



Crude Oil Pipeline Security: Minimizing Illegal Tapping Using “Solids” System

Muhammad Rais

PT. Pertamina Gas

Gedung Oil Center Lt. 1,2,3, & 4

Jl. M.H. Thamrin Kav. 55, Jakarta Pusat, Indonesia 10350

Corresponding author: muhammad.rais@pertamina.com

Manuscript received: June, 9th 2020; Revised: August, 4th 2020

Approved: August, 30th 2020; Available online: September, 4th 2020

ABSTRACT - One of subsidiaries of Pertamina is Pertamina Gas which manage special task in operating crude oil transportation $\pm 15,000$ barrel oil per day (BOPD). In the operation still occur illegal tapping activities and risk of pipeline product theft is a major concern to industry. In 2012, oil thieves drills 748 illegal taps or an average 2 times every day. Losses from transportation approximately 40% per day and loss revenue more than \$20 million a year. The activities of illegal tapping by cutting into pipelines can cause pipeline ruptures and explosions, leading to human casualties, destruction of property, and damage to the environment. Pertamina Gas reported that illegal taps rise to 400% from 2010 until 2013 and effort was taken to minimize illegal tapping frequency and develops integrated system that includes supervision and security of assets along the pipeline called “Security and Oil Losses Management with Integrated Detection System (SOLIDS)”. This system includes liquid management system (LMS), pipeline leak detection system (PLDS), security team patrol, emergency response team (ERT), radio communication-CCTV and corporate social responsibility (CSR). The implementation of SOLIDS is an effective oil loss detection technologies and pipeline security that detect product thefts quickly and accurately locate illegal tapping points. SOLIDS investment costs are still smaller than the company’s losses due oil losses and environmental impact. Pertamina Gas has been succeeded in reducing losses from illegal taps. In 2012 the number of illegal tapping cases 748 points and decreased significantly in 2018 as many as zero case. Consistent implementation of this system will provide solution in reducing losses and illegal tapping under all operational conditions.

Keywords: Crude Oil, Illegal Tapping, SOLIDS, LMS, PLDS, ERT, CSR.

© SCOG - 2020

How to cite this article:

Muhammad Rais, 2020, Crude Oil Pipeline Security: Minimizing Illegal Tapping using “Solids” System, *Scientific Contributions Oil and Gas*, 43 (2) pp., 59-67.

INTRODUCTION

Pertamina Gas Central Sumatera Area (Pertamina Gas CSA) is one of the operational areas of Pertamina Gas which transporting crude oil through 262 kilometers of pipeline from Tempino to Sei Gerong with pipeline diameter of 8”. The Crude oil flowed by $\pm 15,000$ BOPD from the oil field located in the working area of Jambi and South Sumatra, Indonesia. Crude oil is then processed at Refinery Unit III Pertamina. Along right of way (ROW) Pertamina Gas Central Sumatera Area has 5 booster station and 2 metering station.

Based on Ministerial Decree No. 380K/07/Mem/2008 dated August 26, 2008, the government has established Pertamina Gas CSA working area as one of the national vital objects. In the operation of crude oil transportation still occur illegal tapping of oil, resulting in losses and cause environmental pollution.

In the operation of crude oil transportation still occur illegal tapping of oil, resulting in oil losses and cause environmental pollution. The effort taken to reduce the frequency of illegal tapping is to create an integrated system that include supervision and

security of asset along the pipeline called security & oil losses management with integrated detection system (SOLIDS).

Illegal Tapping

Illegal tapping is an illegal activity to leak the pipeline with the intention of taking some of the oil flowing through the pipe. Methods for illegal tapping is leak pipe in the hidden location, sabotage and community involvement. The occurrence of illegal tapping can have an impact on environmental problem such oil spill and can cause fire.

Oil theft use methods hot-tapping and cold-tapping to perform oil bunkering and steal barrels of oil per day from established oil pipelines. In addition to stealing oil from the pipelines, oil theft can also occur during the transportation of the crude oil product to the illegal oil shipping terminal.

METHODOLOGY

Security and Oil Losses Management with Integrated Detection System (SOLIDS)

Pertamina Gas CSA develops integrated systems ranging from asset safeguards to use of technology

to detect oil leaks along the Tempino - Sei Gerong pipeline with SOLIDS system as can be seen in Figure 3.

