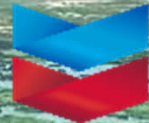Chevron

human energy

Case Studies in Pipeline Spill Elimination

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San Ramon, California
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Agenda
Technology Based Case Studies

CPM Unannounced Live Test

Actual product withdraw test to confirm accuracy of system and operator response.

Maersk Viking Anchor Drag

March 29, 2018 the Maersk Viking drug their anchor chain over CPL's Pipeline.

Video Surveillance Technology Improvement Study

New technology implementation can cause unintended consequences. Incremental improvements lessen the impact of these consequences.

CPM Unannounced Live Test

Computational Pipeline Monitoring

Brief Description of CPM

- Real-time operational data drives a set of algorithms to provide the basis for detection of a leak
- Multiple methods available in the industry

CPL uses the following methods

- Volumetric Balance
- Real Time Transient Model

Regulatory Requirements

- CFR 49 Part 195.444 CPM Requirements
- Comply with API RP 1130 – Computational Pipeline Monitoring for Liquids: Pipeline Segment
  - Section 6.2.1 Testing Methods
  - Section 6.2.3 Periodic Retesting

Objectives of Test

Meet Regulatory Expectations
- PHMSA
- OSFM

Test Leak Detection System
- SimSuite v5.4/v6.7
- Controller with SCADA

Test Preparedness
- Control Center response
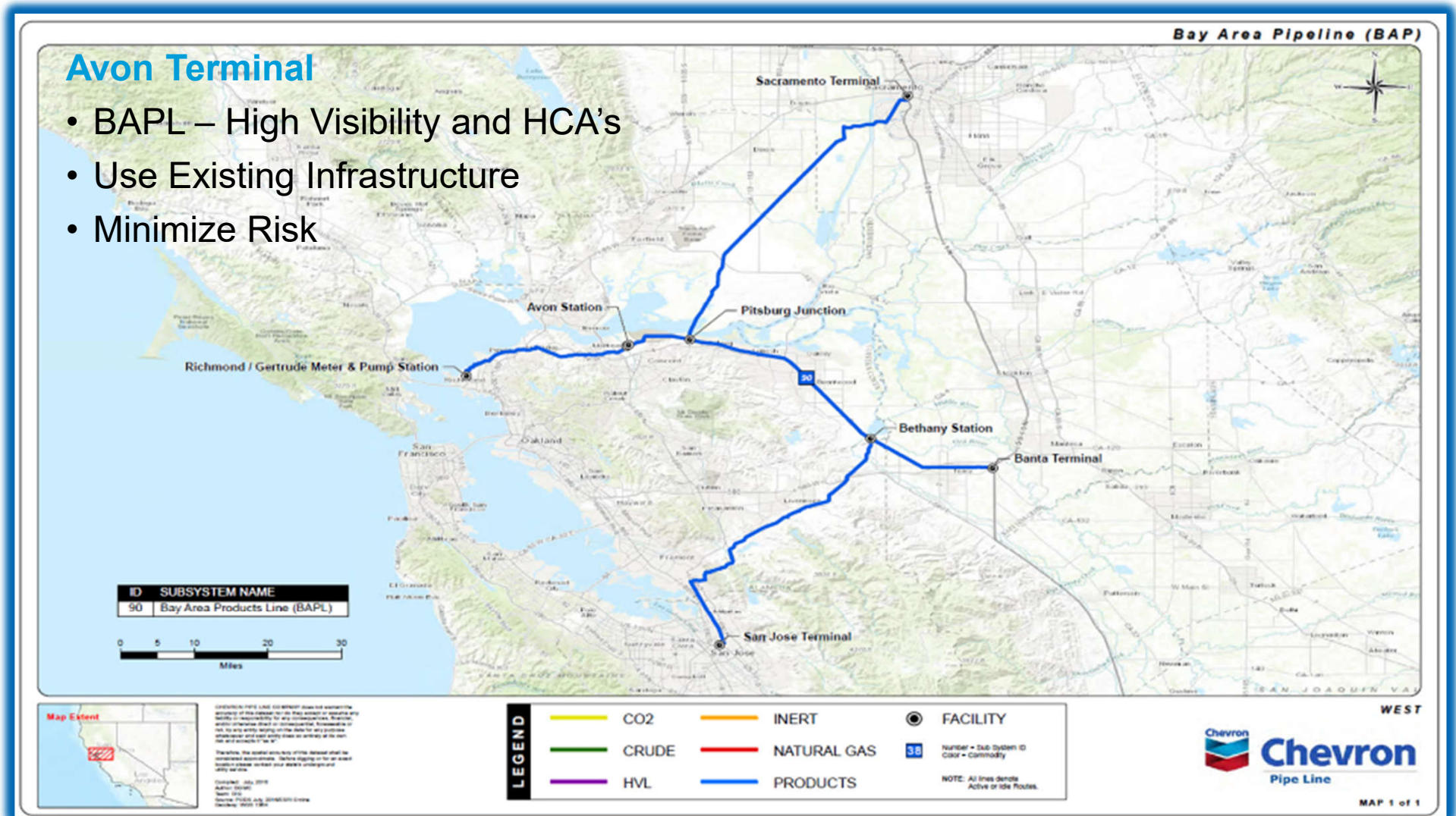- Table top exercise

