GBN INSTRUMENT PM OPTIMIZATION

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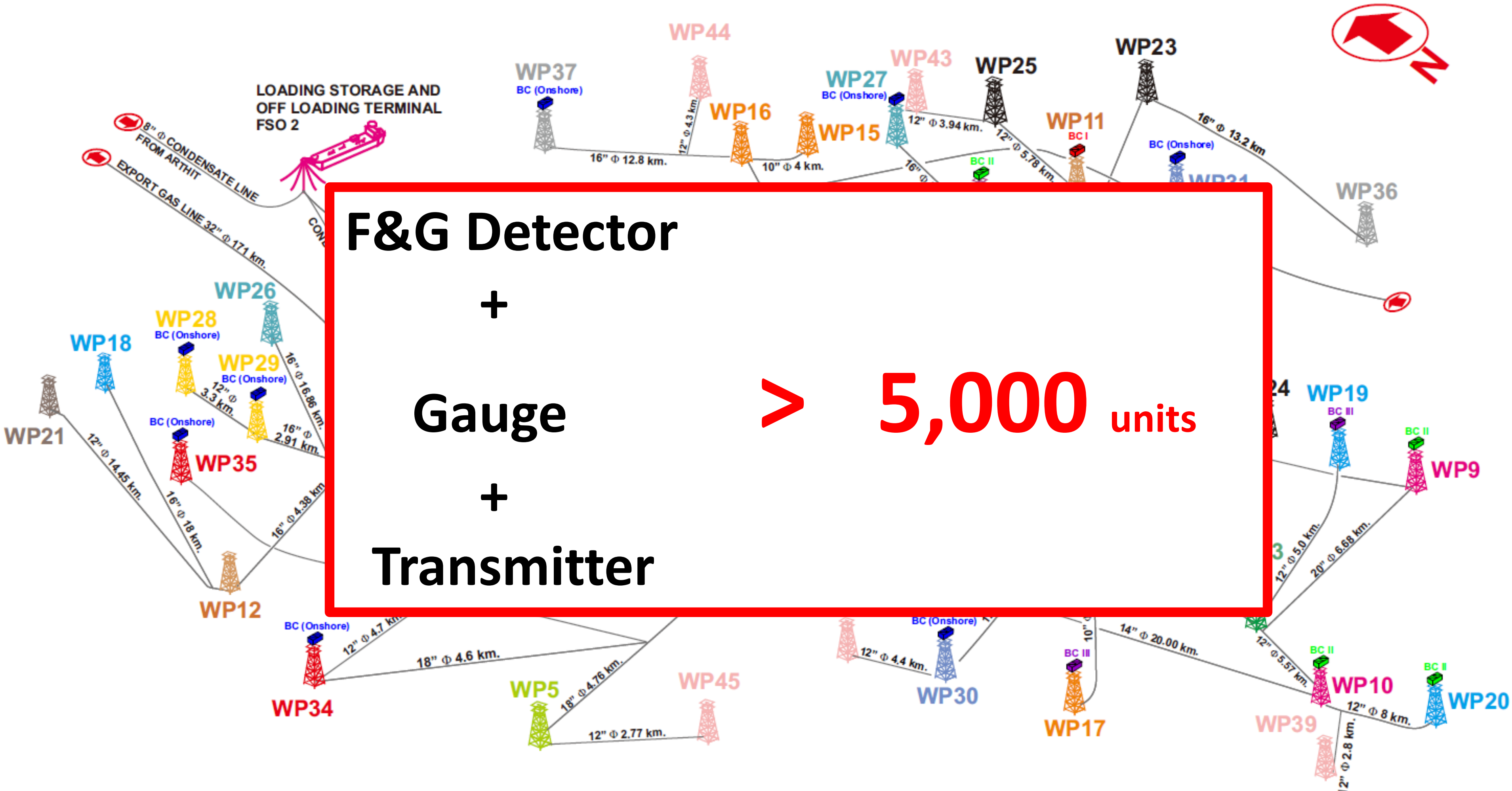
Background



