basic Lab Requirements, see paragraph 2-1.3.

2-4.4.2 Lab Operating Temperature

Lab operating temperature must be maintained during normal business hours, night setback is acceptable unless directed otherwise by project requirements.

2-4.4.3 Fume Hood

2-4.4.3.1 Science Fume hood

A Science fume hood must be of the bench top design, categorized as an Educational Fume Hood, a minimum opening of 18 inches x 8 inches (457x200 mm), minimum working space of 24 inches Width(W) x 13 inches Depth(D) x 22 inches Height (H) (610Wx330Dx560H mm), ducted, approximately 100 cfm (50 liters/sec).

The hood may be designed to operate while the sash (hood access door) is in the partially opened position only.

An on/off switch for the exhaust fan must be provided near the fume hood.

Exhaust ductwork must be sealed.

Exhaust streams must be exhausted directly to the building exterior.

Face velocity must be designed to 100 fpm (0.5 m/s).

Exhaust fan must be located on the roof in accordance with NFPA 45.

Exhaust fan must be spark resistant construction.

Exhaust fan motor must be explosion proof if located in the air stream.

Exhaust stack discharge velocity must be at least 3,000 fpm (15 m/s).

Exhaust must be a minimum of 30 feet (9 m) from any building fresh air intake.

Exhaust must be labeled “WARNING – Chemical Laboratory Exhaust”

Exhaust stack must discharge vertical in an upward direction and be located a minimum of 10 feet (3 m) above the adjacent roof lines.

2-4.4.3.2 Lab Fume hood

For a typical Air Force C++ lab, a 47 or 60 inches (1200 or 1525 mm) lab fume hood is required (size is dictated by the number of samples/tests to be performed on a daily basis), ducted, approximately 750 cfm (354 liters/sec) or 1000 cfm (472 liters/sec), respectively.

The hood must be designed to operate while the sash (hood access door) is in any position (fully opened to fully closed).

Good ventilation is achieved by using a lab fume hood in a small room even when the test is not performed in the hood.

An on/off switch for the exhaust fan must be provided near the fume hood.

Exhaust duct work must be chemical resistant.

Exhaust ductwork must be sealed.

Exhaust ductwork must not be manifolded together with other lab hoods on a constant volume system.

Exhaust streams containing concentration of flammable vapors at concentrations above the Lower Explosion Limit (LEL) must not be connected to a centralized exhaust system per ANSI/ASSE Z9.5.

Hood must be equipped with a flow indicator, flow alarm, or face velocity alarm indicator set to alarm when the face velocity falls outside the range of 80 to 100 fpm (0.4 to 0.5 m/s).

Face velocity must be designed to 100 fpm (0.5 m/s).

During commissioning, the following tests and measurements must be performed in accordance with ANSI/ASSE Z9.5:

- Airflow visualization tests
- Cross drafts velocity tests
- Exhaust flow measurements
- Face velocity tests
- Hood static pressure measurement
- Tracer gas testing

Exhaust fan must be located on the roof in accordance with NFPA 45.

Exhaust fan must be spark resistant construction.

Exhaust fan motor must be explosion proof if located in the air stream.

Exhaust stack discharge velocity must be at least 3,000 fpm (15 m/s).

Exhaust must be a minimum of 30 feet (9 m) from any building fresh air intake.

Exhaust must be labeled “WARNING – Chemical Laboratory Exhaust”

Exhaust stack must discharge vertical in an upward direction and be located a minimum of 10 feet (3 m) above the adjacent roof lines.

Controls (air, water, gas, etc.) must be located exterior of the hood within easy reach.

2-4.4.4 Make-up Air for Fume Hood

Make-up air for the fume hood must meet the lab operating temperature requirements.

2-4.4.5 Vacuum Pump

A vacuum pump must be provided serving the lab fume hood if required by the appropriate fuel test. Vacuum pump must be located at a higher elevation for the

vacuum line to drain back into the fume hood. An on/off switch must be located near the fume hood. Vacuum pump not required for a Type C Testing Lab. The vacuum pump requires good ventilation, so installation in the same room as the lab hood is adequate.

2-4.4.6 Emergency Eyewash and Shower

An OSHA emergency eyewash and shower supplied with tempered water in accordance with ANSI/ISEA Z358.1. Type C labs require only an eye wash. Air Force Type C++ labs require an emergency eyewash and shower.

