MANUAL

AREA CLASSIFICATION
(AMENDMENTS/SUPPLEMENTS TO IP 15)

DEP 80.00.10.10-Gen.

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DESIGN AND ENGINEERING PRACTICE

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
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Shell International Exploration and Production B.V. (SIEP)
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The Hague, The Netherlands,

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They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

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NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and recommends practices for the determination of hazardous areas in facilities handling flammable fluids. It is based on the Institute of Petroleum Model Code of Safe Practice, Part 15, Area Classification Code for Petroleum Installations, 1990 (IP 15). Part III of this DEP amends and supplements specific clauses of IP 15.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of the Royal Dutch/Shell Group or managed by a Group company, and to Contractors nominated by them (i.e. the distribution code is "C" as described in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, gas plants, chemical plants, oil and gas production facilities, and supply/marketing installations.

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 user 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. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

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

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

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 ABBREVIATIONS

ANSI	-	American National Standards Institute
IP 15	-	Institute of Petroleum Model Code of Safe Practice, Part 15, March 1990

1.5 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced in this DEP are listed in (Part IV).

PART II GENERAL CONSIDERATIONS

1. INTRODUCTION

Area classification is the division of a plant or installation into hazardous areas and non-hazardous areas and the sub-division of hazardous areas into zones. This classification is based on the flammability of materials which may be present and the probability of a flammable atmosphere occurring. The classification provides a basis for the selection and protection of electrical equipment appropriate to the defined areas and for the safe positioning of other potential or continuous sources of ignition, e.g. fired heaters, internal combustion engines, etc. It can be used also in the planning and control of hot work.

Area classification refers to normal operating conditions and does not apply to catastrophic situations such as the rupture of a process vessel or large diameter pipework.

2. APPLICABILITY OF IP 15

All new facilities that handle flammable fluids shall be classified in accordance with IP 15, as amended and supplemented by section (3) of this DEP. Variations are allowed, provided that they are formally authorised by the Principal, and only if they achieve a similar level of safety. In areas where national codes are available, or codes other than IP 15 are commonly used (e.g. API RP500B), the codes should be reviewed and supplemented where necessary.

Installations which were operating at the date of issue of this DEP may be evaluated against this DEP, which provides current best practice. Any proposal for modification to an existing installation should be assessed on the basis of whether the benefits from applying the DEP outweigh the implementation costs and risks. If it is intended to reclassify an existing installation on the basis of this DEP, reclassification should cover the whole installation and not just part of it. This is to avoid the application of multiple standards within the same installation.

The area classification of facilities contracted for short duration, such as drilling rigs and mobile units, need not follow this DEP. Such facilities should be subject to a detailed technical safety review prior to use. The review should identify the necessary modifications and the range of permitted operations, so that the same level of protection is achieved as for permanent facilities.

3. ADMINISTRATIVE ASPECTS

Each operating company should have a formal hazardous area classification committee with members drawn from process technology, engineering, operations, and technical safety. Any modification to the hazardous area classification of an existing installation should be subject to a formal change procedure which should include endorsement by the committee; the objective is to ensure a common interpretation of the hazardous area code.

PART III AMENDMENTS AND SUPPLEMENTS TO IP 15

This section provides amendments and supplements to IP 15. Numbering of clauses in this section corresponds to the numbering in IP 15. Clauses of IP 15 which are not amended shall remain applicable as written.

1. INTRODUCTION

1.7.1 Open Area

Add to the existing clause:

Open areas imply free access of the wind to at least two opposite sides. Obstructions such as dense trees, cliffs or other buildings preclude an area being considered "open" unless it can be shown that the wind velocities meet the criteria above within that particular area.

b2. THE TECHNIQUE OF HAZARDOUS AREA CLASSIFICATION

2.1 INTRODUCTION

Add to the existing clause:

As a general rule, the process facilities should be designed such that no area has to be classified as Zone 0 and that the extent of Zone 1 is minimised. Exceptions to this rule include the area around a continuous vent, pits below grade and holding basins.