The SOLIDS system consists of :

Liquid Management System (LMS)

LMS is a system to control and monitor crude oil distribution. This system monitors operational parameters such as pressure, flow rate, temperature, tank level and differential pressure.

Pipeline Leak Detection System (PLDS)

PLDS is a leak location detection system or theft on the pipeline by pressure wave method. This system detects the cause of the decrease in the operating pressure of the crude oil transportation and determines the location of oil pipeline leaks based on the negative wave pressure data received by the transmitter installed on a particular pipe segment (Zhang & Twomey, 2000).

According to API RP 1175, Pipeline leak detection methods have many kinds like inline inspection, volume balance, negative pressure wave etc. Pertamina Gas CSA choose leak detection system with negative pressure wave method.

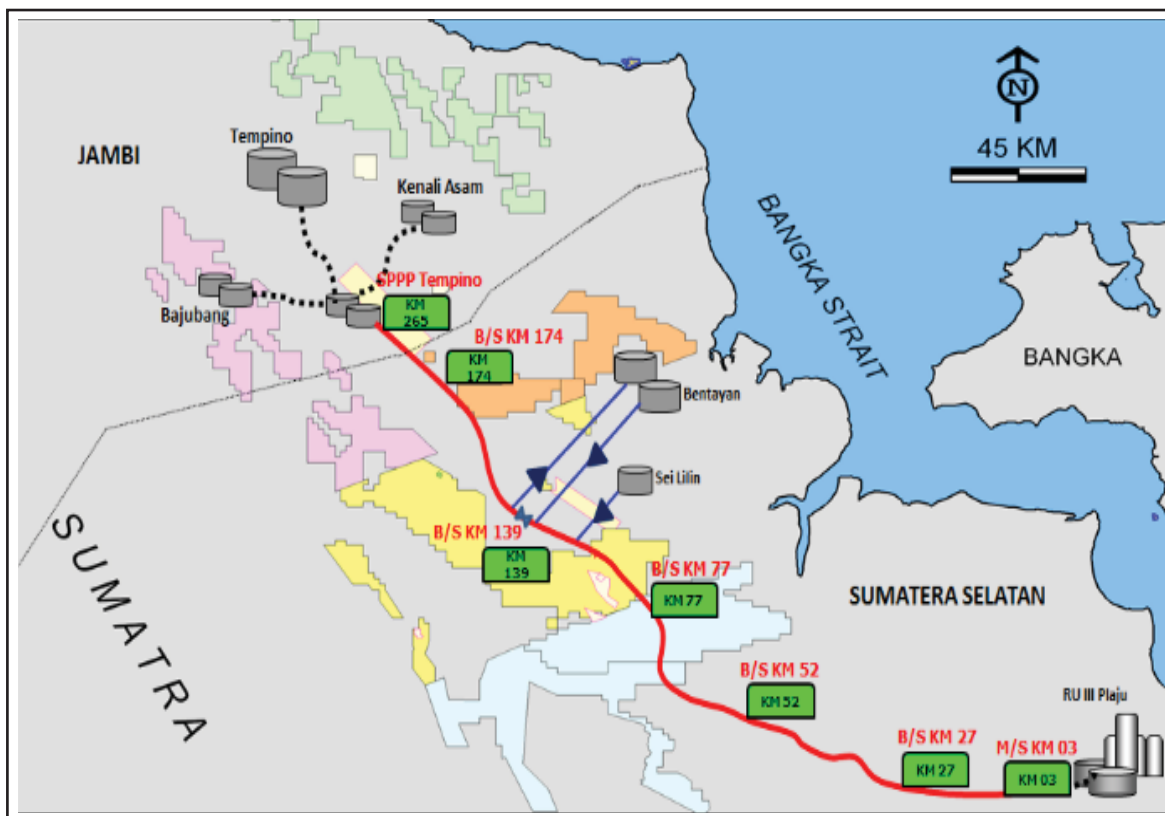


Figure 1
Crude oil pipeline tempino-sei gerong.



Figure 2
Illegal tapping on hidden area.