F&G Detector

+

Gauge

+

Transmitter

> 5,000 units

Background

- Presently maintenance strategy, all field instruments are calibrated every year and every 4 month for F&G detector
- Estimated man-hour for calibration is around 30 mins (2-3 persons)

>2,500 Hours or

<u>208.33 days per years!!!</u>

Problems

- To much routine work for calibration and testing
- Limited of bed allocation
- There is less time to improve others maintenance tasks

Target

✓ Reduce man-hour for field instrument and F&G detector PM activity

✓ By maintain platform reliability and integrity.

How to optimize instrument preventive maintenance strategy?

PTTEP

ORION INSTRUMENTS

K-TEK

Honeywell

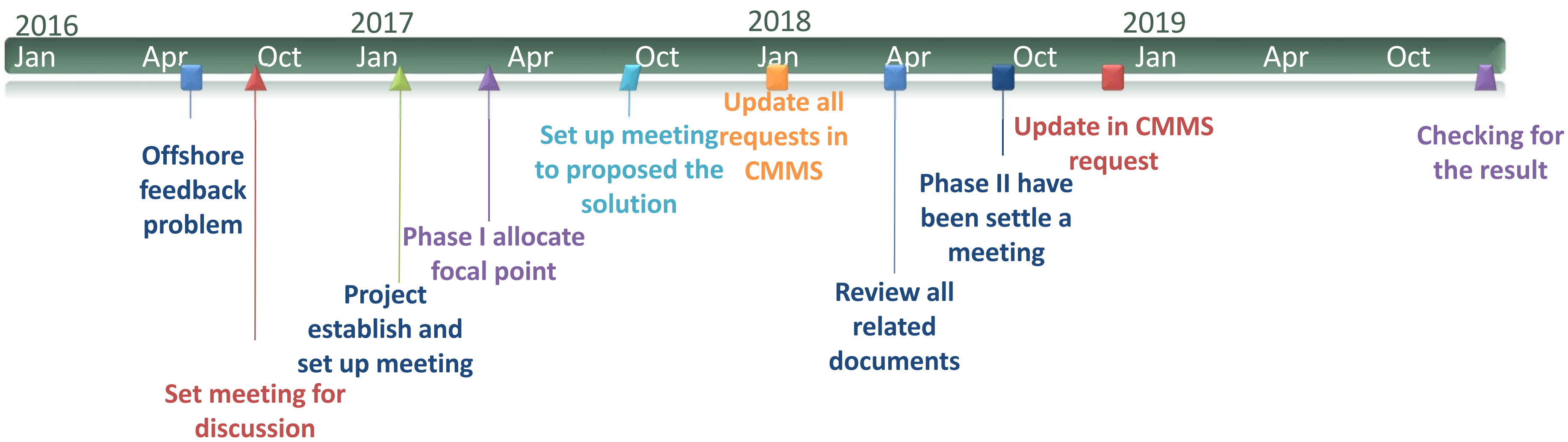
Pneumatic

Hydraulic

Project objective

Target

- Reduce PM man hour for field instrument, all smart transmitter and F&G detector is priority.
- Still maintain platform reliability and integrity
- Update CMMS and check the duplicated task



Project objective

Action

Step 1, Close communication with related party.

Set up several meeting/ workshop with related party to establish work scope and arrange work sequence.

Step 2, Manpower allocated

Identify wells that same phase design with each team and role and responsibility.

Step 3, Review vendor document,

international standard, MFR document and PEGS requirement. Check and compared proper maintenance period

Step 4, Having several meeting, to discuss among PMI/M, PMI/S and PBN/MEI to conclude what we had and propose new proper maintenance period

Step 5, KOM and annual new period maintenance.

