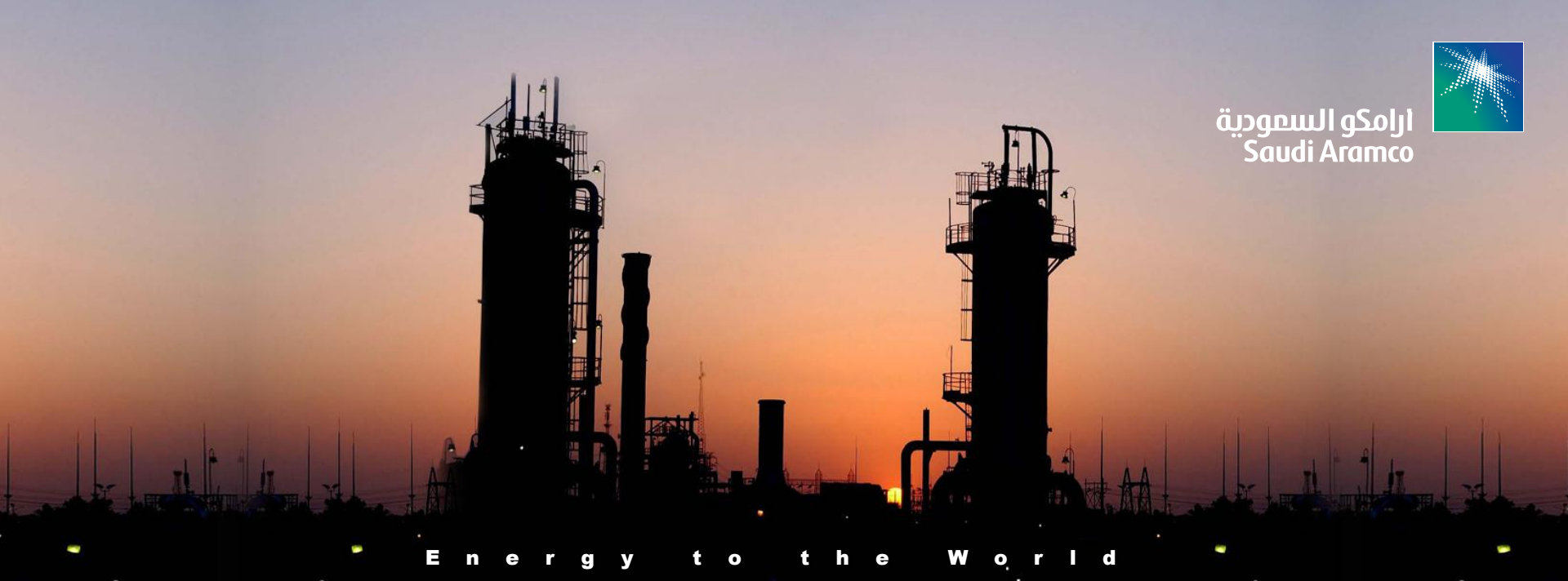




أرامكو السعودية
Saudi Aramco



E n e r g y t o t h e W o r l d



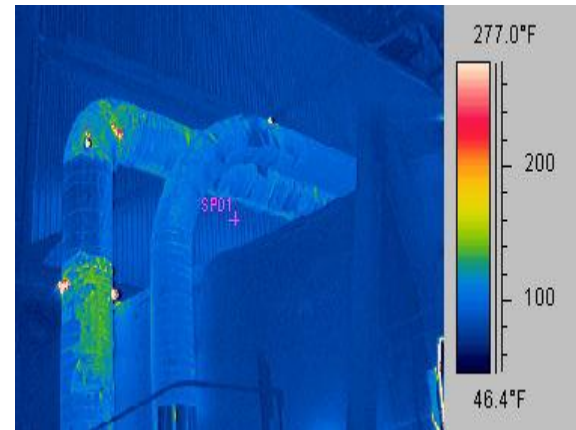
SAUDI ARAMCO LEAK DETECTION AND REPAIR (LDAR) PROGRAM

Environmental Protection Department

Homood Al-Hilal

OUTLINE

- Background
- Saudi Aramco's LDAR Protocol
- LDAR implementation (SOW)
- Benefits of this program
- Best Practice case scenario
- Piloting smart LDAR technology