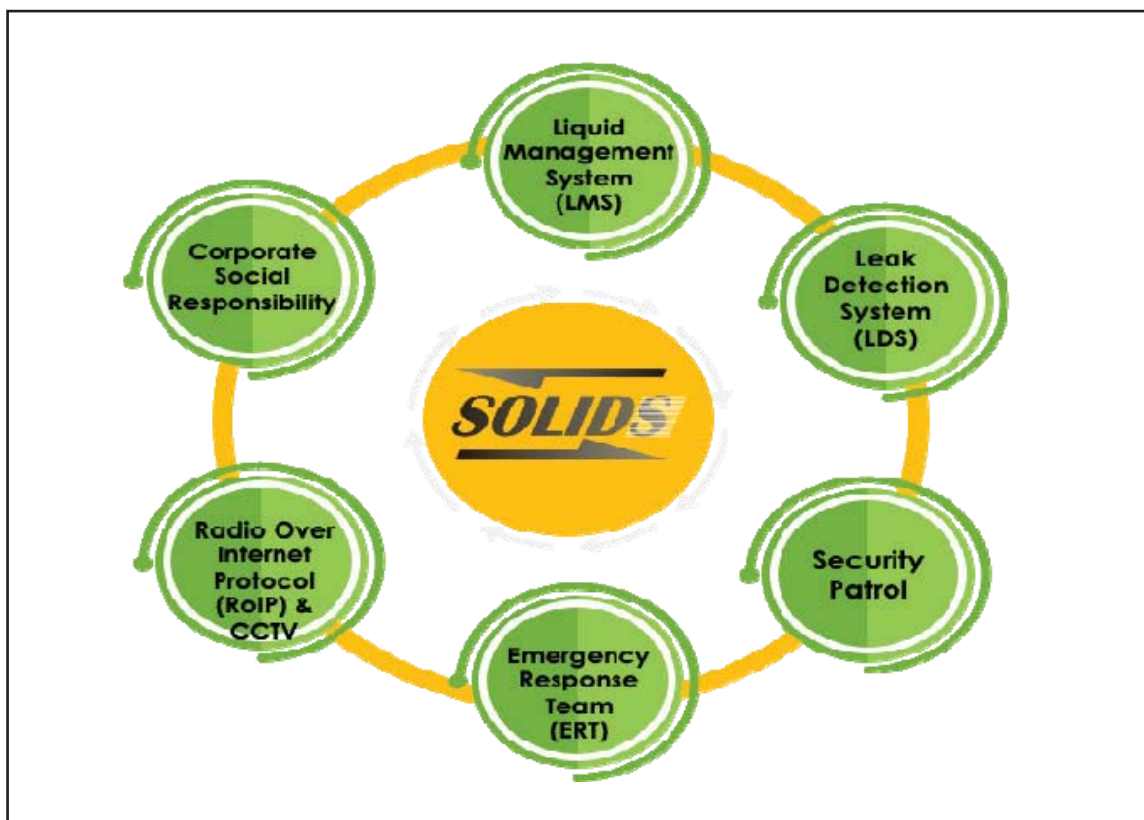


Figure 3
Security and *Oil losses management with integrated detection system* (SOLIDS).

Detection system can analyze when leak occur in pipeline and give the notification alarm location and time of the leak. Leak detection system use HMI for operation and monitoring real time. Operator can be known situation along the pipeline such as pigging activity and start-stop shipping pump.

Display the pipeline position on a map show the operational parameter such as pressure and flow. When occur illegal tapping occur, LDS can give the notification on the map with red alarm (location and time) leak. The alarm is result from pressure

drop calculation, and pressure trending from history database as can be seen from Figure 8.

Every alarm event leak or theft, the software can be saved until 6 months. LDS system can detect the cause of the decrease in operating pressure and detect the location of pipeline leakage with 98% accuracy and prevent the loss of the company due to oil transportation losses. Pertamina Gas CSA has limit for performance leak detection system maximum 1% every segment. Every month Pertamina Gas CSA carry out on tuning test to minimize false alarm.

Performance leak detection system can be seen in Table 1.

Security Patrol

Security patrol is surveillance and security system along the pipeline equipped with GPS Tracker attached to personnel and operational vehicle units.

The security patrol carries out supervision on all assets of Pertamina Gas CSA including warning sign, ROW boundary marker, test point and others that are reported periodically.

Emergency Response Team (ERT)

Is a team formed to conduct emergency counter measures along the pipeline. Emergency conditions include risk mitigation due to illegal tapping and leaking. Activities include emergency response team, heavy equipment, work equipment and material procurement.

The activities of ERT are effective in dealing with the effects of illegal tapping quickly and effectively so that loss of oil (losses) and environmental damage can be minimized.