2-4.4.7 Floor Drains

Floor drains must be provided for emergency showers. Drains must be equipped with a positive sealing plug which is inserted in the drain at all times when not in use or some other means of stopping the drain system. Drains are opened only when in need or after the liquid is determined to be approved for discharge into the drain system.

2-4.4.8 Deionizer Water Tap

A water supply tap for a Type II deionizer water equipment (typically wall mounted) must be provided for Type C++. Provide deionizer tap for Type C only when requested.

2-4.4.9 Glassware Cleaning

The lab must be designed for glassware cleaning (dishwasher). Not required for Type C and C++ unless the number of daily samples is high enough based on installation throughput and manpower requirements.

Prior to cleaning glassware, all fuel from testing is dumped into containers which are either recycled or properly disposed of. Lab personnel are trained to not dump fuels (hazardous waste) into any sink or floor drain. Glassware is essentially empty except for the residual fuel clinging to the container. Detergents are used to clean and breakdown the residual fuel from the glassware and is subsequently dumped into the drain system.

There is no state or federal regulation which require special treatment of the discharge from a DOD fuels lab operating under these conditions. There might be some local or host nation requirement which specifically addresses and requires oil water separators, intermediary containment basins, or some other means to address the residual fuel. A large lab with high quantities of samples might warrant environmental concerns to assure safe discharge is met.

2-4.5 Electrical

See Basic Lab Requirements paragraph 2-1.4.

2-4.6 Fire Protection

Provide a design analysis at the start of the project and provide a list of chemicals and fuels that will be tested in the lab. Document client requirements and provide in the

design analysis. Provide a list of expected chemicals and fuels that will be stored in the lab building. Table 2-2 has a list of some typical chemicals and fuels.

Maximum allowable volume of fuel to be in lab: NFPA 45, Table 9.1.1(b) – Maximum Quantities of Flammable and Combustible Liquids in Laboratory Units Outside of Inside Liquid Storage Areas.

Maximum allowable single container size: NFPA 45, Table 9.1.2 – Maximum Allowable Container Capacity.

Refer to Paragraph 2-1.5 under Basic Lab Requirements for further Fire Protection Requirements.

Lab must be designed to meet Class A or Class B classification per National Fire Protection Association (NFPA) 45.

2-5 FIGURES

Figure 2-1 Bubble Diagram Type A Laboratory, Figure 2-2 Bubble Diagram Type B Laboratory, Figure 2-3 Typical C Laboratory Floor Plan, and Figure 2-4 Typical C++ Laboratory Floor Plan are included below.

