

Petroleum Development Oman

Process Safety Improvements in PDO

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What is a Process Safety event?

Severity	CONSEQUENCES				INCREASING LIKELIHOOD				
	People	Assets	Environment	Reputation	A	B	C	D	E
					Never heard of in the Industry	Heard of in the Industry	Has happened in the Organisation or more than once per year in the Industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No impact					
1	Slight injury or health effect	Slight damage	Slight effect	Slight impact					
2	Minor injury or health effect	Minor damage	Minor effect	Minor impact					
3	Major injury or health effect	Moderate damage	Moderate effect	Moderate impact					
4	PTD or up to 3 fatalities	Major damage	Major effect	Major impact					
5	More than 3 fatalities	Massive damage	Massive effect	Massive impact					



Process Safety in PDO - Context

- Natih flowline incident
- Birba H₂S incident
- CPP fire
- Barik flowline incident
- Nahada / MAF spill
- BVS6 spill
- Mabrook 1 well incident
- SR-84 gas well incident

Some recent
HP incidents in
PDO



- Fuel leak from SBM 3
- Gas leak from redundant gas-lift line
- Anzouz-Sahma 8" export line rupture
- Oil spill at Tank Farm
- K-5322 Fire incident
- Crude oil carry over to Al Ghubar flare
- SRDC K-5440 insulating gasket failure
- Burns injuries NRPS
- Leak from surge tank T-501, Fahud B
- High TVP in MOL
- BVS1 spill

Process Safety
incidents this
year



The External View of Process Safety in PDO

Lloyd's Register Report Key Messages

Lloyd's opinion: Process Safety Risk in PDO is unacceptable

In support of their risk assessment on PDO, Lloyd's have formulated the following 6 key findings:

1. PDO leadership has not effectively established process safety as core value
2. Compliance with systems, standards and procedures is not enforced
3. Declining competence profile, increasing risk profile
4. Barriers prevent open communication with and engagement of staff
5. Accurate process safety knowledge not developed, maintained and applied
6. Failure to learn from own experience

Lloyd's provided 69 pieces of evidence in support of the above findings

Lloyd's commended PDO on being proactive and supported all the already ongoing AI-PSM improvement activities



Asset Integrity - Process Safety Management in PDO

We construct and maintain the hardware barriers

We design so that risks are As Low As Reasonably Practicable

Technical Integrity

Design Integrity

People & Systems

Operating Integrity

We always consider the potential risks from hazards whilst operating our facilities within defined limits and with up to date procedures and effective communications

We have competent people, with the right behaviours working with fit for purpose systems



AI-PSM - the Building Blocks

- Implementing TR-MIE
- Hardware Barrier Verification
- Ex Equipment
- Static Equipment Integrity Management

- Demonstrate ALARP (retro HAZOP, IPF, FERM and OBRA)
- AI-PSM in new projects
- Design and Engineering Manuals (DEM 1/2)

Technical Integrity

Design Integrity

People & Systems

Operating Integrity

- Permit To Work
- Alarm Management
- Live Operating Envelopes

- Leadership and commitment
- Organisation, roles and responsibilities
- Standards and procedures
- Discipline Control and Assurance Framework
- Critical Drawings
- Asset Register
- Operationalise HSE cases
- AI-PSM competence development
- AI-PSM KPIs
- Assurance