Radio Communication & CCTV

This tool is located in booster station and patrol vehicle with the aim that communication between booster station, booster with MCS, mobile radio and point to point can run well. This tool is effective for sending information from the field about operational conditions as well as security disturbances in the pipeline, so that countermeasures can run quickly and precisely. CCTV installed in the booster and metering station to be able to monitor and record images in real time as well as to know the activities and activities that are taking place inside the booster and metering station.

Corporate Social Responsibility (CSR)

Pertamina Gas also coordinates and persuasive approaches with local village officials to secure the existence of oil pipelines in our ROW. Corporate social responsibility (CSR) program is also very helpful in conducting activities and approaches to the community based on the social mapping. Pertamina Gas determined five fields that were prioritized in CSR implementation: education, health, environment, community development and donation.

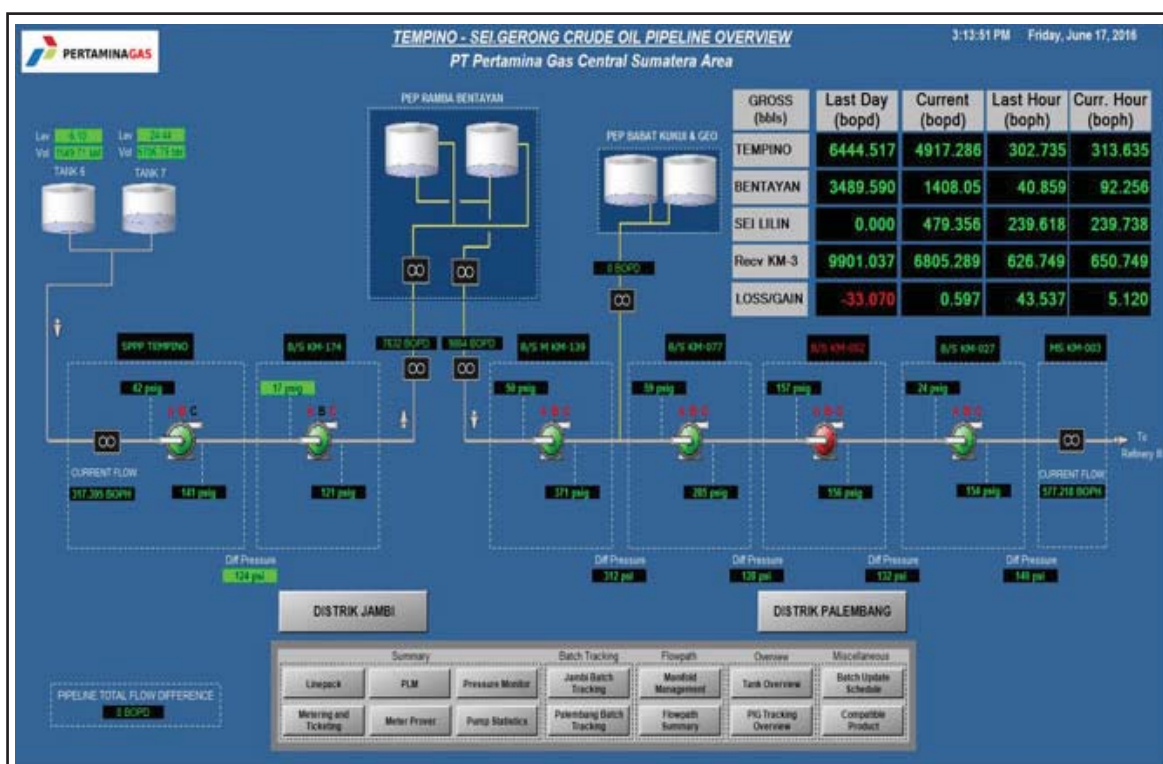


Figure 4
Liquid management system (LMS).

Table 1
Performance LDS Pertamina Gas CSA

Date detected	KM detected	Actual leak	Error (KM)	% Error
16 December 2015	228.456	230.000	1.544	0.582
2 January 2015	183.401	183.050	0.351	0.132
14 January 2015	192.068	190.800	1.268	0.478
19 January 2015	214.521	214.800	0.279	0.105
5 February 2016	193.050	195.950	2.900	0.795
7 February 2016	236.160	235.100	1.060	0.399
10 February 2016	181.514	181.800	0.286	0.108
14 February 2016	209.670	208.500	1.170	0.441
27 February 2016	210.474	210.400	0.074	0.028
16 April 2016	193.200	192.007	1.193	0.449
12 May 2016	193.600	193.600	0.000	0.000
14 June 2016	191.800	191.800	0.000	0.000



Figure 5
Expectation leak detection system (Atmos, 2019).