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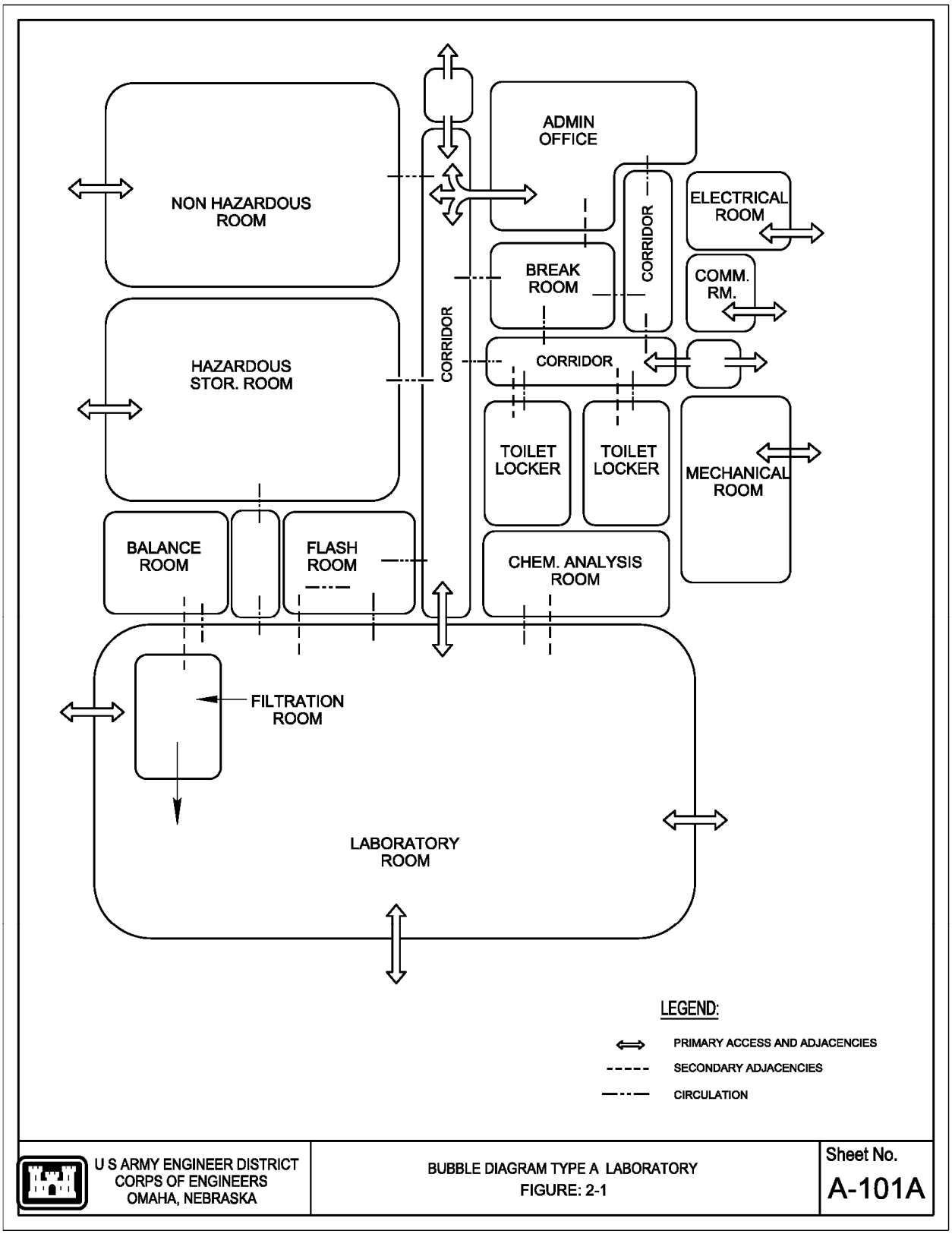