PDO Equipment Dimensions

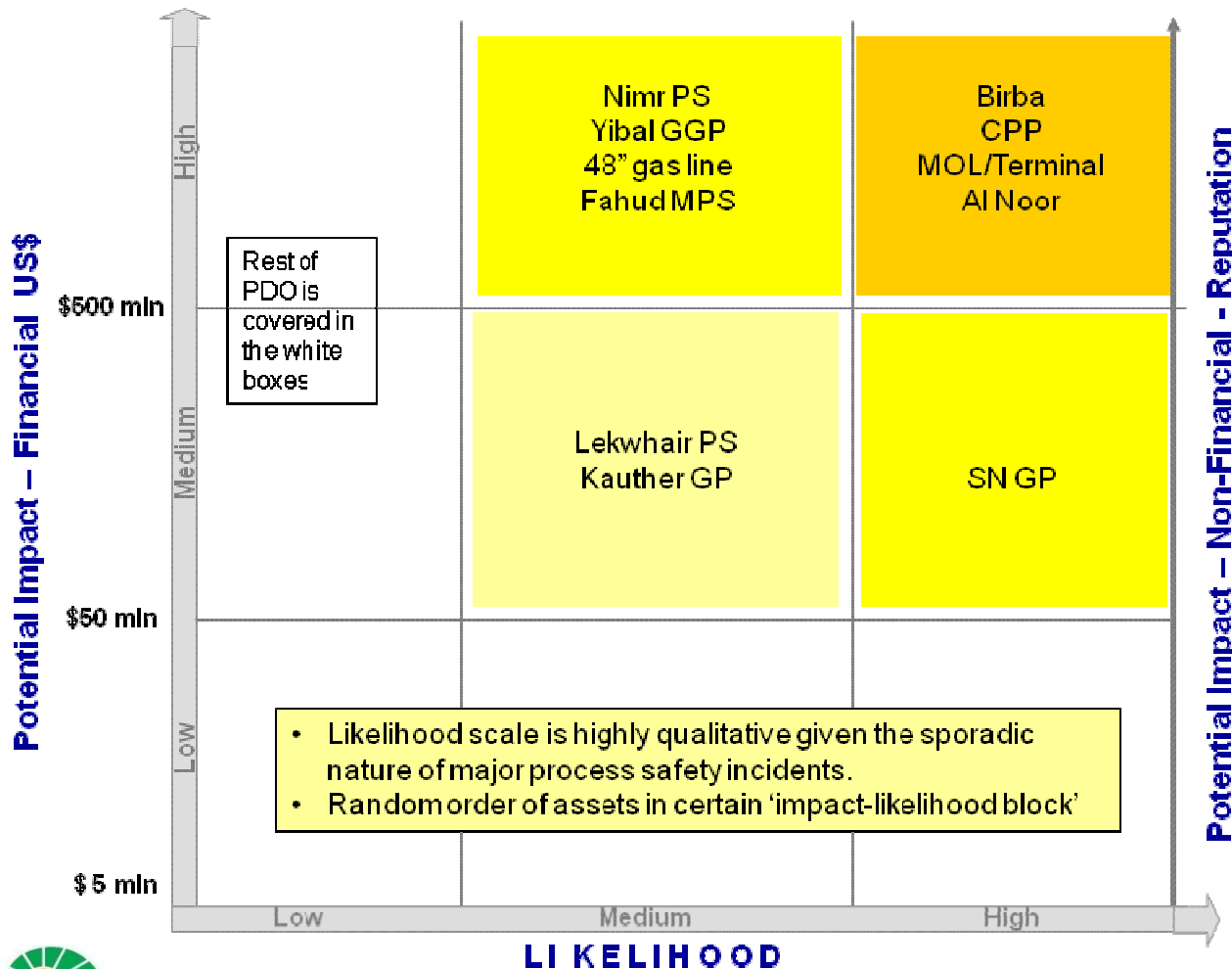
Asset	OND	OSD	GGO	Total
Wells (number) – total wells	2607	2996	233	5836
Pipelines (km)	2400	1238	1369	5007 km*
Flowlines (km)	8500	4500	527	13527 km**
On-plot Piping (number)	12584	8498	5613	26995
Production Stations (number)	29	22	5	56
Pumps (number)	1722	1509	611	3858
Compressors (number)	480	184	77	741
Tanks (number)	142	131	109	382
Vessels (number)	1778	1316	390	3484
Heat Exchangers (number)	554	1955	744	3253
Relief Valves (number)	1889	1641	804	4334
Control system (number)	15	14	3	32
Safeguarding systems (number)	14	15	28	57
Beam Pumps		1525		