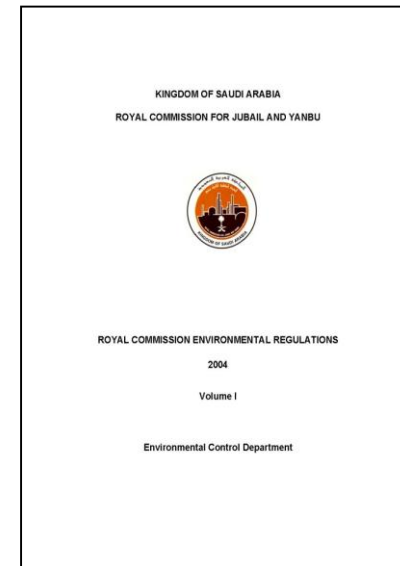
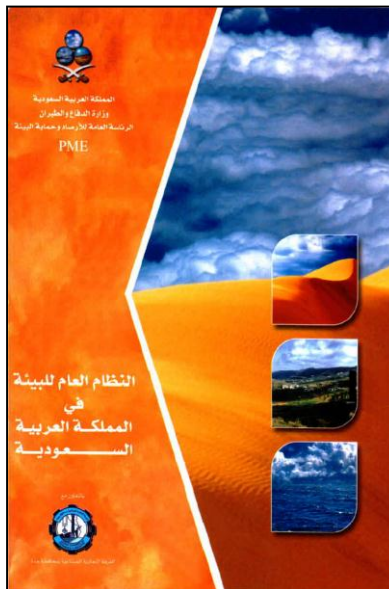
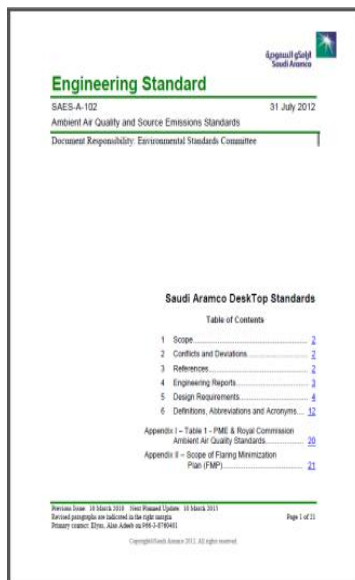
BACKGROUND

- Emitted gas compounds impacts health and environment.
- LDAR is a work practice designed to identify leaking equipment so that emissions can be reduced through repairs at specified location, regular intervals and within a specified time frame.



BACKGROUND

- Requirements as specified under Saudi Arabia and Saudi Aramco Environmental regulations.
- Provide Saudi Aramco Operating Facilities with a consistent process to conduct LDAR.



SAUDI ARAMCO'S LDAR PROTOCOL

Components

- Valves
- Pumps
- Compressors
- Pressure relief valves
- Fittings
- Pipes



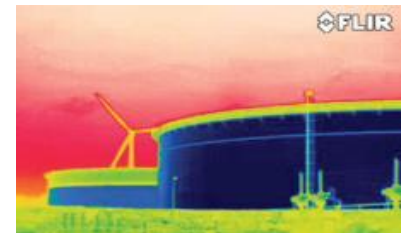
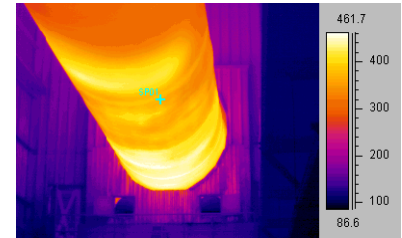
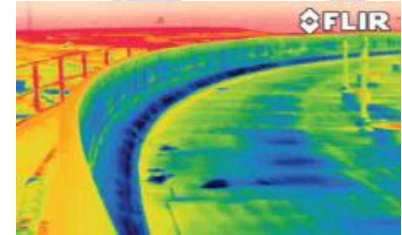
SAUDI ARAMCO'S LDAR PROTOCOL

- The primary reference for this protocol is Method 21 of US EPA 40 Code of Federal Regulations (CFR) Part 60.
- Using of Flame Ionization Detectors (FID) or Photo Ionization Detectors (PID) to detect leaking components.



SAUDI ARAMCO'S LDAR PROTOCOL

- An optical gas imaging camera is capable to detect gas leaks and to assist the LDAR program during the surveying process.