Figure 2-1 Bubble Diagram Type A Laboratory

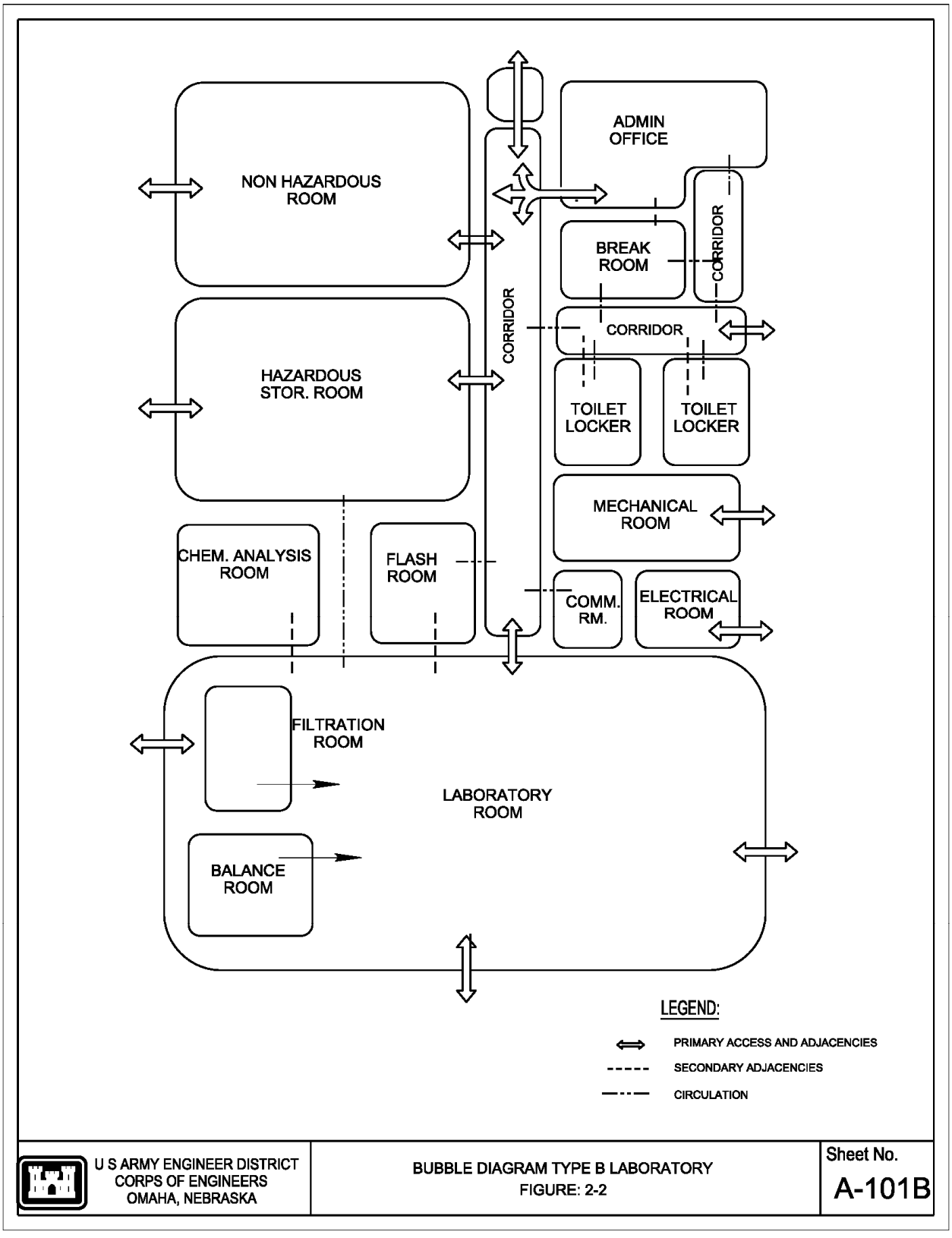
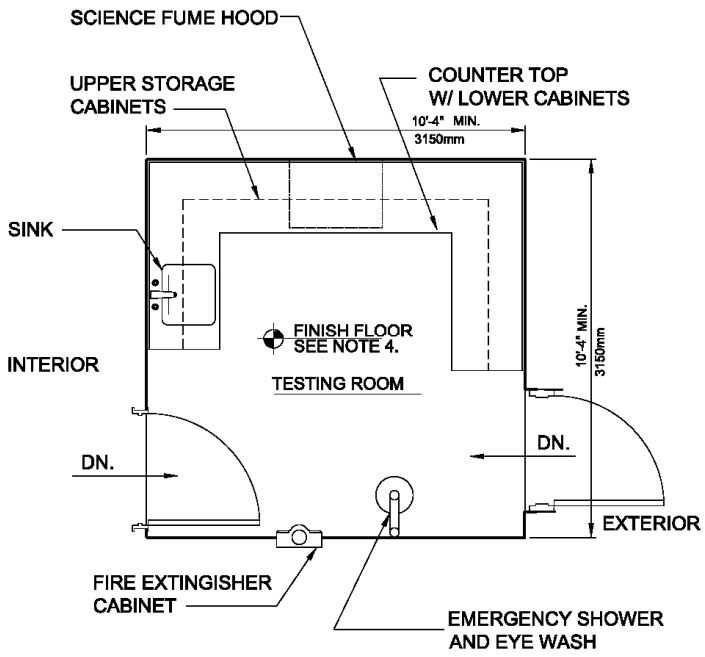


Figure 2-2 Bubble Diagram Type B Laboratory



FLOOR PLAN

N.T.S.

NOTES:

1. INCLUDED IN DESIGN SHOULD PROVIDE SUPPORT SPACES INCLUDING BUT LIMITED TO OFFICE SPACES, MECHANICAL, ELECTRICAL, COMMUNICATION ROOMS, AND TOILET FACILITIES.

2. INTERIOR WALLS MUST BE FIRE RATED A MINUMUM OF 1-HOUR RATED CONSTRUCTION AROUND THE LABORATORY.

3. PROVIDE FLAMMABLE STORAGE CABINET TO STORE SMALL AMOUNTS OF FLAMMABLE LIQUIDS THAT WILL BE TESTED.

4. FINISH FLOOR OF TESTING ROOM SHALL BE A MINIMUM OF 6" (150mm) BELOW FLOORS IN ADJACENT INTERIOR ROOMS.

5. EXTERIOR DOORS SHALL BE OUTSWING AND PROVIDED WITH EXIT DEVICE AND CLOSURE. INTERIOR ACCESS SHALL BE EITHER OUTSWING OR INSWING, VERIFY WITH CODE REQUIREMENTS.