* Muscat to Berlin (Germany)

**Muscat to Los Angeles (USA) going west
Around 50% of all equipment is safety critical



AI-PSM Risk Segmentation



Kicked off in Q4 2008

Critical Assets:

1. Birba
2. Al Noor
3. CPP
4. Main Oil Line

Pathfinder Assets:

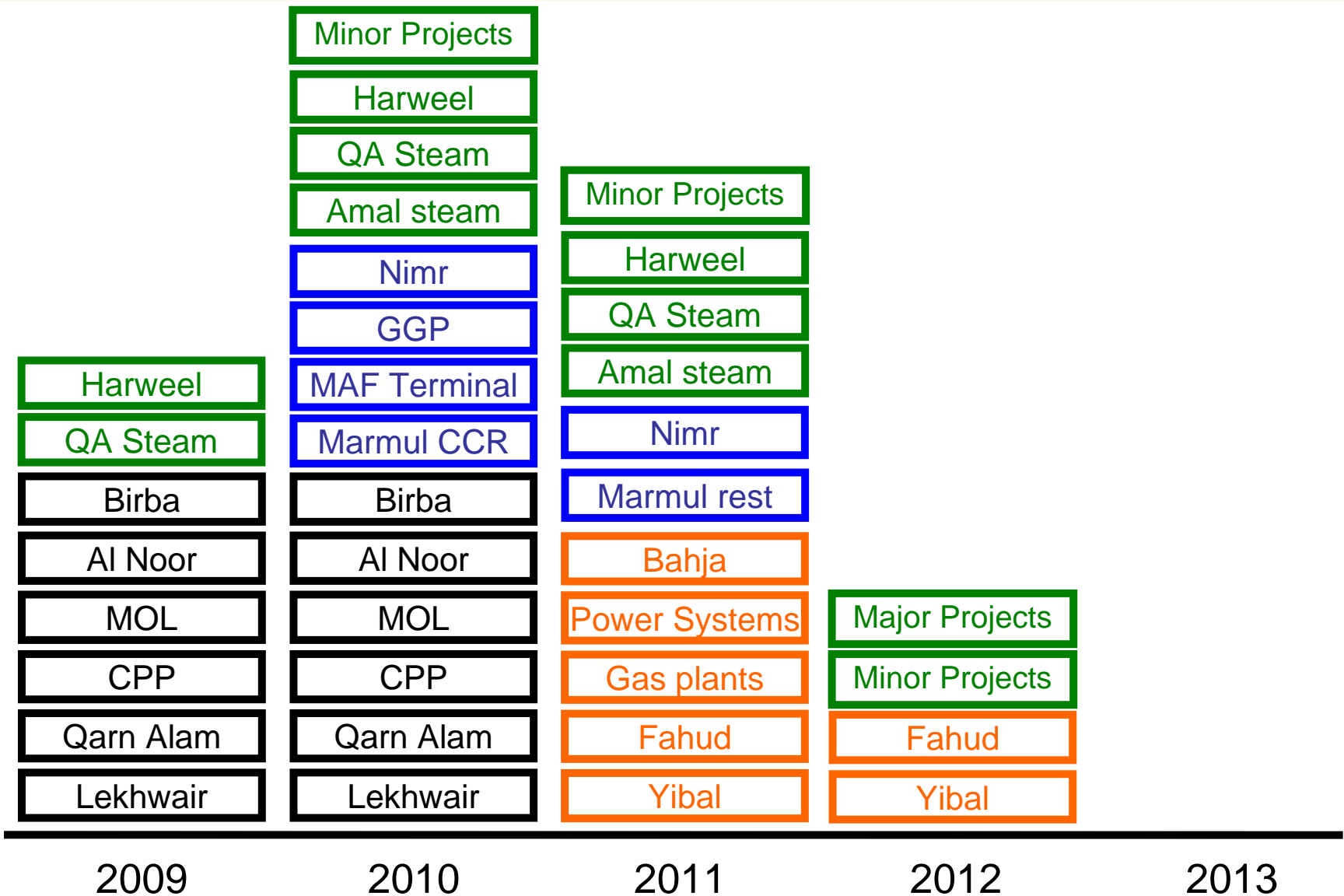
1. Qarn Alam
2. Lekhwair

Added in 2010:

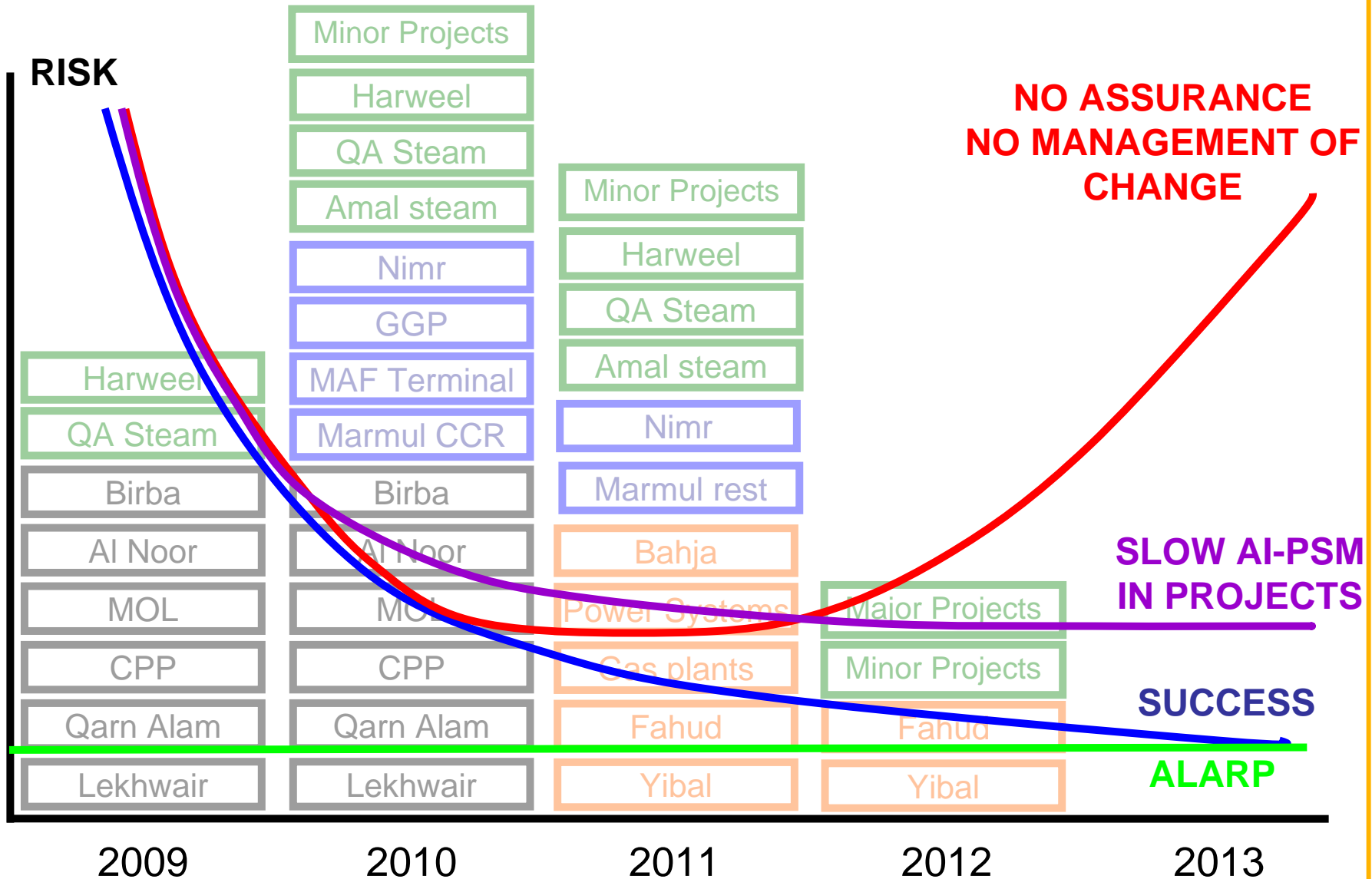
1. Nimr
2. Yibal GGP
3. Terminal
4. Marmul CCR