To ensure team have fully understand, we have conduct new period and job card detail

Project objective

Action

2016

Gather information

- Feedback the problem from E&I technician
- PM E&I works are overload and cannot completed properly
- Feedback the problem to PMI/M to verify the problem
- Set meeting to allocate man power and identify critical well/ item
- Identify scope for phase I and II

2017

Phase I Phase 3J,3K, 3L, 3M and 3N

- Review all instrument data sheet and instrument index
- Verify each item by checking with manufacture / PEGS / international standard requirement to ensure we use corrective information and also keep platform reliability & integrity
- Have several meeting among PMI/M, PMI/R and PBN/MEI to conclude what we had and propose new proper maintenance period

2018

Phase II Phase 3E,3F, 3H and device in fire and gas system

- All work sequence are almost same with phase I but this phase include fire and gas device
- The F&G device is importance and critical for safety.
- The decision of new proposed maintenance period based on PEGS, MFR recommendation and international standard
- Set meeting to discuss the proper period

2019

Implementation

- All work request has been sent to CMMS
- Settle meeting with E&I technician to ensure mutual understanding for new PM and job task.
- The based line of PM still consider to apply for new coming phase

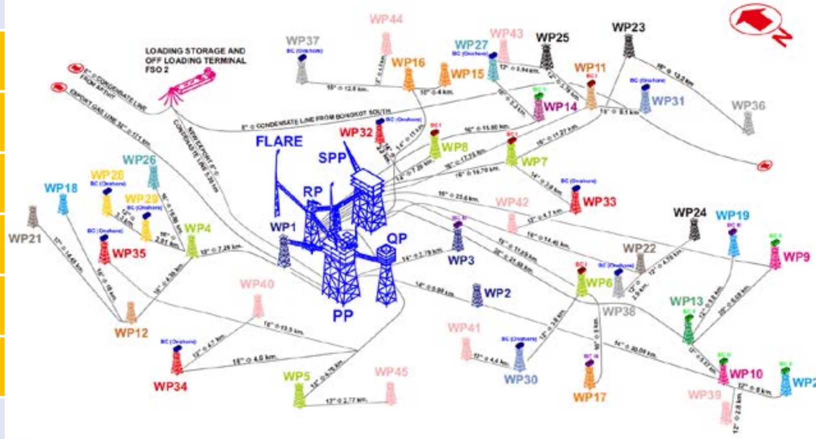
PM Optimization method

Field Instrument

Phase no.	Remote well head no.
Phase1	WP-2/3
Phase2	WP-4/5/6/7/8
3A	WP-9/10
3B	WP-11/12
3C	WP-13
3D	WP-14
3E	WP-15/16/17
3F	WP-18/19/20
3G	WP-21/22
3H	WP-23/24/25
3J	WP-26/27
3K	WP-28/29
3L	WP-30/31
3M	WP-32/33/34/35
3N	WP-36/37/38
3P	WP-39/40/41/42/43/44/45

Step#1: Collected tags of all gauge and group measurement type, brand and model of the field instruments

Step#2: Set-up workshop for maintenance strategy discussion with offshore maintenance team and issue report



PM Optimization method

PTTEP

Field Instrument Methodology

- **Pressure gauge and Temperature gauge**

Consider to change maintenance strategy of gauge (pressure and temperature gauge) from Preventive maintenance base (calibration) to Corrective maintenance base because selected remote wellhead platforms are designed for un-manned operation. Anyway, YPM, visual inspection is required such as arrow checking, bolt tighten

PM Optimization method

Field Instrument Methodology

- **Flow transmitter (Coriolis Type)**

Normally, flow transmitter should be removed to onshore for calibration because no facility to calibrate the flow transmitter and operator can monitor performance or alarm during production well test activity. So maintenance method from Preventive maintenance shall be changed to Corrective maintenance method. YPM, visual inspection is required such as diagnostic code.