System Performance
- Sensitivity
- Reliability
- Robustness/ Repeatability
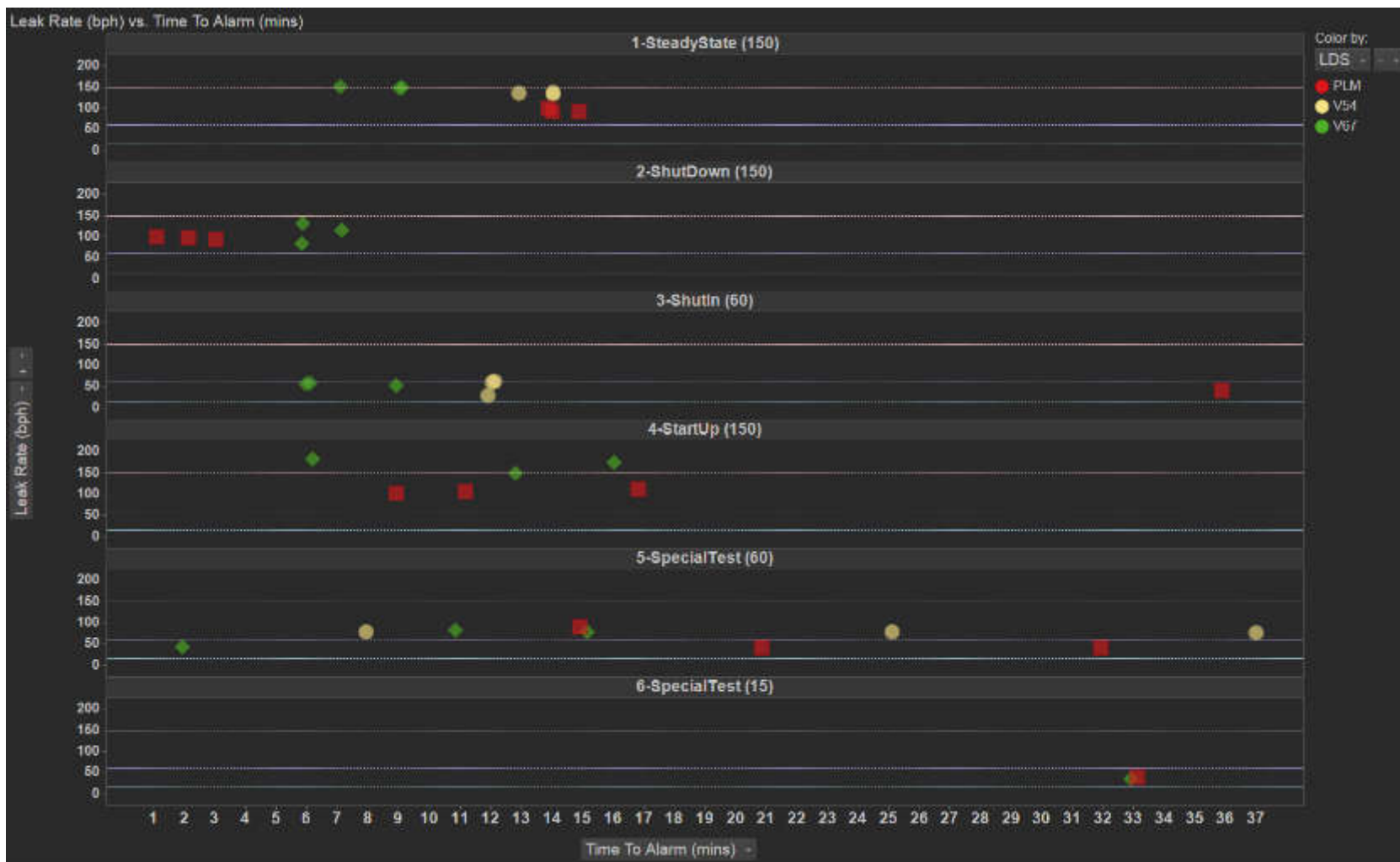
Location, Location, Location