LDAR IMPLEMENTATION (SOW)



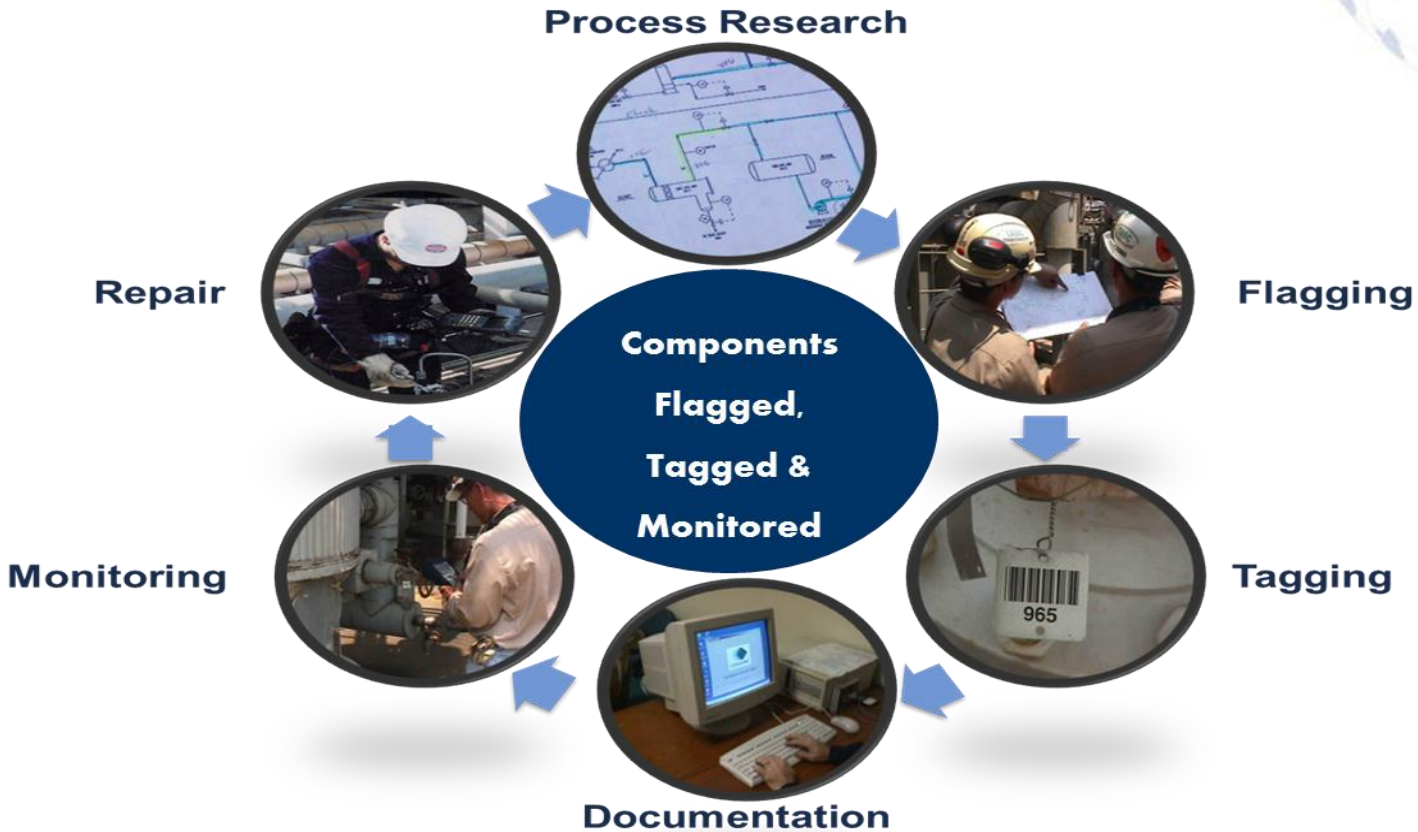
- Prepare master list
- Conduct field survey
- Tag all potential leaking equipment
- Identify the repairs required
- Identify all leaks to the facility that can be minimized
- Install/develop in-house software and database
- Develop a training program
- Calibrate the gas analyzer

BENEFITS

- Protect the environment and reduce fugitive air emission
- Reduce product losses
- Increase facility workers and operators safety
- Decrease exposure for the surrounding community

