



International  
Association  
of Oil & Gas  
Producers

# Surveying & Positioning Guidance note 3

## Contract area description

### Revision history

Version	Date	Amendments
4	April 2006	References to EPSG updated
3	April 2002	Revised to conform to ISO19111 terminology
2	November 1997	
1	November 1995	First issued

## 1 Introduction

These guidelines are intended to be useful to three specific groups:

- 1 Exploration managers and lawyers in hydrocarbon exploration companies who negotiate for licence acreage but who may have limited geodetic awareness.
- 2 Informed users such as OGP Surveying & Positioning members in hydrocarbon exploration companies, for whom the guidelines may serve as a useful summary of accepted practice.
- 3 Licensing Authorities

The guidelines do not attempt to cover every aspect of licence boundary definition. In the interests of producing a concise document that may be as easily understood by the layman as the specialist, definitions which are adequate for 80% of licences have been covered. Complex licence boundaries need specialist advice, both from the survey and the legal professions, and are beyond the scope of this guideline.

## 2 Contract area definition – recommended practice for new licences

Contract Areas and Licence Block Boundaries have often been inadequately described both by the licensing authorities and by licence operators. This has caused problems between operators and between licence authorities and operators both at the acquisition and the development phases of projects. These guidelines set out a procedure for describing boundaries which, if followed for new contract areas world-wide, will alleviate the problem. The guidelines are intended to apply to both onshore and offshore areas.

Contract Areas and Licence Block Boundaries normally have a narrative description as well as a set of defined coordinated points. A statement of the area of the licence should be included.

## 3 Defining the Coordinate Reference System

Coordinates – including geographical coordinates – are ambiguous unless qualified by the relevant Coordinate Reference System identification. Coordinate Reference System descriptions should follow OGP Surveying & Position Committee (S&P) guidelines, which are consistent with the POSC data model. This guidance note summarises the necessary set of Coordinate Reference System descriptors to be defined. For a full description, refer to S&P guidance note number 5.

For all contract areas a description of the Horizontal Coordinate Reference System is essential. If both geographic and projected coordinates are given there is potential for inconsistency and the defining set should be stated.

Although not usually required for licence definition it is recommended that the Vertical Coordinate Reference System to be used for operations is always stated:

Entity	Descriptor	Example
Vertical CRS:	Name	Newlyn

In all cases the unit descriptors, both angular and linear, must be fully described, with the conversion factor to SI units included in the defining parameters if standard SI units (metre) are not used.

### Geographic Coordinate Reference System descriptors

The following are required for coordinates given by latitude and longitude:

Entity	Descriptor	Example
Geographic CRS:	Name	ED50
Geodetic datum:	Name	European Datum 1950
Ellipsoid:	Name	International 1924
	Semi major axis (a)	6378388.000 m
	Inverse flattening (1/f)	1/297.00000

### Projected Coordinate Reference System descriptors

Where boundaries are described on a particular map projection, the projection parameters must be included to adequately describe the projection system. The following are required for licence boundary description given by grid coordinates:

Entity	Descriptor	Example
Projected CRS:	Name	ED50 / UTM zone 31N
Geodetic datum:	Name	European Datum 1950
Ellipsoid:	Name	International 1924
	Semi major axis (a)	6378388.000 m
	Inverse flattening (1/f)	1/297.00000
Map projection:	Name	UTM zone 31N
Method:	Name of projection method	Transverse Mercator
Projection parameters:	A list of parameters and parameter values specific to the projection method, e.g. for Transverse Mercator:	
	Latitude of Natural Origin	0 degrees North
	Longitude of Natural Origin	3 degrees East of Greenwich
	Scale Factor at Origin	0.9996
	False Easting	500,000.0 m
	False Northing	0.0 m

For all other cases, all parameters needed to fully describe the projection are required.

