



IADC Well Classification System for Underbalanced Operations and Managed Pressure Drilling

The purpose of the IADC Well Classification System is to describe the overall risk, application category and fluid system used in underbalanced operations (UBO) and managed pressure drilling (MPD). Wells are classified according to:

- **Risk Level** (0 to 5)
- **Application Category** (A, B or C)
- **Fluid System** (1 to 5).

This classification system provides a framework for defining minimum equipment requirements, specialized procedures, and safety management practices. For further information refer to the IADC UBO HSE Planning Guidelines and other related documents.

Risk Levels

Generally, risk increases with operational complexity and potential well productivity. The examples provided are for guidance only.

Level 0 – Performance enhancement only; no hydrocarbon containing zones.

- Air drilling for ROP enhancement

Level 1 – Well incapable of natural flow to surface. Well is inherently stable and is a low level risk from a well control point of view.

- Sub-normally pressured oil wells

Level 2 – Well is capable of natural flow to surface, but can be controlled using conventional well kill methods. Catastrophic equipment failure may have limited consequences.

- Abnormally-pressured water zones
- Low flow rate oil or gas wells
- Depleted gas wells

Level 3 – Geothermal and non-hydrocarbon bearing formations. Maximum anticipated shut-in pressure (MASP) is less than UBO/MPD equipment pressure rating.

- Includes geothermal wells with H₂S present

Level 4 – Hydrocarbon bearing formation. Maximum anticipated shut-in pressure is less than UBO/MPD equipment operating pressure rating. Catastrophic equipment failure will likely have immediate serious consequences.

- High pressure and/or high flow potential reservoir
- Sour oil and gas wells
- Offshore environments
- Simultaneous drilling and production operations

Level 5 – Maximum anticipated surface pressure exceeds UBO/MPD equipment operating pressure rating. Catastrophic equipment failure will likely have immediate serious consequences.

- Any well where MASP is greater than UBO/MPD equipment pressure rating

Application Category

Category A – Managed Pressure Drilling (MPD) – Drilling with returns to surface using an equivalent mud weight that is maintained at or above the open-hole pore pressure.

Category B – Underbalanced Operations (UBO) – Performing operations with returns to surface using an equivalent mud weight that is maintained below the open-hole pore pressure.

Category C – Mud Cap Drilling – Drilling with a variable length annular fluid column which is maintained above a formation that is taking injected fluid and drilled cuttings without returns to surface.

Fluid Systems

1. **Gas** – gas as the fluid medium. No liquid intentionally added.
2. **Mist** – fluid medium with liquid entrained in a continuous gaseous phase. Typical mist systems have less than 2.5% liquid content.
3. **Foam** – two-phase fluid medium with a continuous liquid phase generated from the addition of liquid, surfactant, and gas. Typical foams range from 55% to 97.5% gas.
4. **Gasified Liquid** – fluid medium with a gas entrained in a liquid phase.
5. **Liquid** – fluid medium with a single liquid phase.

Example:

A well is being drilled from 10,000 feet to 12,000 feet utilizing managed pressure drilling techniques. The pore pressure of the formation is 14.5 ppg and the fracture gradient is 16.5 ppg. The design is predicated on using a 13.0 ppg fluid and maintaining a balanced system with surface pressure. The rotating control device (RCD) and emergency shutdown (ESD) systems are rated at 5000 psi.

From the above information:

MASP is the lesser of BHP minus gas to surface *or* frac at shoe minus gas to surface.

$$\text{MASP}_{\text{BHP}} = 12000 \times 0.052 \times (14.5 - 2) = 7800 \text{ psi}$$

$$\text{MASP}_{\text{frc}} = 10000 \times 0.052 \times (16.5 - 2) = 7540 \text{ psi}$$

As the maximum anticipated surface pressure exceeds the UBO/MPD equipment rating, the classification for the well would be:

Level 5, Category A, Fluid System 5 or 5A5.

Adopted by the IADC Board of Directors, 9 March 2005.