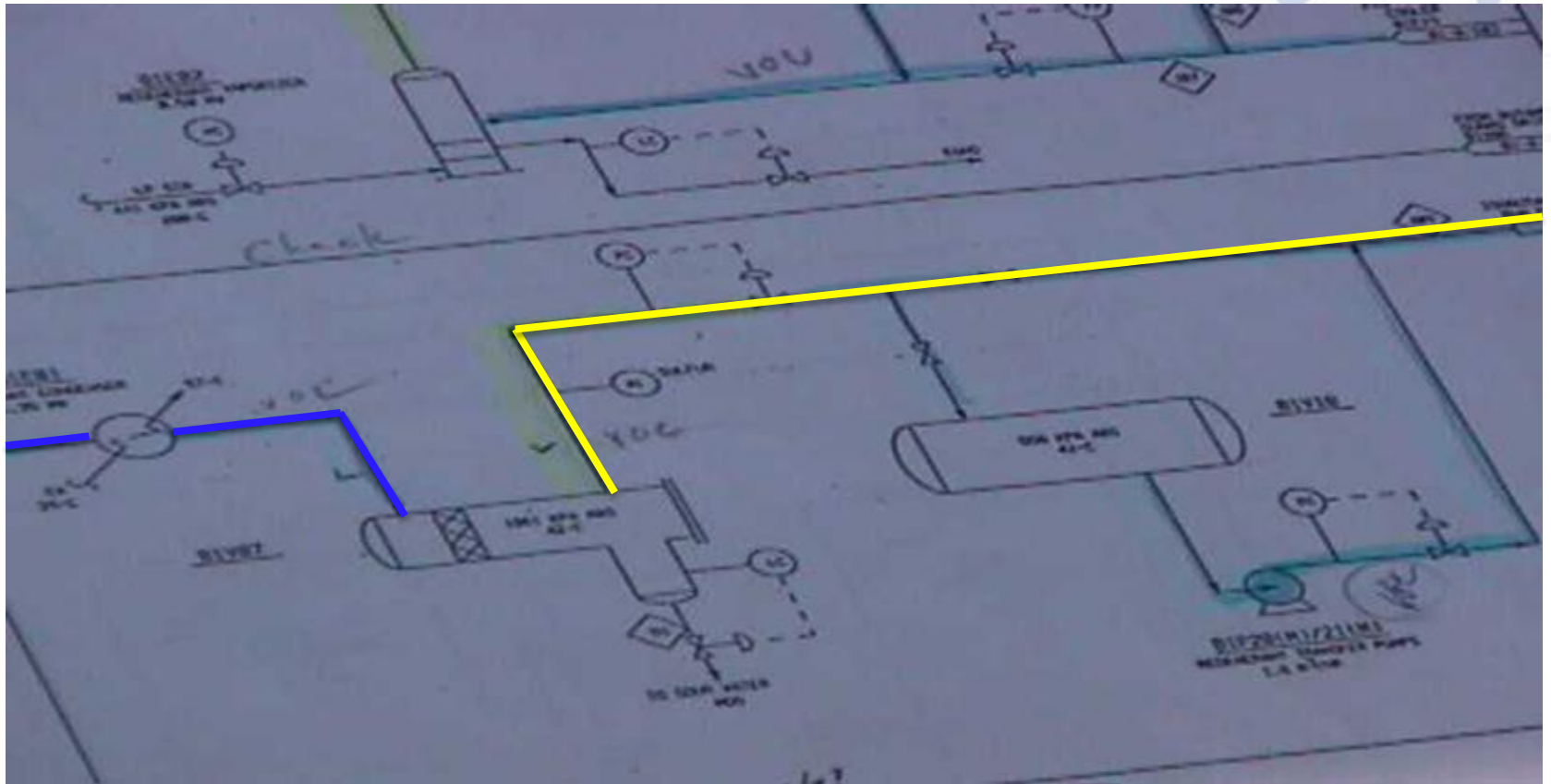
BEST PRACTICE CASE SCENARIO

Implementation Methodology



Process Research

Identify the stream if it's liquid or vapor



Identify the stream if it is HAPS or VOC

HAPS examples

Hexane

Naphthalene

Nitrobenzene

VOC examples

Propane

Phosgene

Benzene

Material Balance & Calculation



Stream No	Lbmole /hr	125/HAP			
		HAP			
		Mol Wt		Kg MOL/hr	WT
H2O (Water)	18	13	6.13	110.29	0.15
H2 (Hydrogen)	2	112	50.88	101.76	0.14
H2S	34	302	137.11	4672.97	6.28
NH3	17	10	4.61	78.50	0.11
DGA	105	0	0.00	0.00	0.00
C1 (Methane)	16	43.74	19.88	318.11	0.43
C2 (Ethane)	30	36	16.34	490.09	0.66
C3 (PROPANE)	44	233	105.99	4663.60	6.27
IC4 (I-BUTENE)	58	442	201.00	11658.26	15.68
NC4 (n-Butane)	58	197.77	89.90	5213.94	7.01
IC5 (i-Pentane)	72	464.99	211.36	15217.85	20.46
NC5 (n-Pentane)	72	121.23	55.10	3967.53	5.34
C6	86.1762	711.48	323.40	27869.38	37.48
Total			1221.70	74362.29	100.00

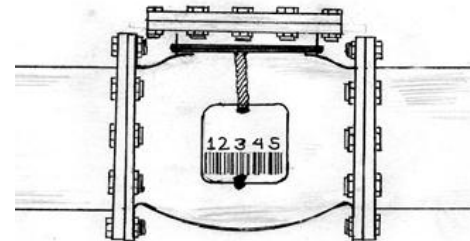
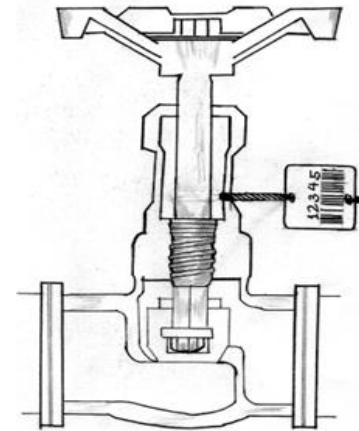
Stream No		174/VOC			