## 4 Describing the boundary lines

The boundary may be described as a series of coordinated turning points using either geographical (latitude & longitude) or grid (easting & northing) coordinates. The outline should be described as follows for such areas:

Point	Latitude	Longitude	Line from - to	Line Type
A	50° 10 '00.0" N	10° 12 '00.0" E		
			A - B	Parallel
B	50° 10 '00.0" N	10° 24 '00.0" E		
			B - C	Meridian
C	50° 00 '00.0" N	10° 24 '00.0" E		
			continue until...	
N	50° 05 '30.0" N	10° 17 '00.0" E		
			N - A	Geodesic
A	50° 10 '00.0" N	10° 12 '00.0" E		

Note that to close the polygon the start point A should be repeated as the last point.

Line Type may be:

Line Type	Property	Turning Point Defined by
Parallel	Line of equal latitude	Geographical coordinates
Meridian	Line of equal longitude	Geographical coordinates
Geodesic	Straight line on the Earth	Geographical coordinates
Grid	Straight line on map	Grid coordinates

There are special cases of line definitions where the legal boundary definition is on a Coordinate Reference System different from that to be used for licence operations. In such cases it is not adequate to merely describe the turning points. It may be necessary to describe the boundary as a series of digitised or computed turning points on the licence Projected Coordinate Reference System and at a defined scale and point separation along the line.

## 5 Alternative boundary definitions:

The simple case above is for a licence described as a set of defined turning points. More complex definitions include:

Boundary	Descriptors	Example
Existing legal boundary		International Median Line
	Statutory defining instrument	International agreement details
	Date	day/month/year
Physical feature	Name	Coastline
	Definition of boundary	Low water mark
	Defining instrument	Map, scale, date, publisher

**Enclaves:** An enclave is an area excluded from the licence area which lies wholly within the licence boundary. This can be addressed by defining the excluded boundary in the same way as the licence boundary, with a descriptor excluding the enclave from the licence area.

**Line extensions:** These are boundaries described by the projection of a defined line from a given end point until it intersects with another feature, *eg* a coastline or median line. A variation is to describe the extension as being from a given point in a defined direction (for which the distinction between true and map grid direction will generally be significant). The method of calculation of the computed coordinates of the intersection point should be agreed with the licensing authority and any abutting licence holders.

An irregular boundary such as a coastline will normally be held for database purposes as a series of coordinated points digitised from the defining instrument – *eg* a topographic map – at a suitable interval to accurately describe the boundary as a set of straight lines joining these points.

Note that certain boundaries change with time. These may be physical features such as rivers, coastline or disputed International boundaries. For these boundaries it is essential that the defining instrument descriptor carries a date stamp.

For physical features such as rivers it is preferable, where legally possible, to describe the boundary as a set of coordinated points defining the boundary on the defining instrument, and then agree with the licensing authority and abutting licencees that these co-ordinates now take precedence over the physical feature, thereby making the definition independent of the feature.

For International Median Lines which are disputed or have never been legally defined, the licensee accepts the licence at his own risk. In these cases it is prudent to define a safe zone within the licence which is the undisputed area within the jurisdiction of the licensing authority.

## **6 Choice of Coordinate Reference System:**

For new licence areas offshore where the licensing authority has not defined the Geographic Coordinate Reference System, the International Terrestrial Reference Frame (ITRF) should be adopted. ITRF is realised by global or national coordinate reference systems such as WGS84 and ETRS89. Boundaries should be described by turning points defined by geographical coordinates (latitude & longitude).

For new licence areas onshore where the licensing authority has not adequately defined the Coordinate Reference System, the National Geodetic system should be adopted, as described by the latest adjustment of the national control network.

The definition of the datum transformation(s) between onshore and offshore Coordinate Reference Systems defining licence areas, and between any defined geodetic datum and WGS84 or other realisation of the ITRF should be agreed between operators and the licensing authority and between operators of abutting licences. The definition of the datum transformation(s) should be published and adopted for use by all operators.

Note that an operator may use other datum transformations for specific Company purposes – e.g. for pipeline landfall work – but for the purposes of all data publication and exchange the agreed transformations shall be used.