RESULTS AND DISCUSSION

LMS provides supervisory control and data acquisition system, which will allow Pertamina Gas to monitor oil status in each section of the 265 km pipeline, running from Jambi Central Sumatera, to Palembang South Sumatera.

Control room in Palembang will use these system to monitor and control information coming from the pipeline. In addition, Pertamina Gas used liquid pipeline operational support software system, to measure the amount of oil in the pipeline and for

batch control purposes. LMS allow to make real-time business decisions using data acquisition, control, and advanced operational applications, providing secure actionable information.

Illegal tapping points occur not only financial impacts of the loss of crude oil product, but the potential explosions that lead to loss of lives and homes. Reliable and sensitive theft detection from these PLDS system is more important in order to detect leaks quickly, locate leaks accurately and minimize false alarm.

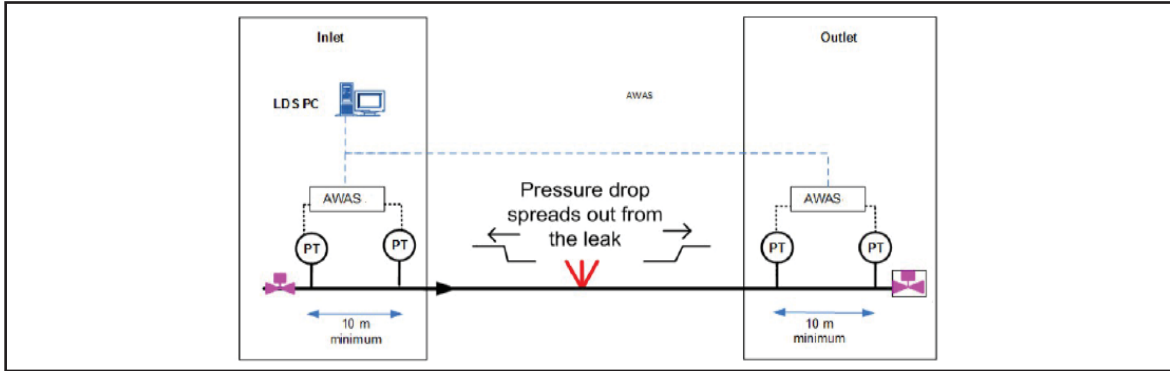


Figure 6
Principle pipeline leak detection system leak (Atmos, 2019).

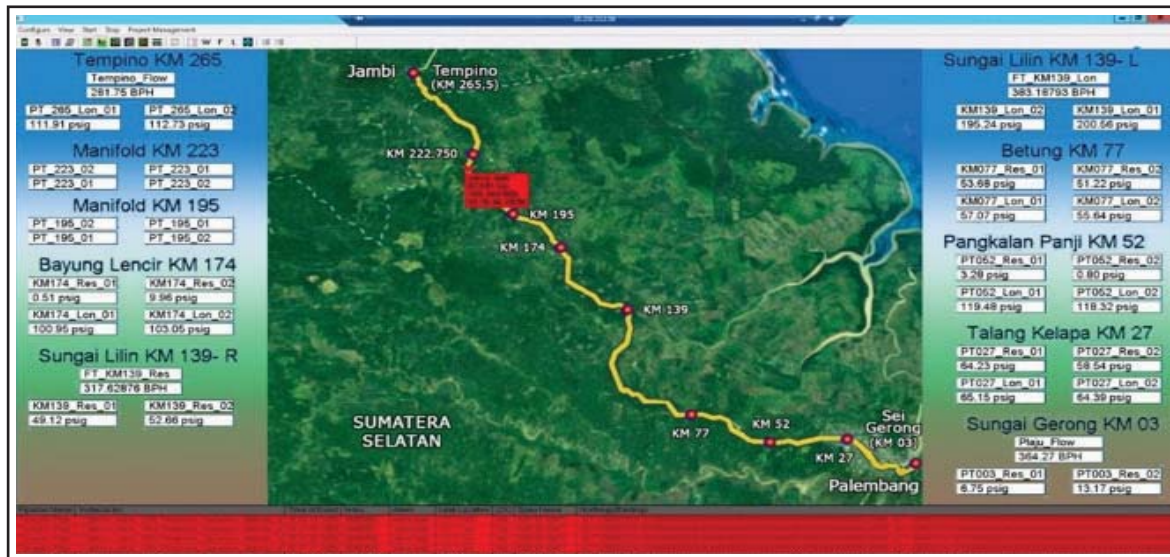


Figure 7
Display LDS Pertamina Gas CSA.