		VOC			
		Mol Wt		Kg MOL/hr	WT
H2O (Water)	18	1	0.65	11.70	0.08
H2 (Hydrogen)	2	2	0.94	1.87	0.01
H2S	34	55	25.17	857.76	5.99
NH3	17	0	0.00	0.00	0.00
DGA	105	0	0.00	0.00	0.00
C1 (Methane)	16	2.68	1.22	19.49	0.14
C2 (Ethane)	30	7	3.27	98.18	0.69
C3 (PROPANE)	44	89	40.48	1781.20	12.44
IC4 (I-BUTENE)	58	238	108.19	6274.81	43.83
NC4 (n-Butane)	58	119.06	54.12	3138.85	21.92
IC5 (i-Pentane)	72	60.01	27.28	1963.96	13.72
NC5 (n-Pentane)	72	4.88	2.22	159.71	1.12
C6	86.1762	0.23	0.10	9.01	0.06
Total			263.63	14316.55	100.00



Flagging on the Field



Tagging



Documentation



Sample of documentation

TAG NUMBER: 001619	LOCATION: Highlight text DF R-2230 2PV-210001	
LEVEL: 65	COMPONENT: VLV	PRODUCT CODE: 4-22
ACCESS: A	SIZE: 2.000	SERVICE: L
SUBPROCESS: 2200V	CONFIGURATION: EA	WARRANTY:
CHARACTERISTIC: CV	CHANGE DATE: 08/14/09	CHANGE BY: 1368
LINE NUMBER: U	P AND ID NUMBER: 3408-XZ-DM-2210	EQUIPMENT ID: 14
ROUTE SEQUENCE: 388.00	MANUFACTURER: U	UNDER 300 HRS SVC: No
DATE INSTALLED: 08/14/09	REMOVED FROM SVC:	
COMMENTS:		