Maximum emphasis should be placed on maintaining process containment, e.g. by minimising the number of small-bore fittings and ensuring appropriate condition monitoring of those fittings.

2.3.1 Last line, replace "ANSI/ASME B31.1" by "ANSI/ASME B31.3".

2.4

Add to the existing clause:

During plant layout design, it is often desirable to group associated secondary grade sources closely together in such a way that the extent of the resulting Zone 2 area is minimised. An example is to group flanges at fixed locations on a pipe rack. In so doing, it should be realised, however, that significant and multiple overlaps of Zone 2 areas may lead to Zone 1 classification, which is not desirable. The acceptable level of overlapping should be based on the definition of the secondary and primary releases given in 1.5.5.2.

2.10.(f)

Add to the existing clause:

The vertical and horizontal extent of the hazardous area should be taken into account in the sizing of the firewall; enclosing the potential sources of release and ignition may be simpler.

2.10.(g)

Add to the existing clause:

Strict control should be exercised over the quantity of flammable fluids within such locations.

2.12.3 Class II(1) or III(1)

Add to the first paragraph of this clause:

The conditions under which a Class II(1) or III(1) fluid can form a flammable mist are not yet fully understood. Until more is known on this topic and when such fluids are under pressure, it is recommended that potential sources of release such as pump seals, flanges and valves are given a hazardous area classification the same as fluids in Class II(2) and III(2), or as category C fluids when using the individual point source method (see Chapter 5). Where spray guards are applied to these sources, such that any mist will coalesce and return to its non-hazardous liquid form, there is no requirement for a hazardous area.

2.15 THE AREA CLASSIFICATION DRAWING

Add to the existing clause:

The area classification drawings shall be kept up-to-date, to take account of:

- new or modified equipment;
- changes in installation protection;
- experience in operation of the installation;
- changes in method or frequency of operations;
- reclassification as a result of measurements in and around hazardous areas.

4. THE CLASSIFICATION OF DRILLING RIGS AND OTHER EQUIPMENT SYSTEMS USED IN WELL OPERATIONS AND PRODUCTION WELLHEAD AREAS

4.1.2.1 Example of Typical Operational Control of a 'Kick'

Add to the third paragraph of this clause:

However, the design should take into account the potentially severe conditions during a kick, e.g. the risk of failure of the diverter line due to erosion.

4.3 WIRELINING

Add to the existing clause:

The depressurising vent of the lubricator should be considered as a source of primary grade release.

The right hand side of Figure 4.2 suggests that the Zone 2 area extends up to the sheave. The vertical extension of 7.5 m should be measured from the stuffing box.

4.5.3

Add to the existing clause:

The area classification of a ditch or trench handling active mud should be the same as the area classification of the mud tank.

4.5.4

Add to the second paragraph:

The area classification applies whether there is artificial ventilation or not.

4.9.1

Add to the existing clause:

In populated areas, the hazardous area around a wellhead should be fully contained within a security fence extending 30 m from the wellhead, to control access of possible ignition sources. Other considerations may apply in the final distance.

5. ALTERNATIVE PROCEDURE FOR CLASSIFICATION OF AN UPSTREAM OR DOWNSTREAM PETROLEUM SECTOR FACILITY BY CONSIDERATION OF THE INDIVIDUAL POINT SOURCE

5.1.(c)

Add to the existing clause:

Bolted (gasket) flanges are still potential sources of release and should be classified as per 5.10.

5.5 DETERMINATION OF THE EXTENT OF A HAZARD ZONE

5.5.4 The Concept of Fluid Condition or Category

Fluid Category G

Add to the existing clause:

When the gas stream contains appreciable amounts of liquid hydrocarbons, the hazard radii provided in Tables 5.3 through 5.6 may be insufficient. The hazard radius should then be evaluated directly, refer to section 5.5.7 (b).

5.5.7 (b)

Add to the existing clause:

Situations where the recommended hazard radii may be insufficient are highlighted further below in sections 5.6 through 5.14.