PM Optimization method

PTTEP

Field Instrument Methodology

- **Magnetic Level gauge and Transmitter**

According to no calibration interval calculation provided from vendor manual, experience from offshore team is required for considering calibration interval instead. Anyway, the transmitter shall be performed diagnostic verifying every year to monitor any error.

PM Optimization method

PTTEP

Field Instrument Methodology

- Pressure Transmitter/DP level transmitter

Determining calibration frequency by calculation formula as following;

$$\boldsymbol{Cal.freq = \frac{(Required\,performance\ - TPE)}{Stability\,per\,Month}}$$

Where: TPE = *Total Probability Error*

$$= \sqrt{ReferenceAccuracy^2 + TemperatureEffect^2 + StaticPressure^2}$$

PM Optimization method

Pressure Transmitter/DP level transmitter

- *ROSEMOUNT model 3051T (lowest stability)*

Define:	*Calibration performance = 0.2%*	
Where:	*Reference Accuracy*	*= 0.075 %*
	Temperature Effect	*= 0.1 %*
	Static Pressure Effect	*= 0.05 %*
	Stability	*= 0.125 % per 5 years*
	Total probable error (TPE)	*= 0.13463 %*

Calculation frequency ~ 3 Years

PM Optimization method

Field Instrument Methodology

- Temperature Transmitter

Determining calibration frequency by calculation formula as following;

$$\boxed{Cal.freq = \frac{(Required\ performance\ - TPE)}{Stability\ per\ Month}}$$

Where:

$$TPE = \sqrt{DigitalAccuracy^2 + (D/A)^2 + DigitalTempEffect^2 + D/AEffect^2 + SensorAccuracy^2}$$

PM Optimization method

Temperature Transmitter

- *ROSEMOUNT model 3144*

Define:	*Calibration performance = 0.75*	*degree C (0.5 % of span)*	
Where:	*Digital Accuracy*	*= 0.1*	*degree C*
	D/A accuracy	*= 0.003*	*degree C*
	Digital temp Effects	*= 0.024*	*degree C*
	D/A effects	*= 0.024*	*degree C*
	Sensor accuracy	*= 0.45*	*degree C*
	Stability per Month	*= 0.00625*	*degree C*
	Total probable error (TPE)	*= 0.462*	*degree C*

Calculation frequency ~ 4 Years

PM Optimization method

Gas detector, GBN, Ref. 10012-GDL-5-GEN-003-R00 Bongkot North Asset Maintenance Guideline

PM Flame detectors: full loop test shall be performed at 4-month frequency.

PM Gas detectors: full loop test shall be performed at 4-month frequency.

PM Smoke detectors: full loop test shall be performed at 6-month frequency.

PM Heat detectors: full loop test shall be performed at 6-month frequency.

PM Manual call point: full loop test shall be performed at 6-month frequency.

PM Fire damper: shall be at 4 monthly intervals.

Complex

- **IR : 41 (Honey well, search line, XNX)**
- **Catalytic : 113 (GM S4100C)**
- **Flame detector (IR) : 44 (GM FL4000H, 3000,3100 and Det tronic U7652)**

TEK + TG

- **IR : 10 + 12 (Det tronic, PIRECL)**
- **Catalytic : 26 (Det tronic, K series)**
- **Flame (IR) : 12 + 20 (Det tronic, Thorn)**
- **IR – 63, Catalytic – 139 and flame – 76**
- **SUM 278**

PM Optimization method

PTTEP

Gas detector, GBS, PM plan for FGS, ref. 10012-GDL-5-GEN-005-R00 Greater Bongkot South Maintenance and Inspection Guideline

Frequency **PM Flame detectors:** full loop test shall be performed at 1- year
Frequency. **PM Gas detectors:** full loop test shall be performed at 1- year
Frequency. **PM Smoke detectors:** full loop test shall be performed at 1-year
Frequency. **PM Heat detectors:** full loop test shall be performed at 1-year
Frequency. **PM Manual call point:** full loop test shall be performed at 1-year
Frequency. **PM Fire damper:** shall be at 6 monthly intervals.