## **7 Computation of licence area:**

Licence areas may be calculated in the following ways:

- a) Grid area from grid coordinates of boundary turning points
- b) Ellipsoidal (“true”) surface area from geographic coordinates of boundary turning points

Depending upon the choice of map projection the two may differ, possibly by several percent.

It has been common practice to use the grid area for two reasons:

- a) Areas were often derived from a map using a planimeter.
- b) Calculation using grid coordinates is easy.

The grid area is unsuitable as a computation of licence area because it depends on the choice of projection, and is therefore variable, and because the scale factor inherent in any projection may make a significant difference between the grid and the ellipsoidal areas. Most GIS applications offering area calculations are grid area calculations. Computers have made ellipsoidal area calculations easy and fast and there is now no good reason not to use ellipsoidal area.

The ellipsoidal surface area computation is the best choice, because the licence areas then conform to the modelled ellipsoidal surface. The surface topography of a licence area is irrelevant for oil and gas licence demarcation, because the production horizon is subsurface. The very small decrease in licence area because of the depth of the production horizon below the ellipsoid should be ignored for licence area computation.

An accuracy tolerance should be included in any area calculation to avoid disputes caused by different computation algorithms or use of different projection methods. A tolerance of 0.1km<sup>2</sup>. will normally be adequate for taxation and demarcation purposes, and will ensure that areas calculated will be in agreement within the tolerance.

## 8 Contract area definition – recommended practice for existing licences

This section describes procedures for working practice in areas for which licences have been issued but for which the descriptions are incomplete. The licensee should take steps to clarify the boundaries of the licence before starting operations, which will require negotiations with the abutting licensees and also with the Licensing Authority.

### 8.1 Inadequate definition by licensing authority:

Where the Concession Area definition issued by a Licensing Authority is incompletely described, which may be because the horizontal Coordinate Reference System has not been quoted or the line type is unspecified between turning points, operators acquiring licences should adopt the following procedure:

- Request clarification from the licensing authority.
- Discuss with all abutting licence holders.
- Agree with licensing authority and abutting licence holders the de facto definition to be adopted to adequately define the boundaries.
- Ensure that any new abutting licensee is advised of the agreement and adopts the same de facto definition.

Where no statement is included in existing licence definitions, then the grid coordinates will normally rule for licences where the boundary is described as a set of grid lines, and the geographic coordinates will normally rule for licences where the boundary is described as a set of geodesic lines or meridians and parallels. Also in general onshore licence boundaries will be defined using grid coordinates and offshore licence boundaries will normally be defined in geographic coordinates.

### 8.2 Disagreements between abutting licensees

Where abutting licensees have already adopted different definitions for their licences - e.g. where a new licence abuts previously discrete licence areas - it may be necessary to have different Coordinate Reference Systems defining the various boundaries. Wherever possible the abutting licensees should agree to redefine their boundary descriptors to be consistent.

## 9 Examples

Note: All examples are theoretical, to illustrate the guidelines:

### Example 1: Simple case, offshore North Sea licence

The licence area (shown for illustrative purposes on the attached map) is bounded by:

Point	Latitude	Longitude	Line from - to	Line Type
A	54° 00' 00.0" N	2° 00' 00.0" E		
			A - B	Meridian
B	54° 30' 00.0" N	2° 00' 00.0" E		
			B - C	Parallel
C	54° 30' 00.0" N	2° 30' 00.0" E		
			C - D	Meridian
D	54° 00' 00.0" N	2° 30' 00.0" E		
			D - A	Parallel
A	54° 00' 00.0" N	2° 00' 00.0" E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0

On this reference system the area of the licence calculated in ellipsoidal terms is 1814.0 sq. km to 0.1 km<sup>2</sup>.<sup>1</sup>

<sup>1</sup> Note: the equivalent grid area calculated to 0.1 sq. km. on the ED50 / UTM zone 31 projected coordinate reference system would be 1812.6km<sup>2</sup>.