Avon Terminal

- BAPL – High Visibility and HCA's
- Use Existing Infrastructure
- Minimize Risk

Results of the Test
Time to Detect Leak

Maersk Viking Anchor Drag

CPL's Leak & Intrusion Detection Support Center
Maritime ROW protection
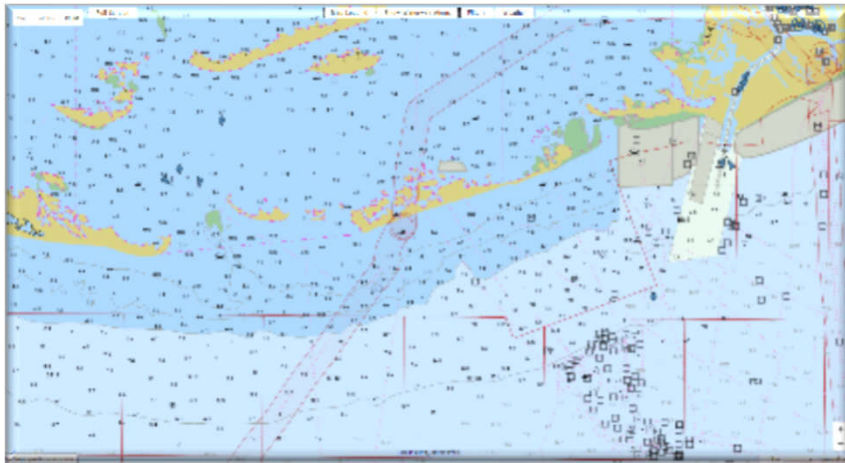
Marine Encroachment Monitoring

- Oceaneering's PortVision® AIS-based vessel-tracking service is being used to monitor vessel activities

  - Overlay of vessel positions on maps with pipeline ROW

- Triggers to speed and position parameters alert console

- Contact ship, ship owner and other authorities

- Monitored 24/7 from the Chevron Pipeline Control Center-Leak and Intrusion Detection Support Center (LIDSC) console.

Event Summary / Response
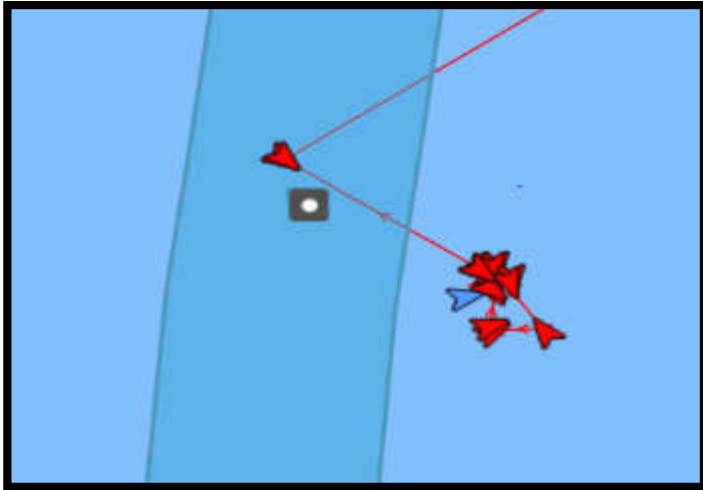
Maersk Viking – Encroachment (PortVision)