Quantity

- **IR** : **91 (GM-IR2100/IR5000)**
- **Catalytic** : **6 (GM- S4100C)**
- **Flame detector (IR)** : **140 (GM- FL4000)**

SUM : **237**

Gas detector, ART

Table 1—Frequency for Performing Proof Tests

PIRECL Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Response Proof Test	Yes	1 year

Still Maintain 6-Month, High gas production
Extended to 1-Year, Low gas production

Originally – 4M, extend to 6M in 2015.
Now, increase to 1Y in 2016

Quantity

- **IR : 3XX**
- **Catalytic : None**

Catalytic

GBN Catalytic brand : General monitor model : S4100

The accuracy of the Smart Transmitter depends upon routine re-calibration which should be carried out at least every 90 days. This procedure is extremely simple and may be carried out by one person aided by prompts from the digital display. Calibration may be completed in less than 2 minutes. All calibration parameters are tested by advanced software routines before being accepted. Any errors detected will be shown on the digital display by means of an appropriate fault code.

	S4100CH Clean Environment	S4100CH Contaminated Environment	S4100C Clean Environment	S4100C Contaminated Environment
FM Certificate	3037588-S4100CH	3037588-S4100CH	3034949-S4100C	3034949-S4100C
Product Life (Years)*	21	21	21	21
λ_{DD} (Fails per hour)	1.26E-5	1.7E-5	1.1E-5	1.63E-5
λ_{DU} (Fails per hour)	6.79E-8	1.67E-6	3.34E-8	1.83E-6
Safe Failure Fraction (SFF)	>99%	92%	>99%	92%
Safety Integrity Level (SIL)**	3	2	3	2
Diagnostic Test Interval	1 sec	1 sec	1 sec	1 sec
Response Time (with 100% LEL methane applied)	T_{50} < 10 sec	T_{50} < 10 sec	T_{50} < 10 sec	T_{50} < 10 sec
Average Probability of Failure on Demand PFD_{avg}1oo1***	1.25E-4	1.89E-3	3E-4	2.4E-3

Table 4 – SIL Parameters for S4100CH and S4100C

* Catalytic bead sensor life is typically 3-5 years.
** Hardware Fault Tolerance (HFT) = 0

Catalytic life sensor is 3-5 years

Response time should be checked.

IR Detector

GBN IR brand : **GM FL4000H, 3000,3100 and Det tronic U7652**

Maintenance and Repair General monitor

Catalytic gas detectors require a routine "check" every 90-days. While no routine calibration is actually required for IR detectors, a gas check is still recommended every 90-days. Typically, calibration takes between 1 – 3 minutes. Should a catalytic sensor require replacement, it can easily be changed out in the field. IR point detectors require factory repair, however repair frequency is typically very low. Also, a spare IR detector can be installed while the defective one is sent to the factory.