When dispersion calculations are used to derive the hazard radius, attention should be paid to the following:

- Releases resulting in hazard radii larger than 30 m fall outside what is normally considered for area classification. Such releases should be designed out.
- The main parameters influencing the extent of the hazard zone are the fluid composition and process conditions, the size of the hole through which the fluid is being released and, in the case of gases, the initial release pressure. Secondary parameters are the distance of the release source from a solid boundary, e.g. a floor or a wall, and the wind velocity.
- The selection of the release hole size is critical in the determination of the release rate. The release hole size for equipment (pumps and compressors), flanges and valves should be determined in consultation with manufacturers and/or mechanical engineering specialists as appropriate.
- For fluid category A, B and C, it should be noted that the amount of pressure drop over the path of the release can have a large effect on the release rate, due to flashing. This happens in particular in vent lines.
- An approved dispersion model should be used, e.g. the FRED suite of programs (MF 95-1519).
- For the complete three-dimensional envelope of a hazardous area, the methodology given in Figures 6.2 and 6.3 applies. Parameters can be interpolated or extended to suit the radii which result from dispersion calculations.

It is possible to specify a hazard radius lower than the radii derived from Tables 5.1 through 5.6, so long as this is fully supported by calculations. This should be, however, on an exception basis, in order to preserve simplicity and consistency of the area classification process.

5.6.2

Add to the existing clause:

When no monitoring of the outer seal integrity is in place, pumps equipped with double seals should be considered as standard pumps.

The use of standard pumps for fluid category A is not recommended, unless an analysis of the potential releases is carried out.

5.7.3

Add to the existing clause:

In the case of fluid category A with 12 mm diameter, and fluid category B with 25 mm diameter, the hazard radii should be confirmed by dispersion calculations.

5.8.1

Add to the existing clause:

For high-pressure compressors (above ANSI class 1500 for reciprocating compressors, and above ANSI class 900 for centrifugal compressors), and in the case of gases lighter than air, an analysis of the potential releases is recommended to confirm whether the 5 m hazard radius is still adequate.

5.9.3

Replace second sentence with:

If discharge velocities are above 150 m/s, the distance to the lower flammability limit should be determined by dispersion calculations.

5.9.4

Add to the note of Table 5.4:

Such calculation is recommended for vent rates in excess of 100m^3/h.

5.9.6

Add to the existing clause:

In the case of fluid category A with 25 mm diameter, the hazard radius should be confirmed by dispersion calculations.

For high-pressure gas systems (above ANSI class 900), the hazard radii should be confirmed by dispersion calculations.

5.10.3

Add to this clause:

Compression joints for instrument tubings should have the same classification as flanges.

Replace note of Table 5.6 with:

1. This table assumes pipework construction to recognised codes and standards, i.e. DEP 31.38.01.11-Gen., DEP 31.38.01.12-Gen., DEP 31.38.01.15-Gen. and DEP 32.37.10.11-Gen.

2. The possibility of the blow-out of part of a gasket (typically between 2 adjacent bolts for flat ring gaskets) has not been considered, which is legitimate when proper installation and maintenance procedures are being followed. If that is not the case, it is stressed that the hazard radii for fluid category A and B in the above table are totally inadequate and that other types of gaskets should be considered (spiral wound or ring type joints).

5.10.4

Replace first sentence of first paragraph with:

Small-bore pipes (i.e. smaller than 40 mm in diameter) are prone to accidental damage and possible release to atmosphere. They should be designed, installed and maintained in accordance with recognised standards (i.e. DEP 31.38.01.11-Gen., DEP 31.38.01.12-Gen., DEP 31.38.01.15-Gen., and DEP 32.37.10.11-Gen.) and good working practice. The full protection from potential impact and physical abuse, either by location or physical protection, is particularly relevant.

6. VARIATION IN VENTILATION CONDITIONS

6.3.4 The Criterion of 'Adequate Ventilation'

Add to the existing clause:

The number of air changes per hour for a given configuration can be estimated from model tests in a wind tunnel or from measurements made on similar facilities. In all cases, evidence that the required number of air changes is achieved without stagnant areas should be obtained through physical measurements carried out after construction.