Maersk Viking – 748'L x 138'W x 62' Hull Depth

Encroachment Event – PortVision

- Maersk Viking drifted into geo-fenced pipeline zone (PortVision®) triggering an alert at the LIDSC console

- At the time, winds measured 19.4 miles per hour (gusts up to 33.3 mph) resulting in the vessel to drift ~½ mile from its original anchored position

Chevron Pipeline Control Center Response

- Following the alert, LIDSC controller identified the vessel type / size noting it posed a significant risk to both an active and abandoned Chevron crude pipelines.

- United States Coast Guard (USCG) New Orleans Command Center was contacted and assisted hailing the vessel (*Maersk re-engaged their dynamic positioning system*)

- Maersk Viking Captain contacted the LIDSC Console and agreed to hold position pending field team response (354' west of the pipeline with ~450' of anchor chain extended to the east).

- Pipeline line was shutdown and pressure reduced to 0 PSI on 29 March.

- Chevron Crisis Management Team convened to formulate response.

Event Response

Maersk Viking & Oceaneering – Survey

Chevron Pipeline Response Activities

- CMT convened to review / discuss field team assessment plan

- Engineering and Integrity groups secured dive and survey resources to perform on site damage assessment

- Chevron ROW representatives combined to identify all enterprise assets potentially impacted by the anchor drag

  – CPL 12" Oil line

  – CUSA 18" Oil line (abandoned in 70's)

- Communication protocol was established to coordinate CPL and Maersk joint response and investigation activities

- CPL representative was placed on board the Oceaneering vessel to monitor visual and sonar surveys conducted by Oceaneering

Event Response
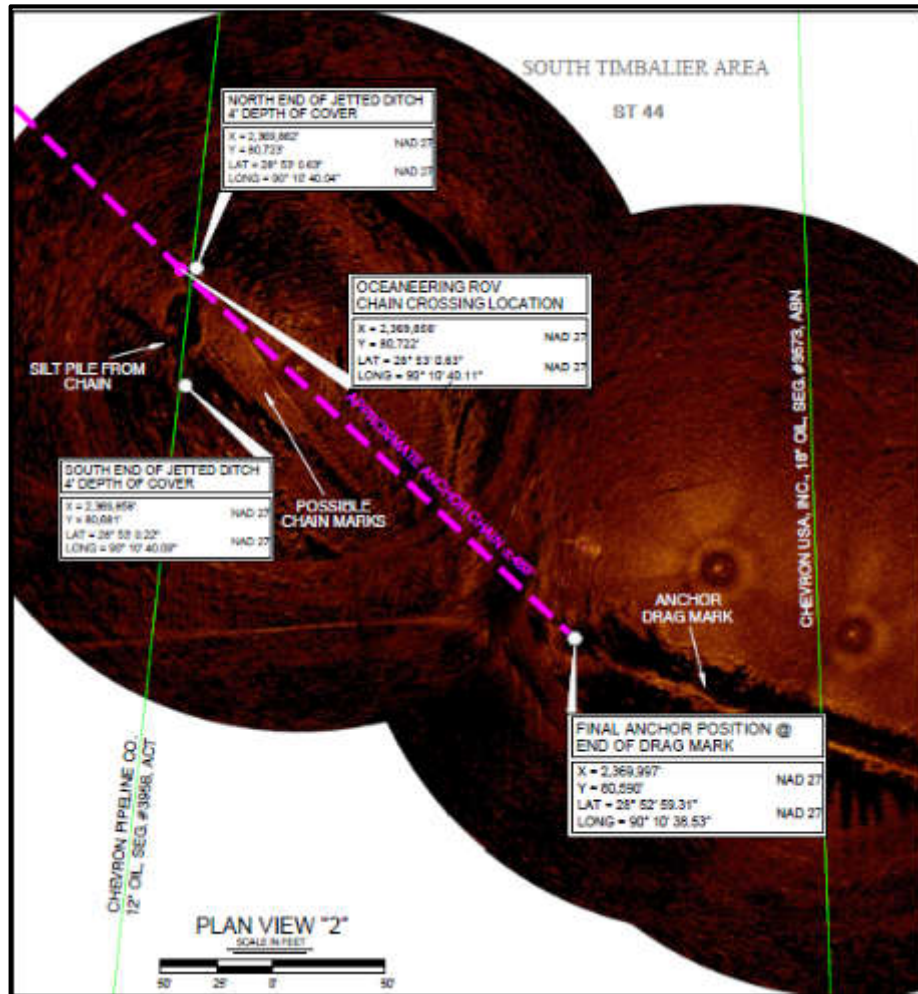
Oceaneering – Survey Results
(*Anchor final resting location : ~150 feet east of CPL 12" line*)