### Example 2: Simple case, onshore UK Licence

The licence area (shown for illustrative purposes on the attached map) is bounded by:

Point	Latitude	Longitude	Line from - to	Line Type
A	572000.00	236500.00		
			A - B	Grid
B	572000.00	292600.00		
			B - C	Grid
C	604000.00	292600.00		
			C - D	Grid
D	604000.00	236500.00		
			D - A	Grid
A	572000.00	236500.00		

Coordinates are referenced to the following system:

Coordinate Reference System name:	OSGB 1936 / British National Grid
Geodetic datum name:	OSGB 1936
Ellipsoid name:	Airy 1830
Ellipsoid semi major axis (a):	6377563.396 m
Ellipsoid inverse flattening (1/f):	299.3249646
Map projection:	British National Grid
Method:	Transverse Mercator
Latitude of Natural Origin	49 degrees North
Longitude of Natural Origin	2 degrees West of Greenwich
Scale Factor at Origin	0.999601272
False Easting	400,000.0 m
False Northing	-100,000.0 m

On this reference system the area of the licence calculated in map grid terms is 1795.2 km<sup>2</sup> to 0.1 km<sup>2</sup>.

During licence operations elevations should be given in metres referenced to the Newlyn vertical coordinate reference system.

### Example 3: A more complex case

Description:

The licence area boundary starts at point A situated on the mean low water line and defined by geographical coordinates on ED50 datum as below. The boundary then follows a geodesic line eastwards to cut the International Median Line between the United Kingdom and France at point B (51° 05.1' N, 1° 45.6' E, ED50). The boundary then follows the median line generally southwestwards to point C at longitude 1° 20' E (ED50) and then proceeds northwards to point D where it intersects the UK coastline at the low water mark. The boundary then follows the coastline defined by the mean low water line eastwards to close back on point A.

The licence area (shown for illustrative purposes on the attached map) is bounded by:

Point	Latitude	Longitude	Line from - to	Line Type
A	51° 05' 07.2" N	1° 35' 00.0" E		
			A - B	Geodesic
B	51° 05' 06.0" N	1° 45' 36.0" E		
			B - C	International boundary as defined in $\alpha$ published by $\beta$ on $\chi$ .
C	54° 30' 00.0" N	1° 20' 00.0" E		
			C - D	Meridian
D	50° 58' 45.6" N	1° 20' 00.0" E		
			D - A	Mean low water line as defined on map series $\alpha$ sheet no. $\beta$ at 1: $\chi$ scale, published by $\delta$ on $\epsilon$ .
A	51° 05' 07.2" N	2° 00' 00.0" E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0

On this reference system the area of the licence calculated in ellipsoidal terms is  $\alpha$  km<sup>2</sup> to 0.1 km<sup>2</sup>.

#### Example 4: Enclave

The licence area (shown for illustrative purposes on the attached map) is bounded by:

Point	Latitude	Longitude	Line from - to	Line Type
A	54° 00' 00.0" N	2° 00' 00.0" E		
			A - B	Meridian
B	54° 30' 00.0" N	2° 00' 00.0" E		
			B - C	Parallel
C	54° 30' 00.0" N	2° 30' 00.0" E		
			C - D	Meridian
D	54° 00' 00.0" N	2° 30' 00.0" E		
			D - A	Parallel
A	54° 00' 00.0" N	2° 00' 00.0" E		

Excluding the following enclave, which does not form part of the licence area:

Point	Latitude	Longitude	Line from - to	Line Type
E	54° 14' 00.0" N	2° 14' 00.0" E		
			A - B	Meridian
F	54° 16' 00.0" N	2° 14' 00.0" E		
			B - C	Parallel
G	54° 16' 00.0" N	2° 16' 00.0" E		
			C - D	Meridian
H	54° 14' 00.0" N	2° 16' 00.0" E		
			D - A	Parallel
E	54° 14' 00.0" N	2° 14' 00.0" E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0

On this reference system the area of the licence calculated in ellipsoidal terms is 1805.9 km<sup>2</sup> to 0.1 km<sup>2</sup>.



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