

LABORATORIES

DEP 34.17.10.31-Gen.

April 2006
(DEP Circular 63/08 has been incorporated)

DESIGN AND ENGINEERING PRACTICE



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TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	CHANGES FROM THE PREVIOUS EDITION	5
1.5	COMMENTS ON THIS DEP	5
2.	GENERAL	6
3.	LOCATION AND LAYOUT	7
4.	ARCHITECTURAL DESIGN	8
4.1	WALLS, CEILINGS AND FLOORS	8
4.2	DOORS	8
4.3	WINDOWS	8
4.4	LOCATION OF BENCHES	9
5.	PIPING	10
5.1	GENERAL	10
5.2	MATERIALS	11
5.3	PIPING SYSTEMS	12
5.4	COLOUR CODING	15
6.	ELECTRICAL INSTALLATION	16
6.1	GENERAL	16
6.2	STANDARDS	16
6.3	INSTALLATION PRACTICE	16
6.4	SOCKET OUTLETS	16
6.5	EARTHING	17
6.6	ELECTRICAL SUPPLY SYSTEM VARIATION	17
6.7	EMERGENCY FACILITIES	17
7.	FIXED FURNITURE	18
7.1	GENERAL	18
7.2	LABORATORY BENCHES	18
7.3	FUME CUPBOARDS	19
7.4	SAMPLE TABLES AND SHELVES	20
7.5	SPECIAL EXHAUSTS AND DRAINS	20
8.	CFR ENGINE ROOM	21
9.	COMPRESSED & LIQUIFIED GAS SAMPLES LABORATORY	22
9.1	SAMPLE RECEPTION/COLLECTION	22
9.2	LABORATORY AREAS	22
9.3	STORAGE OF CALIBRATION MATERIALS	23
10.	SAMPLE/REAGENT RECEPTION AND STORAGE	24
10.1	SAMPLE/REAGENT RECEPTION/COLLECTION	24
10.2	SAMPLE STORE	24
11.	FIRE-FIGHTING FACILITIES	25
11.1	GENERAL	25
11.2	FIRE, SMOKE AND GAS DETECTION	25
11.3	FIRE CONTROL MEASURES	25
11.4	FIRE EXTINGUISHERS AND WATER HOSE REELS	25
12.	REFERENCES	26

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of laboratories.

This DEP is a revision of the DEP with the same title and number dated December 1996. A summary of changes since the previous edition is given in (1.4).

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them.

This DEP is intended for use in oil refineries, chemical plants and gas plants.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. Based on the potential impact on design, construction and maintenance costs, the Principal may decide to consult with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

Amended per
Circular 63/08

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

Amended per
Circular 63/08

1.3.2 Specific definitions

Very toxic (substances)

substances that are very hazardous for the environment or human health, as specified in DEP 01.00.01.30-Gen. (which also identifies "toxic" substances by reference to chemical substances databases).

1.4 CHANGES FROM THE PREVIOUS EDITION

The previous edition of this DEP was dated December 1996. Other than editorial changes, the following are the major changes to the previous edition.

Old section	New Section	Change
2	2	Acceptable locations for main laboratories updated to require placement in a non-major hazard area and general revisions. Obsolete codes reference removed.
3	3	Definition of non-major hazard area updated and general revisions.
4	4	Layout and maximum area of a laboratory unit should be determined by formal risk assessments and hazardous area classifications. Provision of ceiling space added and bench spacing updated. Requirements added for fire resistance of building elements. Distance to nearest escape door added and general revisions.
5	5	Requirements added for painting and insulation. Hazards on the use of gas cylinders inside laboratory added. Compressed air quality updated and general revisions.
6	6	Electrical code updated.
7	7	Requirements and codes added for laboratory furniture, fitting and fume cupboard updated. Requirement for gas chromatograph apparatus added.
8	8	Requirement added for mechanical exhaust ventilation for CFR room
9	11	Requirements for fire-fighting facilities updated.
All	All	External standards references updated.
-	9	New section for requirements regarding compressed/liquefied hydrocarbon gas samples.
-	10	New section for sample/reagent reception and storage.

1.5 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the DEP Administrator at standards@shell.com. Shell staff may also post comments on this DEP on the Surface Global Network (SGN) under the Standards folder. The DEP Administrator and DEP Author monitor these folders on a regular basis

2. GENERAL

In general, there are two common types of laboratories in an oil refinery, chemical plant or gas plant:

- A main laboratory (sometimes called a general site laboratory) is a separate building and shall be located in non-major hazard area. This shall be away from any plant containing hydrocarbons or hazardous chemicals, and should preferably be located in the administration area.
- A plant laboratory as part of the control building.

The main laboratory building shall be designed in accordance with DEP 34.17.00.32-Gen.

The plant laboratory shall comply with DEP 34.17.10.30-Gen. and DEP 34.17.00.32-Gen.

For other research or non-refinery laboratories, the requirements for a main laboratory shall apply.

Formal risk assessments and hazardous area classifications are required to enable the selection of appropriate equipment to be used in laboratory areas. This is of particular importance for areas where large volumes of hazardous materials are handled. Samples stores, sample reception and the compressed/liquified hydrocarbon gas samples laboratory (LPG/LNG) should be classified Zone 1.

In laboratories that are continuously occupied by people, indoor temperatures should be maintained between 20 °C and 26 °C and a relative humidity of between 30 % and 70% for human comfort. Laboratory instruments that operate outside these ranges should be placed in a separate enclosure or room.