Event Resolution

- Multiple site survey's were conducted to confirm location of the anchor and assess the condition of all enterprise assets present in the impact zone

- SME's reviewed the survey reports and developed an anchor extraction plan

- Maersk made a unilateral decision to lift the anchor and extract the vessel from the geo-fenced zone

- Arranged additional site surveys to confirm the integrity of the line following the retreat of the Maersk Viking

- CPP operations elected to further confirm the pipeline integrity through use of divers to safely conduct a final pre-start examination

- Standup pressure test was performed and the line flown before safely returning to service on April 2 (~100 hours of pipeline interruption)

Video Surveillance Technology Improvement Study

Video Surveillance Technology Improvement Study

13 Northwest sites accounted for 55% of the camera alerts on the LIDSC console in 2017

Most common triggers were environmental in nature

- Rapid temperature changes across piping or other objects in the field of view
- Animal, birds & bugs

A expanded data review was conducted in May 2018 incorporating all [31 active & pre-commissioned sites]

- 660 alerts produced each day
- 55 mins of each hour consumed by video clip review
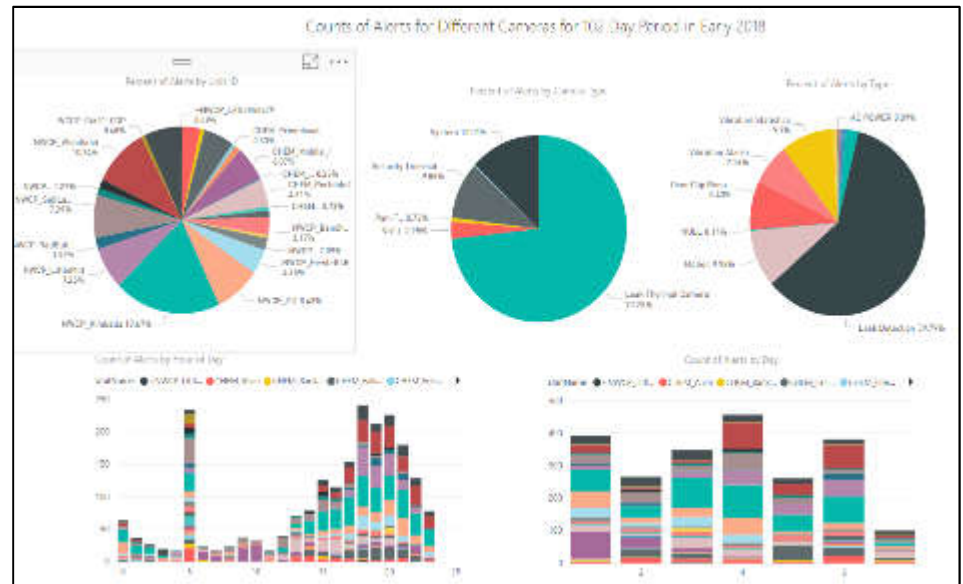
Data illustrates the value of incorporating machine learning to process data and imagery

