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CALCULATING THE NUMBER OF GAS PILOTS AND LNG CIRCULATING IN THE MABOG LINE (MARINE BOIL OF GAS) COOLING SYSTEM AT PT. PERTA ARUN GAS

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ABSTRACT

Along with the development of PT. Perta Arun Gas, the challenges to refinery operations also have a significant impact, the company is expected to be able to minimize even the slightest losses that may occur during the industrial process. One of them is that in the flow of the LNG distribution (loading) process to ships, the formation of Boil-Off Gas (BOG) as a result of the expansion in the loading room is inevitable. So that the BOG that forms must be eliminated so as not to cause overpressure in the ship's tank, the B-6803/4 marine flare facility is available to burn the formed BOG so as not to pollute the environment if the gas is directly discharged into the atmosphere. The main tool in this recovery system is the Atomizer, which aims to reduce the temperature of the BOG by atomizing a certain amount of LNG with pressurized vapor gas into the BOG input flow so that heat transfer occurs so that it is in accordance with the specifications of the compressor feed temperature. After a series of calculations, it was found that the total LNG and gas buffer needed to be able to cool the MaBOG line during the loading process with an estimated time of 12.3 hours was 305.6 m3 for LNG and as much as 0.069 mmscfd for gas buffer. This need is in the background with the adjustment of the outlet temperature setting of the second section atomizer (V-6805/13-24) is -140 °C and with the input temperature in HV-68108 which is -80 °C. In addition, after obtaining a calculation model to obtain the value of LNG and gas buffer requirements, the author also tried to conduct some systematic analyses on the influence of LNG and gas buffer requirements on changes in BOG inlet temperature using MS. Excel.

keyword : LNG, *Boil-Off Gas*, *Buffer* Gas

INTRODUCTION

The Arun NGL refinery in Lhokseumawe, Aceh, is one of the largest facilities in the liquefaction of natural gas in the world. Although in its heyday in 1994, this refinery produced 76,000 m3/day of liquefied natural gas (LNG), but as time went on, the natural gas reserves in the Block B and NSO wells were getting thinner. As a result, the production of the Arun refinery has decreased significantly since 1995. This situation has a direct impact on several surrounding industries, which have been forced to stop operations due to a lack of gas supply as a raw material and source of energy.

To overcome this crisis, the Indonesian government decided to revitalize the Arun NGL refinery into an LNG re-gasification and receiving terminal (hub). PT. Perta Arun Gas (PAG) took over this operation and became the main gas distributor for the needs of Aceh and North Sumatra. The details of the needs of industrial gas and power plants in Aceh and North Sumatra are as follows, 145 MMSCFD for PT. Pupuk Iskandar Muda, 15 MMSCFD for the Aceh Government Electrification program, 10 MMSCFD for PT. Aceh Kraft Paper and 125 MMSCFD for the availability of gas fuel in the Medan area. With a total gas demand of 295 MMSCFD and an installed capacity of 400 MMSCFD, LNG supply is obtained from the Bontang and Tangguh refineries.

The duties of PT. PAG as an *LNG-hub* business started on April 2, 2019 with the arrival of Grace *Baleria*'s first cargo LNG from Australia which has a contract with one of the major companies in Japan. Furthermore, the LNG will be stored in PAG's F-6001/2 tanks and will be retrieved at the specified time.

With the increasingly busy LNG-hub and regaification business, PT. PAG as one of the energy companies in Indonesia supports the government's program, namely *Net Zero Carbon*, by minimizing gas combustion/*flaring* during the *Reloading process*.

This reloading *process* is the retrieval of LNG that has been stored at PT. PAG by the LNG owning company. In the process of *reloading* the pressure or BOG of the ship tank, it will increase, so it is necessary to release the BOG that will be sent to land. BOG released from the ship is expected not to be *flared*. Therefore, PT. PAG utilizes the BOG from the ship's tank so that it can be used as *a feed* compressor K-6801 A/B/C/D. But with the ship's tank BOG temperature ranging from -80^{o}C, it is not in accordance with the design of the compressor's

temperature suction which requires a temperature of (-130 ~ -150)ºC. So that the BOG from the ship's tank will be cooled first through three overall stages, namely: using *atomizer section 1st, atomizer section 2nd,* and MaBOG.

