Kill Methods for ERA Duration Calculation

This page contains a description of the various kill methods applied in a blowout situation, the expected probabilities for each of these kill methods to be successful, and the expected duration to stop the blowout.

Overview

Blowout Duration is used for estimation of oil pollution on sea and is based on the expected time it takes to stop an uncontrolled blowout by use of different kill methods.

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Kill Methods

The descriptions and input parameters for the different kill methods are based on:

Topside Intervention

Crew intervention topside.

A Weibull distribution has been adapted to model this parameter.

Weibull parameter alpha: 0.8

Weibull parameter beta: 2.3

Scaling parameter A: 0.63

Numbers found in “2024 version of Blowout and well release frequencies based on SINTEF Offshore Blowout Database 2023” by Vysus.

Subsea Intervention

Crew intervention subsea (e.g. capping, but relief well drilling or use of capping stack are not included in this category)

A Weibull distribution has been adapted to model this parameter. Weibull parameter alpha: 0.85 Weibull parameter beta: 6 Scaling parameter A: 0.62

Numbers found in “2024 version of Blowout and well release frequencies based on SINTEF Offshore Blowout Database 2023” by Vysus.

Bridging

The wells kills itself by the formation cave in and block the wellbore, thereby killing the blowout.

A Weibull distribution has been adapted to model this parameter. Weibull parameter alpha: 0.7 Weibull parameter beta: 6 Scaling parameter A: 0.45

Numbers found in "2024 version of Blowout and well release frequencies based on SINTEF Offshore Blowout Database 2023" by Vysus.

Coning

Coning is primarily the result of movement of reservoir fluids in the direction of least resistance, balanced by a tendency of the fluids to maintain gravity equilibrium. The analysis may be made with respect to either gas or water.

Applicable for production wells.

Unless the field/reservoir geologist or similar has recommended coning as an effect to consider, probability should be Fixed to zero.

Capping Stack Offset

Decision:
Time lost before mobilization is started

Probability: 100 % Duration: Well specific input. Could be given as a triangular distribution with min/mean/max numbers or as a deterministic number.

Example 1: T(0.5, 1, 2) Example 2: D(1) T: Triangle distribution D: Deterministic number

Mobilization:

Equipment and resource Fixed-up, fabrication of parts, parts and personnel transportation, ready for deployment from shore

Probability: 100 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers

Example: T(8, 10, 14)

T: Triangle distribution

Deployment:
Time to deploy equipment to site and get ready for operation

Probability: 100 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers

Example: T(1,2,3)

T: Triangle distribution

Prepare offset installation system:
Plan subsea layout, establish wet storage area (mooring corridors, dead man anchors etc.), typically 15 runs. Restrict to additional time beyond mobilization and deployment. Sensitive to weather conditions (when going through splash zone).

Probability: 100 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers

Example: T(2,3,4)

T: Triangle distribution

Stack installation:
Transit carrier with capping stack to WH/BOP and install stack on the blowing well 7a: Transit stack to WH/BOP 7b: Connect 7c: Shut in well

Probability: 100 % Duration: Well specific input. Could be given as a triangular distribution with min/mean/max numbers or as a deterministic number.

Example: a) T(1,1.13,1.5) b) T(0.33,0.5,1) c) D(0.33)

T: Triangle distribution D: Deterministic number

Operational delays:
Delays throughout operation, not covered by above factors, e.g. related to mobilization, weather, vessel availability and ROV failure, operational failures (communication, sim ops). Typical seasonal occurrence probabilities adjustable for local conditions: summer/winter

Recommended probability: Summer: 2 % Winter: 15 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers

Example: T(2,5,20)

T: Triangle distribution

Capping Stack Vertical

Decision:
Time lost before mobilization is started.

Probability: 100 % Duration: Well specific input. Could be given as a triangular distribution with min/mean/max numbers or as a deterministic number.

Example 1: T(0.5, 1, 2) Example 2: D(1)

T: Triangle distribution D: Deterministic number

Mobilization:
Equipment and resource Fixed-up, parts and personnel transportation, ready for deployment from shore.

Probability: 100 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(8, 10, 14)

T: Triangle distribution

Deployment:
Time to deploy equipment to site and get ready for operation (typically, 1-3 days for the NCS).

Probability: 100 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(1,2,3)

T: Triangle distribution

Additional time for debris clearance:
Additional time necessary for debris (pipe, items from the rig etc.) clearance beyond the time of decision, mobilization and deployment (LMRP disconnect successful).

Recommended probability: 2% Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(2,3,4)

T: Triangle distribution

Stack Installation:
Lower stack to WH/BOP (sensitive weather conditions (through splash zone)). Compare with run BOP data (wow) 5a. Run stack from vessel to wellhead 5b. Connect 5c. Shut in well

Probability: 100 % Duration: Well specific input. Could be given as a triangular distribution with min/mean/max numbers or as a deterministic number.

Example: a) T(1,1.13,1.5) b) T(0.33,0.5,1) c) D(0.33)

T: Triangle distribution D: Deterministic number

Operational Delays:
Delays throughout operation, not covered by above factors, e.g. related to mobilization, weather, vessel availability and ROV failure, operational failures (communication, sim ops). Typical seasonal occurrence probabilities adjustable for local conditions: summer/winter

Recommended probability: Summer: 1 % Winter: 10 % Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(2,5,20)

T: Triangle distribution

Relief Well

Probability:
The probability that a relief well is being planned and executed, is 100 %.

Decision:
Time lost before mobilization is started.

Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example 1: T(0.5, 1, 2) Example 2: D(1)

T: Triangle distribution D: Deterministic number

Mobilization:
Equipment and resource Fixed-up, parts and personnel transportation, ready for deployment from shore.

Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers

Example: T(2,3,6)

T: Triangle distribution

Move Rig:
Rig transportation.

Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(4,7,8)

T: Triangle distribution

Drilling:
Time to drill to the relief well intersection point.

Duration: Well specific input. Should be given as a triangular distribution with min/mean/max numbers.

Example: T(20,30,40)

T: Triangle distribution

Steer/Control:
Geomagnetic steering into the blowing well.

Duration: Recommended numbers from GL 0498.

Use maximum time 20 days for vertical wells and 30 days for horizontal wells.

T(7,12,20/30)

T: Triangle distribution

Dynamic kill:

Time spent killing the well.

Duration: Recommended numbers from GL 0498.

Example: T(1,2,5)

T: Triangle distribution