Objective

Objective:
  a. Reduce the total number of camera alerts
  b. Improve user awareness & effectiveness
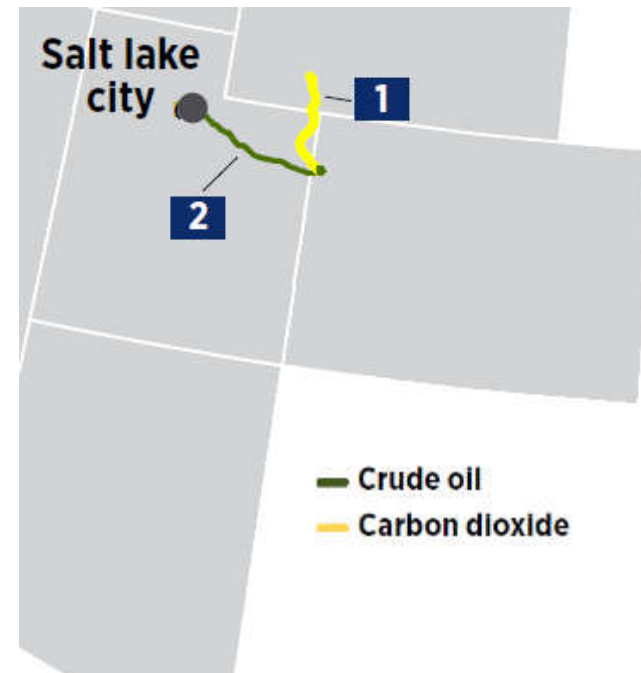 c. Reduce console workload
  d. Increase console capacity

Benefit:
  a. Reduction in operator workload
  b. Restore user confidence in the equipment
  c. Increase console capacity
  d. Defer need for a second console

Salt lake city

1

2

— Crude oil
— Carbon dioxide

DCAM Artificial Intelligence Features

20 Dual Camera Analytic Module's [DCAM]
were installed in July 2018 providing

- Dual sensor [thermal & color] video feed
- Automated event detection and quantification
- Real-time leak visualization, analysis and qualification
- Low false alert rate and a variety of filters to address environmental factors (glare, shadow, rain, fog & snow) and camera movement

- Object Scene Counting [number of objects in the scene]
- Object Time in zone [time based alert trigger]
- Object Size Setting [triggers alert on basis of minimum object size]
- Object Speed Setting
- Object Temperature Setting
- Automatic Enabling/Disabling of Alarm Rules

Pre-Commissioning Process

Recommended False Alarm Estimations based on 70-80 PSI leak simulation															
Modify only the **yellow cells**															Average False Alarms per CAM/DAY
	Distance /m					Detection level				Sensitivity	Delay (Leak)	Object Speed	Leak Fltr	Min Object size	
	DCAM			Generation 1		Leak size (70+ PSI)									
Setting	25mm	13mm	7.5mm	19mm	13mm	9mm	Level*		l/s	m3/hr						
Close	30	16	9	20	14	9	L4+	95%	0.35	1.3	O/D+	20s	F	L3	12	0.5
								99%			O/D+	20s	F	L3	6	2
							L10+	95%	0.95	3.4	O/D+	20s	F	L3	30	0.1
								99%			O/D+	20s	F	L3	15	0.4
Clos/Med Custom L4	30	16	9	17	12	8	L4+	95%	0.35	1.3	O/D+	20s	F	L3	13	0.3
Clos/Med Custom L10	50	26	15	29	20	14	L10+	95%	0.95	3.4	O/D+	20s	F	L3	24	0.1
Medium	70	36	21	40	28	19	L4+	95%	0.35	1.3	O/D+	20s	F	L4	6	2
								99%			O/D+	20s	F	L3	4	3
							L10+	95%	0.95	3.4	O/D+	20s	F	L4	15	0.1
								99%			O/D+	20s	F	L2	7	2
Med/Far Custom L4	80	42	24	48	33	24	L4+	95%	0.35	1.3	O/D+	20s	F	L4	5	2.4
Med/Far Custom L10	90	47	27	54	37	26	L10+	95%	0.95	3.4	O/D+	20s	F	L3	12	0.7
Far	100	52	30	60	41	28	L4+	95%	0.35	1.3	O/D+	20s	F	L3	4	3
								99%			ThLo	15s	F	L2	4	TBD
							L10+	95%	0.95	3.4	O/D+	20s	F	L3	10	1
								99%			O/D+	20s	F	L2	4	3