Atomizer is a fog device equipped with a nozzle to spray fluids, namely a mixture of LNG *liquid* and pilot gas, while MaBOG is a cooling drum with the working principle of connecting BOG from ships and circulating LNG *liquid* from G-6802 C/D pumps *Atomizer sections 1st* and *2nd* have 12 atomizer points on each *section*. So far, there is no theoretical data on how many optimal *atomizers*, gas and LNG pilot points are used every time a reloading is carried out. So the author wants to research how much LNG *liquid* and the optimal pilot gas are used every time a *reloading is carried out*.

The success of this research will not only increase the operational efficiency of PT. PAG, but also made a great contribution to PT. PAG and power plants in the region. By deeply understanding the dynamics of gas flow, researchers will develop strategies that optimize the use of gas pilots and LNG circulation. This will not only increase productivity, but also reduce losses in the gas production and distribution process.

EXPERIMENTAL METHODOLOGY

Process Equipment Unit Name

The process equipment units in this process are: MaBOG Recovery Includes: Atomizer Section 1 and 2, drum D-6804, G-6803 A and B, and K-6801 C/D

Performance Indicators

In this thesis, the operating conditions from the ship's BOG flow to the MaBOG System facility are the main object of data collection. In this operating condition, the data variables taken are in the form of temperature, pressure and flow rate of both the inlet and outlet of the MaBOG system. Data collection was obtained directly at PT Perta Arun Gas.

Procedure for Running MaBOG

Methods, Techniques, and Tools

1. Method: Vapor return to MaBOG line system will be desired by LNG through atomizer, LNG supply to atomizer is transferred from the circulation pump is carried out continuously
2. Technique: The MaBOG line is cooled down with LNG and maintained with an atomizer. The BOG from the reloading results when it has reached a temperature of -143oC is returned by MaBOG to recovery to tank storage.
3. Tools: Circulation pump (G-6802 A/B/C/D), F-6801/02/03/05, Berth-3, B-6803/04, D-6804, GM-6803 A/B, K-6801 A/B/C/D, atomizer and accessories, personal protective equipment (PPE) such as: shoes, helmet, gloves, mask,

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Work Instructions

Preparation

1. Make sure both the 28" and 30" MaBOG lines have cooled down 2-3 hours before the "Pilot On Boand" with the three TI indicators in the following sets: TI-6892 & TI-6893 are – 80o C & 100 º C, TI-6894 at -150 ºC to -140 ºC sets
2. Make sure the 30" block shell is in the opening position and the HV-68108 cover
3. Maintain a level in the Quenching Drum (D-6804) of 40-50% by auto-operating the LV-6817 and TV-6894
4. Maintain PV-68217 full opening position
5. Maintain all LNG tank pressures between 700-800 mmH2o. If needed, it can run three units of BOG compressor.

Procedure

1. LNG shipping currently operating at Berth-3
2. On service Transmitter FT-6837 (Flow MaBOG from ship tank)
3. Set the HV-68108 opening slowly and leave the HV-68109 in the closed condition.
4. The atomizer opening in front of the marine office as needed with a temperature reduction monitor on TI-6892 and TI-6893 gas flow to the Queching Drum (D-6804) and PV-68216 on flare B-6804 if the MaBOG temperature is low below -143 ºC, all MaBOG can be flowed to the MaBOG system.
5. Set TV-6892, TV-6893 and TV-6894 so that the target temperature is reached as follows: TV-6892 shows -125 ºC, TV-6893 shows -140 ºC, TV-6894 shows -155 ºC.