**We may consider adding for cleaning glass for IR lamp
For serchline excel, alignment and zero are option to consider

Det tronic

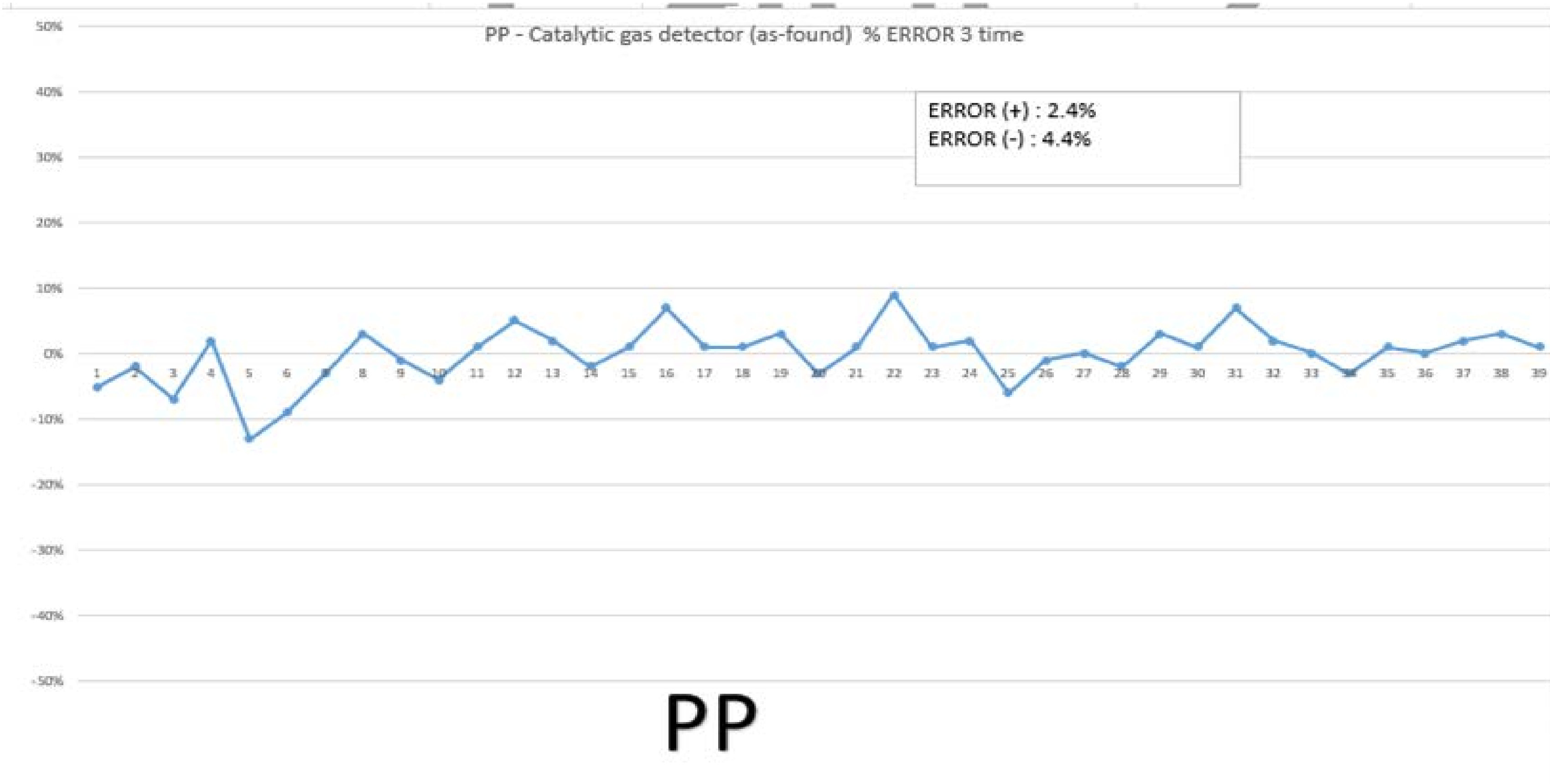
Table 1—Frequency for Performing Proof Tests

PIRECL Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Response Proof Test	Yes	1 year