Heating, ventilating and air conditioning of a main laboratory shall be in accordance with the principles specified in the ASHRAE Publication 4514 and ASHRAE Application Handbook related to laboratory and Engine Test Facilities. For HVAC in non-laboratory space in the building, see DEP 34.17.00.32 Gen

For heating, ventilating and air conditioning of a plant laboratory in a control building, see DEP 31.76.10.10-Gen. Requirements arising from any health, safety and environment risk assessment studies relevant for the laboratory should be considered in the design.

The illumination level in laboratories should be at least 400 lx.

Ambient noise limits within the laboratory shall be in accordance with DEP 31.10.00.31-Gen.

3. LOCATION AND LAYOUT

The laboratory building and any adjacent area reserved for extension shall be located in a non-major hazard area as defined in DEP 34.17.00.32 Gen.

General design drawings including typical cross sections shall be prepared by the Principal, showing laboratory rooms, offices, chemical and glass stores, sample receiving area, bottle wash room, CFR (combustion fuel reference) engine room, air conditioning, machine room, gas cylinder area, instrument/maintenance workshop, pantry, wash/locker room, toilets, cleaners' cupboard, etc. Information pertaining to any additional requirements for specialised laboratory equipment, such as venting, room environmental conditions, utilities etc., should be included.

The CFR engine room, see (8), shall be located so that noise and vibrations are kept outside the laboratory rooms. Separation shall be achieved by means of fire resistant walls and doors. If it is located in a separate building next to the laboratory and if there is a corridor connecting the two buildings then the corridor shall have an air lock.

The laboratory used to handle compressed and liquefied hydrocarbon gas samples should be designed so that vessels containing liquefied gases enter via an external door directly into the dedicated gas handling laboratory and not via other laboratory areas/corridors.

Gas supply bottles shall be located outside the building (5.3.8).

**Amended per
Circular 63/08**

In order to minimize the risk of fire flash-over and to minimize the extent of explosion damage, retained samples, bulk solvents, chemicals and fuels should be stored in a separate building at least 15 m from the laboratory. This store shall be Zone 1 and adequately ventilated near the ceiling and the floor to prevent accumulation of very toxic or flammable vapours. Ventilation and spillage containment facilities shall be provided where chemicals, solvents or fuels are poured.

4. ARCHITECTURAL DESIGN

4.1 WALLS, CEILINGS AND FLOORS

Layout and maximum area of a laboratory unit should be determined by formal risk assessments and hazardous area classifications. NFPA 45 shall apply if specified by local regulations.

All internal walls, ceilings and floors of rooms where flammable products are stored or used shall have a fire resistance of at least one hour. Doors in these walls shall be self-closing and shall have a fire resistance of at least one hour. For the fire resistance requirements of other building elements, see DEP 34.17.00.32 Gen.

Adequate space in the ceiling shall be provided to accommodate utilities piping, cable services, drainage, ventilation ducts and laboratory equipment, including space for future services.

If annular spaces above ceilings are unavoidable (pitched roofs), these spaces shall be ventilated to prevent an accumulation of gases.

If there is a flat concrete roof, the acoustic and fireproof ceiling panels may be glued to the underside of the concrete ceiling. The underside shall be flat to prevent dead corners where light gases could collect.

If a perforated ceiling is required for an evenly distributed supply of air from the air-conditioning system then the ceiling panels shall be chemical resistant finished.

In sample storage areas, ventilation shall be such that gases lighter than air cannot accumulate near the ceiling (i.e., extraction shall take place at the highest point of the room) and gases heavier than air cannot accumulate on the floor (i.e., extraction shall take place at the lowest point of the room). See also the ventilation arrangement in a typical analyser house, Standard Drawing S 17.001.

4.2 DOORS

Each laboratory room containing flammable or explosive products shall have at least two doors located as far as possible from each other and should have one door opening directly to the outside of the building.

Access to the laboratory shall be such that easy transport of samples is possible through a separate entrance. Equipment doors shall be sized so that the largest piece of anticipated equipment can enter the building and the room in which it will be installed.

The distance of travel from within the laboratory to the nearest final exit or exit serving a storey should be no more than 15 m.

The emergency exit door in the plant laboratory in a pressurized control building shall be protected against opening from the outside and shall be self-closing, to prevent loss of over-pressure in the control building. The main entrance door to the laboratory shall open outwards.

4.3 WINDOWS

All internal doors and all internal windows in laboratory rooms shall have transparent Georgian wired glazing with a maximum pane size of 0.25 m² and 1 m², respectively. See also DEP 34.17.00.32-Gen.

The number of outer windows shall be limited for safety and insulation reasons. These windows shall have a maximum pane size of 1 m² in main laboratories and 0.25 m² in plant laboratories. See also DEP 34.17.00.32-Gen. and DEP 34.17.10.30-Gen.

The sills of all windows shall be at least 250 mm above the laboratory benches.

The laboratory windows shall be protected from direct sunlight. This can best be achieved by locating the laboratory in such a way that direct sunlight cannot reach the windows. If

this is not possible, a solar-reflecting film shall be affixed to the glass panes or sun blinds shall be installed.

4.4 LOCATION OF BENCHES

Benches and tables shall be located so that from any point in the laboratory the emergency exits can be reached in two different directions. Therefore, no finger-type benches shall be designed, but only wall-type benches and island-type benches.

Free space between tables and benches should be at least 1500 mm, between bench or table and wall at least 800 mm.

The central corridor in a laboratory room should be at least 2000 mm wide.