RESULT AND DISCUSSION

After a series of calculations, it was found that the total LNG and *gas buffer* needed to be able to cool the MaBOG line during the loading process with an estimated time of 12.3 hours was 305.6 m3 for LNG and as much as 0.069 mmscfd *for gas buffer*. This need is in the background with the adjustment of the outlet temperature setting of the second section atomizer (V-6805/13-24) is -140 °C and with the input temperature in HV-68108 which is -80 °C.

In addition, after obtaining a calculation model to obtain the value of LNG and *gas buffer requirements*, the author also tried to conduct some systematic analyses on the influence of LNG and *gas buffer* requirements on changes in BOG inlet temperature using MS. Excel. The correlation of LNG demand and *gas buffer* to the change in the inlet temperature variable is plotted by the author in the following graph.

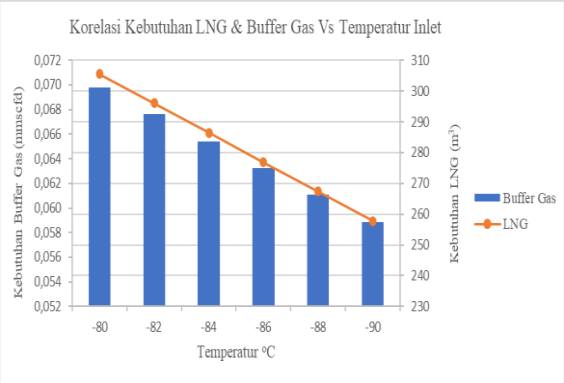

Figure 1. LNG and *Gas Buffer* Requirements Chart Vs Inlet Temperature

From the graph data above, it can be concluded that the colder the temperature of the BOG that enters the MaBOG *Recovery System*, the need for LNG and *the required gas buffer* will be less, and vice versa. In BOG that enters with a temperature of -90°C, the LNG and *gas buffer* needs are 257.8 m3 and 0.058 mmscfd, respectively, while in the BOG that enters with a temperature of -82°C, the LNG and *gas buffer* needs are 296.03 m3 and 0.067 mmscfd, respectively. The difference in LNG and *gas buffer* needs is due to the higher the incoming BOG temperature, the heat that must be removed from the system will be greater when compared to the cooler BOG inlet temperature. BOGs that enter with a temperature of -82°C must release heat of 3,162 mmbtu/hr, while BOGs that enter with a temperature of -90°C only release heat of 2,673 mmbtu/hr.

CONCLUSIONS

The MaBOG *Recovery System* functions to repurchase or reuse the BOG formed during the LNG loading process, this aims to reduce *the losses* that can occur if directly burned in *the marine flare*, from the calculation results it is obtained that the amount of gas and LNG buffer needed for circulation for cooling the MaBOG line during the LNG loading process is equal to305.6 m3 LNG and 0.069 mmscfd gas buffer, the amount of heat that must be removed for each section is: 1st section of -1.8296 mmbtu/hr (Heat Release) and 2nd section of -1.4549 mmbtu/hr (Heat Release), the need for circulating LNG and gas buffer is influenced by the temperature and flow rate of the incoming BOG and the time required during the *recovery* process , based on Figure 4.3 Graph of LNG and *Gas Buffer* Requirements Vs Inlet Temperature in BOG entering with a temperature of -90°C, the LNG and *gas buffer* requirements are 257.8 m3 and 0.058 mmscfd, respectively, while in BOG entering with a temperature of -82°C, the LNG and *gas buffer* requirements are 296.03 m3 and 0.067 mmscfd, respectively. The difference in LNG and *gas buffer* needs is due to the higher the incoming BOG temperature, the heat that must be removed from the system will be greater when compared to the cooler BOG inlet temperature. With less LNG and *gas buffers* used, it will increase the efficiency of its use, the number of *atomizers* used in each section is: section 1st 4.6 and section 2nd section 3.8, with a total of 8.42 *atomizers*. So that the efficiency of using *atomizers* can be done by using only 8 *atomizers* out of a total of 24 *atomizers* on the *MaBOG line.*

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