- Each camera was tested at a leak rate of .4ml per sec at approximately 70psi
- The minimum object size correlates to the number of pixels filled needed to trigger an alert, this number adjusts along with the measured distance and is important in determining the estimated number of false alerts
- A false alert is defined as any event that is not an actual leak or security event.
- False alerts may be caused by personnel or animals in the field of view

Customized Alert & Masking
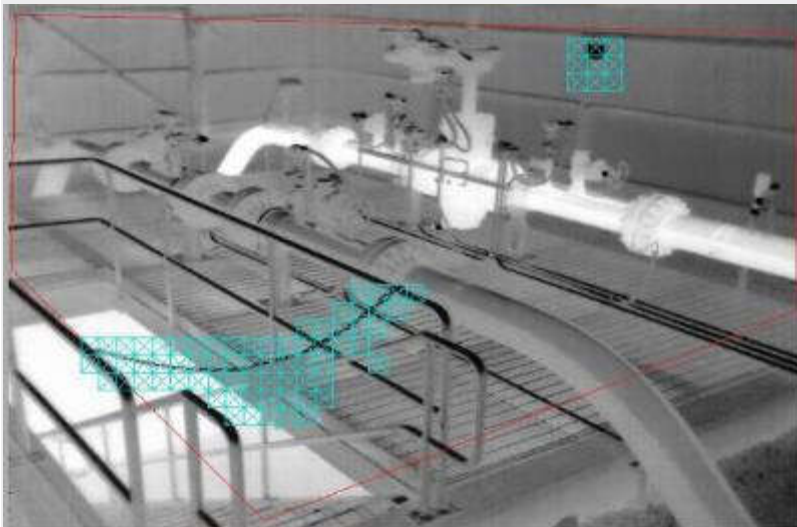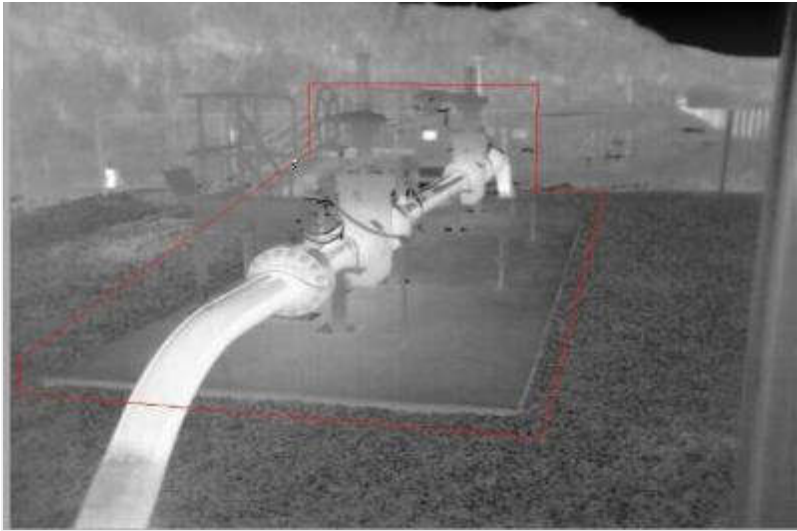
Results

July – September 2017 (37,626)

July – September 2018 (4,240)

89% reduction in alerts

Pipeline Resources

Chevron Pipe Line's Emergency Response Portal

Developed to Provide Information to Emergency Responders

- Pipeline Maps
- Emergency Response Manuals and Plans
- Local Contact Information

http://response-planning.com/erpp/chevron#

National Association of State Fire Marshals

<u>Free</u> Pipeline Emergency Training developed in cooperation with API and NASFM

www.firemarshals.org/Pipeline-Emergencies