U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	TYPICAL C LABORATORY FLOOR PLAN FIGURE 2-3	Sheet No. A-102

Figure 2-3 Typical C Laboratory Floor Plan

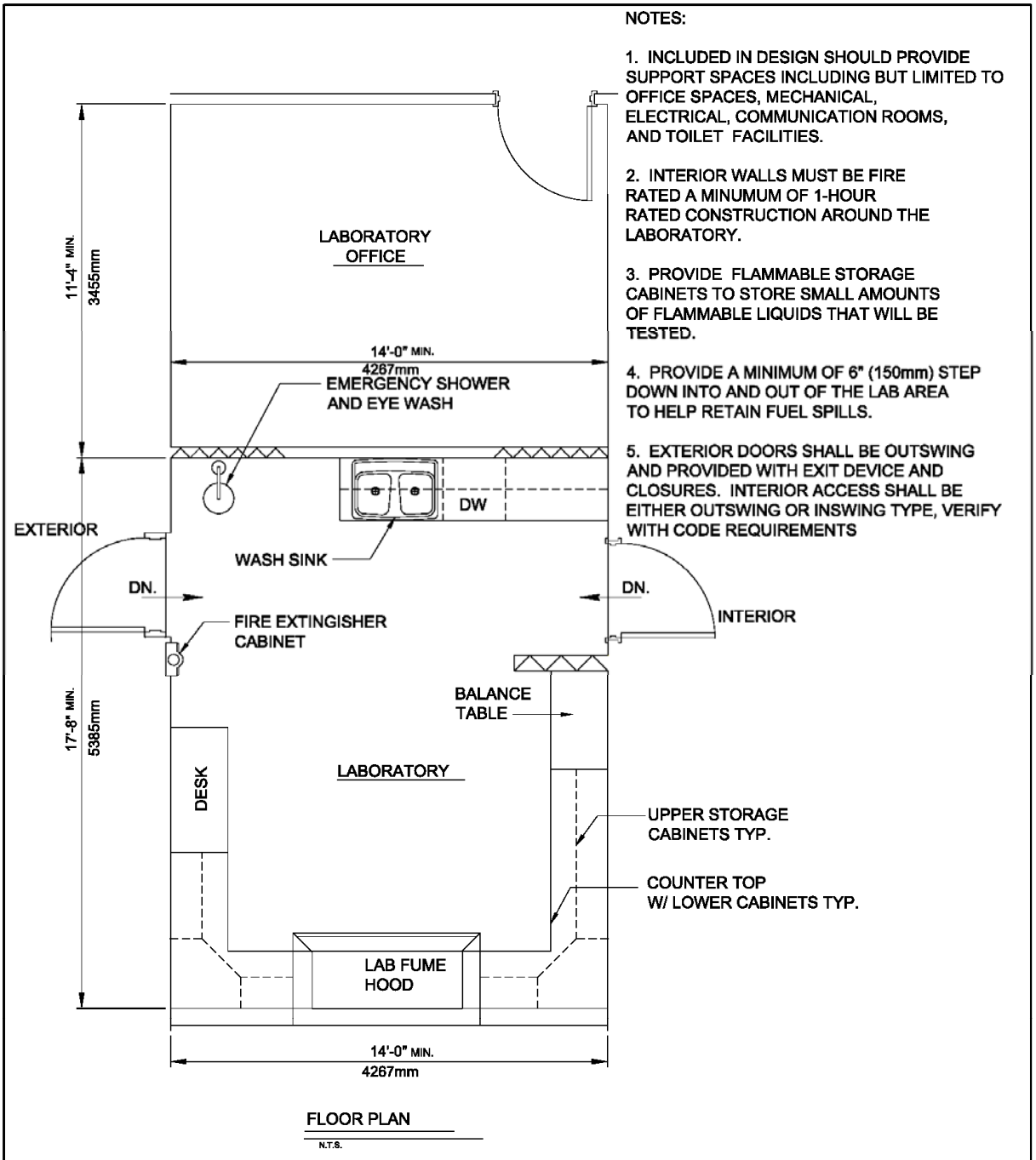


Figure 2-4 Typical C++ Laboratory Floor Plan

2-6 TABLES

Tables 2-1 Fuels Laboratory Equipment Reference Table and Table 2-2 Possible Products in a Flammable Storage Room Table included below.