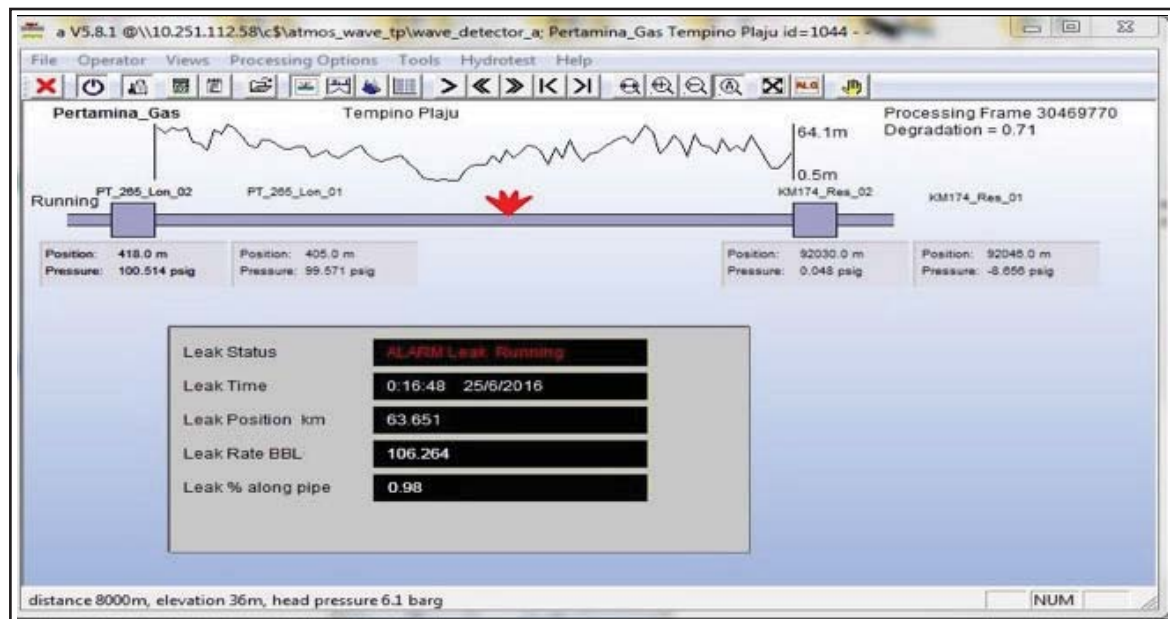


Figure 8
Pressure trending LDS (Atmos, 2019).

Crude Oil Pipeline Security: Minimizing Illegal Tapping using "SOLIDS" System (Rais, M.)

With the existence of a security cooperation agreement on the oil pipeline, it can maintain security and order in the community, maintain oil pipelines and good relations with the community. Emergency response team (ERT) respond to any emergency incident. ERT is very effective for minimizing oil spill, carrying out environmental rehabilitation, minimizing losses in the event of a fire or other incident.

The oil pumping station is equipped with radio communications and CCTV. The use of video cameras to monitor the interior and exterior of a property, transmitting the signal to set of monitors. Radio communication and CCTV system is a cost-effective form of security. Once the system has been installed they are very easy to maintain and require little reparations.

CSR demonstrate company's commitment to help their community. The CSR program has succeeded

in enhancing the company's reputation and credibility through environmental social responsibility activities that are integrated with business strategies for the benefit.

From consistent implementation of SOLIDS and supported by good coordination with government and CSR program along the ROW. Pertamina Gas CSA succeeded in reducing illegal tapping from 2010 until 2018 which can be seen in Figure 12.

In 2010 the frequency of illegal tapping was 131 points and increased dramatically in 2012 by 748 points. With the implementation of SOLIDS, the frequency of illegal tapping from 2010-2018 has been greatly reduced and by 2018 Pertamina Gas CSA has succeeded in reducing the frequency of illegal tapping to zero.

The system will continue and continue to maintain the consistency and security of national vital objects through Pertamina Gas CSA operations.