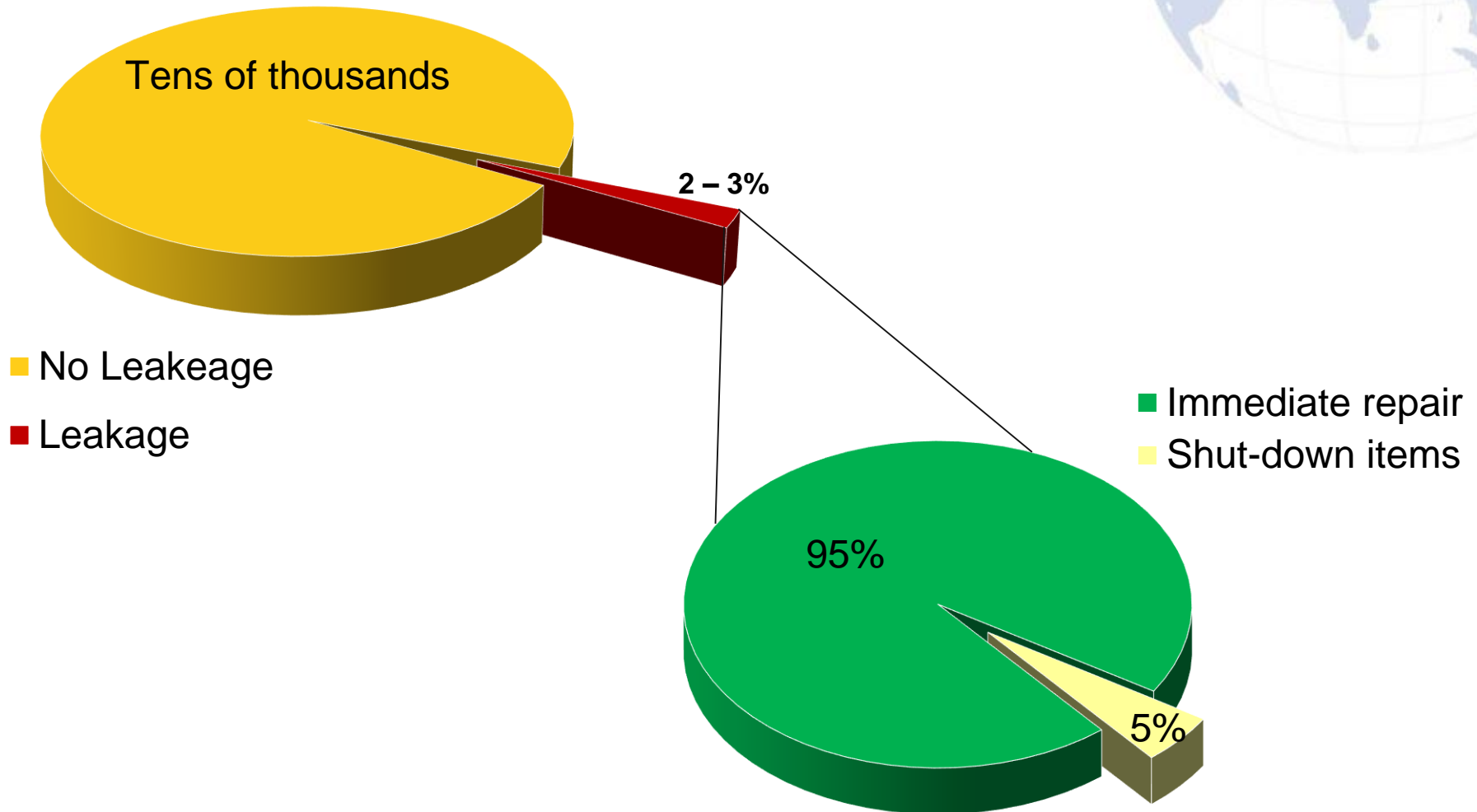
TAG NUMBER: 001620	LOCATION: 4FT N SIDE OF F-2340 CNLP 2FV-240015	
LEVEL: 85	COMPONENT: VLV	PRODUCT CODE: 33-22
ACCESS: A	SIZE: 6.000	SERVICE: V
SUBPROCESS: 2200V	CONFIGURATION: EA	WARRANTY:
CHARACTERISTIC: U	CHANGE DATE: 08/14/09	CHANGE BY: 1368
LINE NUMBER: U	P AND ID NUMBER: 3408-XZ-DM-2240	EQUIPMENT ID: 130
ROUTE SEQUENCE: 445.00	MANUFACTURER: U	UNDER 300 HRS SVC: No
DATE INSTALLED: 08/14/09	REMOVED FROM SVC:	
COMMENTS:		



MONITORING Toxic Vapor Analyzer



MONITORING Toxic Vapor Analyzer



Building in House Capacity

Permanently Assigned
Two Employees



Trained and Certified



Established a Complete LDAR Lab



Purchased Two Toxic Vapor Analyzers



SMART LDAR TECHNOLOGY

- Piloting the Autonomous Gas Leaks Detection System (IntelliRed) Smart LDAR Camera.
- Uses thermal imaging and visible camera that can remotely and autonomously detect hydrocarbon gas leaks.





Thank you!