These IR gas detector is able to extend calibration to 1 Y

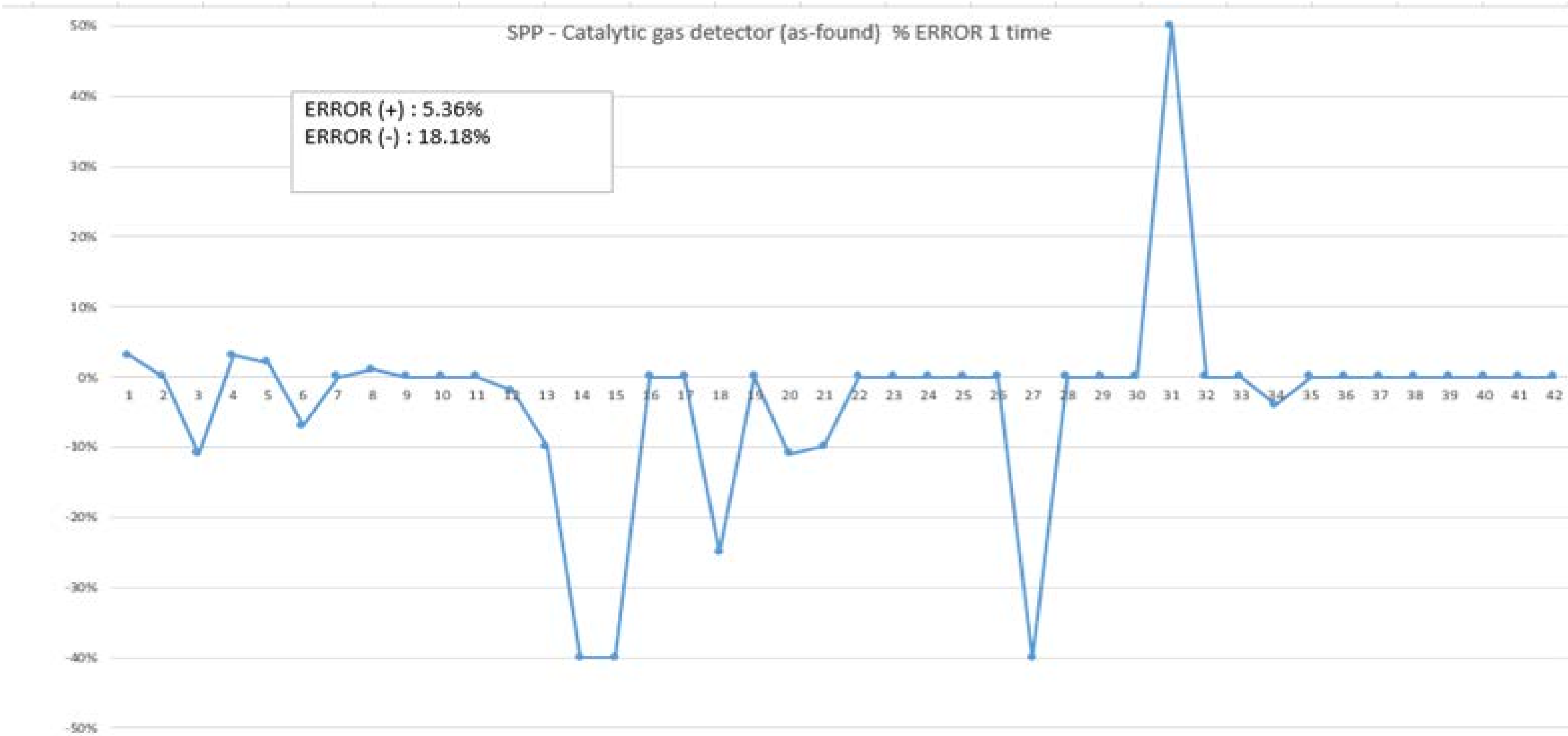
Catalytic

Analyzed 117 recorded data from 3 calibrated time



Catalytic

Analyzed 42 recorded value from 1 calibrated time



SPP

Summary PM Instrument

Instrument Equipment	Brand	Existing interval	Propose interval	Remark
Catalytic gas detector	General monitor	4M	6MPM	Trial test for 6M and consider to extend later
IR gas detector	Honeywell, General monitor, Det-Tronic	4M	1 YPM	Separate by each location
Pressure Gauge/Temperature gauge	Ashcroft	1 YPM	(YPM), CM	See note-1
Flow transmitter	Emerson, Micro Motion	1 YPM	(YPM), CM	See note-1
Pressure Transmitter/DP level transmitter	Emerson Rosemount	1 YPM	(YPM), 3 YPM	See note-2
Temperature Transmitter	Emerson Rosemount	1 YPM	(YPM), 3 YPM	See note-2
Magnetic Level gauge and Transmitter	Magnetrol	1 YPM	1 YPM, verify diagnostic, 3 YPM, calibration	