Figure 9
Security patrol team.



Figure 10
Emergency response team.



Figure 11
Monitoring station by CCTV.

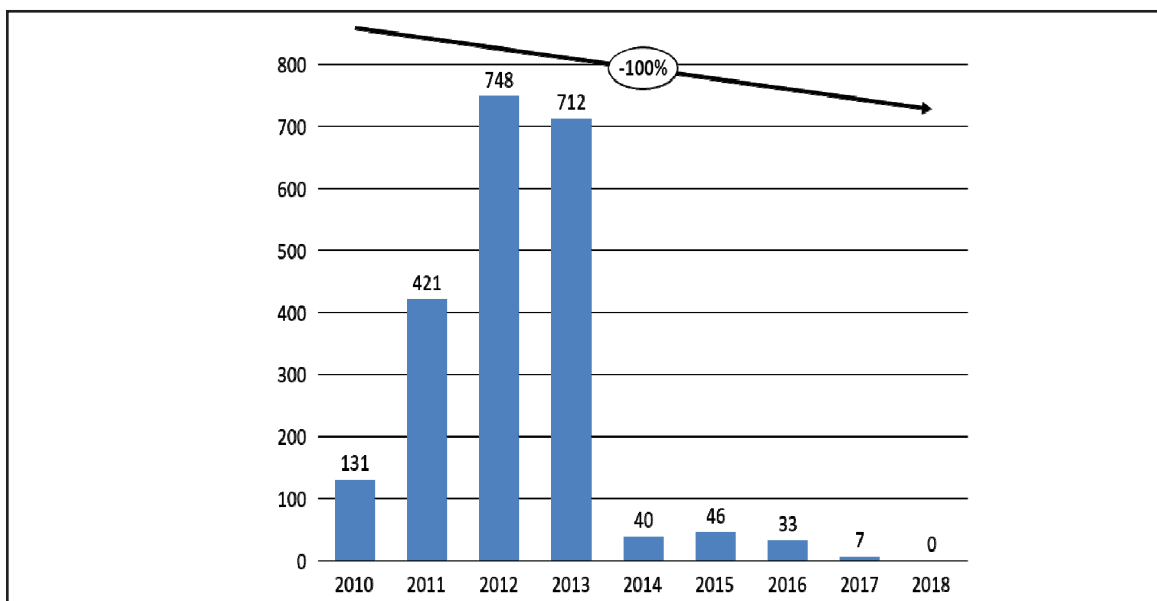


Figure 12
Decrease in Illegal tapping event year 2010 - 2018.

CONCLUSIONS

From the above exposure can be summed up, cases of illegal tapping decreased from 748 cases in 2012 to 0 case in 2018. Pertamina Gas has successfully conducted various efforts in tackling illegal tapping with SOLIDS through optimization of Liquid Management System (LMS), Pipeline Leak Detection System (PLDS), Security Patrol, Emergency Response Team (ERT), Radio communication & CCTV and Corporate Social Responsibility (CSR).

Implementation of SOLIDS, empowerment and improvement of good relations with the community can help tackle the case of illegal tapping.

ACKNOWLEDGMENT

I am enormously grateful to my supervisor, Asep Mulyana Manager Central Sumatera Area PT Pertamina Gas and all members for warm support and thoughtful guidance.

GLOSSARY OF TERMS

Symbol	Definition	Unit
SOLIDS	security & oil losses management with integrated detection system	
LMS	Liquid Management System	
PLDS	Pipeline Leak Detection System	
ERT	Emergency Response Team	
CSR	Corporate Social Responsibility	
CSA	Central Sumatera Area	
ROW	Right of Way	
API RP	American Petroleum Association Recommended Practice	
HMI	Human-Machine Interface	
GPS	Global Positioning System	
MCS	Master Control System	

REFERENCES

- American Petroleum Institute (API)**, 2015. *Pipeline Leak Detection Program Management, 1st Edition*, American Petroleum Institute (API).
- Atmos International**, 2019. *Atmos Wave Product Service & Brochure*. [Online] Available at: <https://www.atmosi.com/en/productsservices/atmos-wave/> [Accessed 2019].
- Zhang, J. & Twomey, M.**, 2000. *Implementing a Reliable Leak Detection System on a Crude Oil Pipeline. Advance in Pipeline Technology, Dubai*. California, REL Instrumentation Incorporated.