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Table 2-1 Fuels Laboratory Equipment Reference Table

Fuel Type	Test	Counter (Inches)	Good Ventilation or Science Fume Hood	Lab Fume Hood	Vacuum Pump	Comp Air	Natural Gas Propane	Distilled Water	120V *	240V *	Sink	Nitrogen cylinder	Dessi cator	Explosion Proof Refrigertr	Testing Oven **	Ice Maker	Bal ***	Test Time Minutes	Lab Type A	Lab Type B-1	Lab Type B-2	Lab Type B-3	Lab Type C
JET FUEL	Appearance	30	X															10	X	X	X	X	X
	Color (visual)	20	X															10	X	X	X	X	X
	Density or API Gravity	20	X															20	X	X	X	X	X
	Flash Point ^	36	X				X [4]		X									45	X	X	X	X	X
	Particulate Matter +	36		X	X				X	X			X	X	X		X	170	X	X	X	X	
	Distillation	36	X						X	X	X [5]							90	X	X	X	X	
	Copper Strip Corrosion	36	X						X		X [5]							230	X	X	X	X	
	Freezing Point	30	X							X		X						60	X	X	X	X	
	Existent Gum	48		X		X				X	X		X		X			480	X	X	X	X	
	Vapor Pressure	[1]	X							X	X [5]					X		120	X	X	X	X	
	Water Reaction	30	X					X			X							30	X	X	X	X	
	Lead Content	36	X						X									90	X	X	X	X	
	FSII (& Other Additives) +	30	X					X										60	X	X	X	X	
	Filtration Time	48		X	X				X	X			X		X			170	X	X	X	X	
	Water Separation Index	30	X						X									30	X	X	X	X	
	Conductivity	30	X															10	X	X	X	X	
	Thermal Stability	48	X							X								480	X		X		
	Color (Saybolt)	30	X						X									15	X		X		
	Acid Number	48		X					X		X	X						30	X		X		
	Aromatics	TBD	X															TBD	X				
	Mercaptan Sulfur	TBD	X															TBD	X				
	Net Heat	TBD	X															TBD	X				
	Smoke Point	TBD	X															TBD	X				
	Naphthalenes	TBD	X															TBD	X				
	Hydroperoxides	TBD	X															TBD	X				
	BOCLE	TBD	X															TBD	X				
DIESEL	Appearance	30	X															10	X	X	X	X	X
	Carbon residue Test	48		X						X								120	X	X	X	X	X
	Cloud Point	[2]	X							X								60	X	X	X		
	Pour Point	[2]	X							X								60	X		X		
	Copper Strip Corrosion	36	X						X		X							170	X		X		
	Cetane Index	N/A	X															10	X		X		
	Viscosity	48	X							X								120	X		X		
	H20 & Sediment/Centrifug	36	X						X									30	X		X		
	Particulate Contamination	36		X	X				X	X			X		X			170	X		X		
	Ash	TBD	X															TBD	X				
	Aromatics	TBD	X															TBD	X				
	Sulfur	TBD	X							X								TBD	X		X		
	Lubricity (HFRR)	TBD	X															TBD	X				
MOGAS	Appearance	30	X											X				10	X	X	X	X	X
	Vapor Pressure	[1]	X							X	X			X				120	X	X	X		
	Unwashed Gum	48		X		X				X	X		X	X	X			480	X		X	X	
	Oxidation Stability	[3]	X						X		X			X				480	X		X		
	Lead Content	36	X						X					X				360	X			X	

* Power supply voltage may vary by region and equipment requirements

** two ovens required: a general oven for drying glassware and a separate oven for performing tes

*** Balance to be located in an area isolated from air movement, perhaps a separate room

^ consider additional ventilation (fume hood, snorkel, spot ventilation) as recommended in ASTM

+ additional test AF labs perform, designated (C++ Lab)

[1] bath mounted on floor, 30 inches wide, 32 inches above ground

[2] mounted on floor, 48 inches wide

[3] mounted to floor-standing platform (platform extends 1' above floor), bath sits on platform and is 1' square and 2' high

[4] propane is normally provided with the test equipment, propane canister

[5] drain from equipment to sink or floor drain required

Note to designer: verify order of sampling and proximity to emergency eyewash/shower, electrical supply, fume hood, etc. to optimize safety and functionality

Table 2-2 Possible Products in a Flammable Storage Room Table

Note: This list is not an all-inclusive list. In addition to this list, fuel samples and other products may be used and stored in a typical Flammable Storage Room for DOD Fuels Laboratories