For sheltered or enclosed areas on existing installations not meeting the criteria of 12 air changes per hour, the effectiveness of the ventilation should be confirmed by calculations, taking into consideration the potential size of the releases and their durations (i.e. time taken to detect and isolate the faulty equipment). The ventilation system should be such as to ensure that:

- The time necessary to remove any flammable mixture is as low as reasonably practicable. Secondary ventilation systems may be considered to achieve this.
- No flammable atmospheres can form from fugitive emissions anywhere within the area under consideration.

NOTE: Fugitive emissions are defined as those small releases which continuously occur from process components during normal operations. They specifically exclude releases which may occur during start-up conditions, maintenance operations, or that may result from component failure or the operation of sample points and vents.

6.5.8 Over-pressure Ventilation (Pressurisation)

Add to the existing clause:

The requirement for 50 Pa over-pressure may be waived if it is demonstrated that the over-pressure in the enclosure is sufficient to ensure a net positive pressure at any point of the enclosure boundary, considering all anticipated combinations of wind velocity and direction.

7. APPLICATION TO THE SELECTION AND LOCATION OF ELECTRICAL FACILITIES

Add to the existing chapter:

The selection of electrical equipment for use in hazardous areas should be in accordance with DEP 33.64.10.10-Gen. In case of conflicting requirements between this chapter 7 and the DEP, the DEP shall prevail.

8. APPLICATION TO THE CONTROL AND LOCATION OF IGNITION SOURCES OTHER THAN ELECTRICAL

8.3

Add to the existing clause:

The location of fixed sources of ignition should be derived during plant layout work. It must be realised that the situation where a fixed source of ignition is located just outside a hazardous area leads to a much higher probability of ignition as compared to electrical equipment located just inside. This is why, in order to keep a consistent level of safety throughout the plant, fixed sources of ignition should be located as far as practicable outside hazardous areas (see 8.6.1).

8.5.2 Ignition Temperature versus Flashpoint

Add to the existing clause:

The presence of liquid droplets in a gas may change the ignition behaviour of the gas, because droplets can make good thermal contact with a hot surface and on ignition will ignite the surrounding gas. Surface temperature should not exceed the ignition temperature of the liquid droplets in the gas.

8.7.1

Replace last paragraph with:

Within these general considerations the choice essentially is between diesel engine, gas engine and gas turbine drives, to stipulated levels of protection as detailed in the following sections. The requirements for gas engines are similar to diesel engines, except for the fuel and ignition systems.

8.7.2

Add to the existing clause:

Diesel and gas engines for use in hazardous areas should be in accordance with DEP 31.29.80.30-Gen. and DEP 31.29.90.30-Gen., respectively. In case of conflicting requirements, the DEPs shall prevail.

8.7.2 (b) (vi)

Delete the words "such as Halon".

8.7.6.2 (b)

Add to the existing clause:

When the fuel gas flange connection is located inside the turbine room, preventive maintenance and regular gas checks of the connection should be included in the maintenance and operating procedures.

8.8.2 (e)

Replace the word "Halon" by "a suitable inert gas".

PART IV REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/ supplements/revisions thereto.

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Diesel fuelled compression ignition engines	DEP 31.29.80.30-Gen.
Spark ignited gas fuelled engines	DEP 31.29.90.30-Gen.
Piping - General requirements	DEP 31.38.01.11-Gen.
MF Piping classes	DEP 31.38.01.12-Gen.
EP Piping classes	DEP 31.38.01.15-Gen.
Instrument impulse lines	DEP 32.37.10.11-Gen.
Electrical Engineering guidelines	DEP 33.64.10.10-Gen.
FRED	MF 95-1519

INTERNATIONAL STANDARDS

The Institute of Petroleum Model Code of Safe Practice, Part 15, Area classification code for petroleum installations	IP 15 (March 1990)

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United Kingdom.

AMERICAN STANDARDS

Classification of areas for electrical installations at drilling rigs and production facilities on land and on marine fixed and mobile platforms	API RP500B

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