1. *(YPM), During platform – YPM, visual inspection is required such as arrow checking, bolt tighten. Refer next sheet for activated phase*
2. *(YPM), for those equipment connected to PCS. YPM still include activate block and bleed valve, check ZERO transmitter Refer next sheet for activated phase*

Summary PM Instrument

PTTEP

The phase that agreed in new PM schedule are below

Phase no.	Remote well head no.
Phase1	WP-2/3
Phase2	WP-4/5/6/7/8
3A	WP-9/10
3B	WP-11/12
3C	WP-13
3D	WP-14
3E	WP-15/16/17
3F	WP-18/19/20
3G	WP-21/22
3H	WP-23/24/25
3J	WP-26/27
3K	WP-28/29
3L	WP-30/31
3M	WP-32/33/34/35
3N	WP-36/37/38
3P	WP-39/40/41/42/43/44/45

Benefit

Description	Total Q'ty	Working Hour (in 3 Years)	
		Existing	New
Pressure gauge	1,760	2,640	176
Pressure Transmitter	1,030	1,545	515
Level gauge and transmitter	282	423	169.2
Temperature Transmitter	421	631.5	210.5
Flow transmitter (Colioris type)	86	129	8.6
Catalytic gas detector	139	139	92
IR gas detector	139	139	46
	3579	5,369.3	**1079.3**

60%

WORKING TIME REDUCING

Q&A

THANKS

FOR YOUR ATTENDTION

Temperature Transmitter

Calibration frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions. Use the following procedure to determine calibration frequency that meets the needs of your application.

1. Determine the required performance.
2. Calculate total probable error.
   a. Digital accuracy = °C
   b. D/A accuracy = (% of transmitter span) × (ambient temperature change) °C
   c. Digital temp effects = (°C per 1.0 °C change in ambient temperature) × (ambient temperature change)
   d. D/A effects = (% of span per 1.0 °C) x (ambient temperature change) × (Process temperature range)
   e. Sensor accuracy = °C
   f. $TPE = \sqrt{(DigitalAccuracy)^2 + (D/A)^2 + (DigitalTempEffects)^2 + (D/AEffects)^2 + (SensorAccuracy)^2}$
3. Calculate stability per month.
   - (% per months) × (process temperature range)
4. Calculate Calibration Frequency.
   - $CalFreq = \frac{(RequiredPerformance - TPE)}{StabilityPerMonth}$

Temperature Transmitter

Example for Rosemount 3144P Pt 100 ($\alpha = 0.00385$)

Reference temperature is 20 °F
Process temperature change is 0–100 °C
Ambient temperature is 30 °C

1. Required performance: ± 0.35 °C
2. TPE = 0.102 °C
   a. Digital Accuracy = 0.10 °C
   b. D/A Accuracy = (0.02%) × (30 – 20) °C = ±0.002 °C
   c. Digital Temperature Effects = (0.0015 °C/°C) × (30–20) °C = 0.015 °C
   d. D/A effect = (0.001%/°C) × (100 °C) x (30–20) °C = 00.01 °C
   e. Sensor accuracy = ± 0.420 °C at 400 °C for a class A RTD sensor with CVD constants
   f. TPE = $\sqrt{(0.102)^2 + 0.0022^2 + 0.0152^2 + 0.012^2 + 0.4202^2)}$ = 0.102 °C
3. Stability per month: (0.25%/60 months) × (100 °C) = 0.00416 °C
4. Calibration frequency: $\frac{0.35 - 0.102}{0.00416}$ = 60 months (5 years)