PRODUCT CATEGORY	PRODUCT NAME
ALCOHOL	ETHANOL, ABSOLUTE
	ETHANOL, Denatured
	ISOPROPANOL
	METHANOL
SOLVENTS	
	TOLUENE
	TOLUENE HPLC Grade Certified
	PETROLEUM ETHER
	HEXANE
	HEXANE 99% Purity
	ISOOCTANE
	HEPTANE
	PENTANE
	ACETONE
	ACETONE High Grade
	XYLENE
	NAPTHA
	STODDARD SOLVENT
	DRYCLEANING SOLVENT
	LANCER ACID for Dishwasher
	LANCER CLEAR for Dishwasher
PETROLEUM PRODUCTS	FUEL & PACKAGED PETROLEUM PRODUCTS - VARIOUS

APPENDIX A REFERENCES

AMERICAN SOCIETY OF HEATING AND AIR CONDITIONING (ASHRAE)

ASHRAE STD 110, *Method of Testing Performance of Laboratory Fume Hoods*

ASHRAE 62.1, *Ventilation for Acceptable Indoor Air Quality*

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ANSI/ASSE Z9.5, *Laboratory Ventilation*

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1, *American National Standard for Emergency Eyewash and Shower Equipment*

UNDERWRITER'S LABORATORY

UNIFIED FACILITIES CRITERIA

http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

UFC 1-200-01, DoD Building Code (*General Building Requirements)*

UFC 1-200-02, High Performance and Sustainable *Building Requirements*

UFC 3-410-01, *Heating, Ventilating, and Air Conditioning Systems*

UFC 3-530-01, *Interior and Exterior Lighting Systems and Controls*

UFC 3-575-01, Lightning and Static Electricity Protection Systems

UFC 3-600-01, *Fire Protection Engineering for Facilities*

UFC 3-420-01, Design, Plumbing Systems

UFC 3-460-01, *Design: Petroleum Fuel Facilities*

UFC 4-021-01, *Design and O&M: Mass Notification Systems*

INTERNATIONAL BUILDING CODE (IBC)

IBC, as modified by UFC 1-200-01

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) (MOST RECENT EDITIONS)

NFPA 1, Fire Code

NFPA 10, Standard for Portable Fire Extinguishers

NFPA 13, Standard for the Installation of Sprinkler Systems

NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances

NFPA 30, Flammable and Combustible Liquids Code

NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals

NFPA 70, National Electrical Code

NFPA 72, National Fire Alarm and Signaling Code

NFPA 101, Life Safety Code

NFPA 780, Standard for the Installation of Lightning Protection Systems

NFPA 400, Hazardous Materials Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191, *ADA-ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities Dated: July 23, 2004, with amendments*

CFR 1910.132; *Code of Federal Regulations, Personal Protective Equipment (PPE)*

CFR 1910.157; *Code of Federal Regulations, Portable Fire Extinguishers*

CFR 1910, Subpart D*; Code of Federal Regulations, Walking-Working Surfaces*

CFR 1910, Subpart E*; Code of Federal Regulations, Means of Egress*

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4140.25M, *DOD Management of Bulk Petroleum Products, Natural Gas, and Coal*

MIL-STD-3004, *Quality Assurance/Surveillance for Fuels, Lubricants and Related Products*

MIL-STD-3007, *DOD Standard Practice for Unified Facilities Criteria and Unified Facilities Guide Specifications*

APPENDIX B GLOSSARY

B-1 ACRONYMS AND ABBEVIATIONS

AF	Air Force
AFCEC	Air Force Center for Engineering and the Center
BIA	Bilateral Infrastructure Agreement
CONUS	Continental United States
DAF	Department of the Air Force
DoD	Department of Defense
EMC	Electrical Metallic Conduit
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HNFA	Host Nation Funded Construction Agreements
HVAC	Heating, Ventilating and Air Conditioning
IMC	Intermediate Metallic Conduit
LED	Light-Emitting Diode
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MDP	Main Distribution Panel
MTS	Manual Transfer Switch
NAVFAC	Naval Facilities Engineering Command
OSHA	Occupational Safety and Health Administration
PVC	Polyvinyl Chloride Conduit
SOFA	Status of Forces Agreements
UFC	Unified Facilities Criteria
UL	Underwriter’s Laboratories
U.S.	United States

B-2 DEFINITION OF TERMS

Sash — Operating door on lab fume hood.

Snorkel — Spot ventilation. A moveable or permanent exhaust positioned over specific equipment.