AI-PSM longer term asset / project coverage



AI-PSM Risk Reduction



Extensive Communication to change the Culture

Start at the top

Director and Shareholder engagements

- 2 Monthly Technical Directors meetings on AI-PSM
- 3 Technical Board sessions on AI-PSM

Extended leadership team engagements

- Dedicated sessions for Process Safety
- Extensive coverage of 2010 AI-PSM deliverables in all asset directorate business plans and Performance Contracts

Middle management and workforce engagements

- Consistent messages from the leadership
- Media and face to face engagements



Successful Communication: Taming the Two Beasts

The Lion - Occupational Safety

- Hunts in groups
- Is often visible (audible etc)
- Common in its own environment
- Is a killer
- Can never be fully tamed
- Can never be left unguarded
- Needs constant vigilance



The Tiger – Process Safety

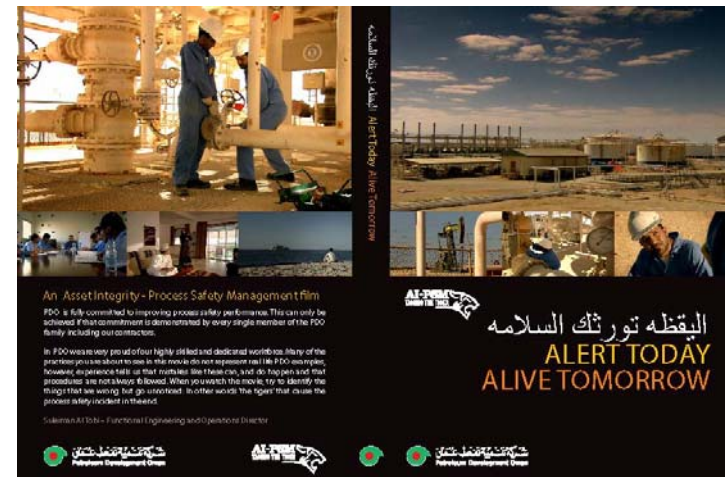
- Hunts alone
- Is secretive and hard to detect (well camouflaged)
- Not commonly seen
- Is a killer
- Can never be fully tamed
- Can never be left unguarded
- Needs constant vigilance

Turn your back on either at your peril



Successful Communication: Alert Today – Alive Tomorrow

- Started in the summer of 2009
- 12 draft scripts being created before the final storyline was agreed by a PDO team of Communications and Engineering professionals
- In early November, a multi-award winning drama crew from Myriad Global Media started shooting the film in the recently converted Marmul B training facility in South Oman
- This involved mobilising a 25 person team to the Interior, including camera crew, sound, production management staff, actors and extras
- Ten professional Omani actors were employed
- Ten PDO operations staff were also employed as extras, adding authenticity to the operational activities and meeting sequences
- Launched in the summer of 2010
- The film is the first of its kind in the region in that it also includes an interactive section to be used for training purposes.
- Running off a DVD menu the interactive section helps reinforce lessons learned from key events in the film.
- PDO is sharing the movie with its national and regional Oil and Gas colleagues



Key Challenges

- Manage a large volume of work covering different disciplines across all directorates in PDO
- Demonstrate the success of the programme by passing an independent audit in Q4 2010 for the critical assets
- Manage sustainability through Assurance and Management of Change
- Improve the competence of staff to deal with current and future asset complexity and age
- Step-up the Engineering and Well Engineering coverage of Process Safety
- Continue the AI-PSM training and communication effort

These are linked to the 10% contribution of Process Safety on the 2010 corporate scorecard. We have to keep the momentum going!

