The Hilltop Review

Volume 7
Issue 1 *Winter 2014*

Article 11

December 2014

Separation of the Petroleum System

Ali Ibrahim Neamah
Western Michigan University

Separation of the Petroleum System

Cover Page Footnote
I would like to offer my thanks to Dr. Said for his support and advise during the process of this research. I would also like to thank Western Michigan University Chemical Engineering program for presenting me with the opportunity to enhance my education. I would like to thank the South Oil Company of Iraq for my previous employment. And finally, I would like to thank Jessica Postma for her review of this research.

Separation of the Petroleum System

By Ali Ibrahim Neamah
Department of Engineering
aliibrahimnea.neamah@wmich.edu

Introduction

I was an employee at the South Oil Petroleum Company (Dhi Qar, Iraq) for two years. During this time, I learned a multitude of vital information that is necessary for engineers who work with crude oil separation and crude oil separation equipment. It is substantial and beneficial for the engineer to understand the equipment. This research focuses on the extraction of petroleum from the ground as well as the remaining steps used in the separation process of oil from the gases, water, and other various chemicals. This study includes the side design for some important equipment that is used in the separation system in the field.

This research will directly help and inform the employees of the necessary details of working in the oilfield. This study will inform regarding how best to deal with various chemical materials, equipment, how to avoid operational mistakes, and how best to deal with and solve those mistakes if they do occur. This research is crucial since it explains in detail the overall process of separating crude oil and the crude oil storage process. It also informs of how to know the quality of crude oil based on the American Petroleum Institute (API) - as well as how to recognize various pumps which are used in pumping oil from oil tanks to the export. I will also share my own personal work experience and information gained from working at the Nasiriyah Degassing Station.

Overall, this study will provide engineers and employees who work in the oilfield with needed and detailed information about the equipment and the chemical and physical nature of the oil mixture. In tandem with this are the necessary steps to open and close the oil wells, how to control the pressure temperature of the mixture of oil, the equipment used in the separation of oil from water and gases associated, and how to maintain the ideal temperature and pressure to get the best process for the separation of oil with a high efficiency.

The Origin of Crude Oil

There are a multitude of theories that refer to the origin of crude oil. One of the more popular theories is that oil may come from the bodies of tiny creatures and dead plants. The general idea of this theory is that the residue of animals and vegetation were deposited at the bottom of the ocean millions of years ago. Rocks containing organic material, mixed with sand and mud, were carried by rivers flowing into the sea, where they settled, layer upon layer, on the seabed. Due to old classes being buried deeply, the dissociation of organic materials occurs based on weight and pressure. The pressure generates heat and then two factors (pressure and temperature) are playing an important role in the decomposition of the organic materials.

Radiation, chemotherapy, and bacterial representation turn to the organic matter components of hydrogen and carbon, which in turn, develop into the material that we now know as petroleum. It is believed that these layers have, overtime, accumulated numerous sedimentary rocks (such as limestone, sandstone, and dolomite, among others) formed from thin and fragile particles, that have arranged into solid blocks. This occurs due to the tremendous pressure that is generated as a result of the accumulation of these rocks on each other (8).

The Composition of Crude Oil

The hydrocarbon chains of Al-naphthenic paraffin and aromatic compounds are included in the basic installation of petroleum 80-90% g. There are a relatively tiny amount of oxygenic compounds, sulfur, and nitrogen, and the properties of the physical and chemical petroleum are defined by the ratio of the chemicals involved in the composition (2 and 5).

The Classification of Crude Oil

The petroleum classification system is of great importance, as it determines the direction of oil refining and it establishes a list of the types of products and their quality. The hydrocarbon's composition affects the classification of petroleum. Petroleum contains some types of paraffins and other types of naphthenics - and those compositions have a direct influence on the overall classification of crude oil (3).

Petroleum Classified into Three Categories (6):

1. Oil Paraffinic: Paraffin waxes that contain trace amounts of asphalt materials.
2. Petroleum Asphalt: Large quantities of asphalt materials.
3. Crude Oil Mixed: This kind of crude oil has paraffin materials and asphalt materials.

The Physical Properties of Petroleum

1. Specific weight (relative) or American petroleum institute (API): The specific weight and density are the most important properties used when studying petroleum and petroleum products. However, these two properties are particularly important when calculating the weight and mass of petroleum products in cases in which they are appointed (8). The volume of these products is by direct measurement and the API starts from 10 to 50 API degrees with other kinds of petroleum being API between 10-45. (8).
2. Viscosity: The resistance of the liquid when removing one of the layers for another layer under the influence of an external force. It is discriminated between the dynamic viscosity and the relative (8).
3. Molecular Weight: Molecular weight depends on the petroleum molecular weight of the compounds involved and the ratio between them. It often ranges of ore from 250 to 300. And increasing the molecular weight of the oil raises the boiling point (8).

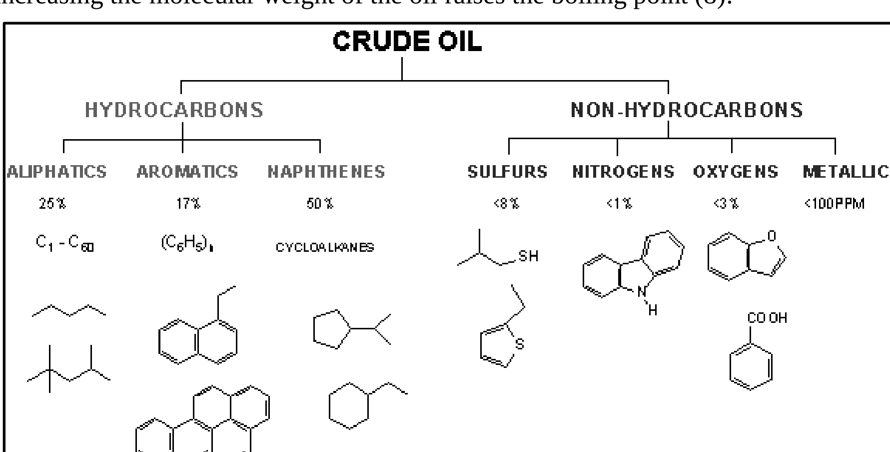

Figure 1: Chemical structure of crude oil (6)

The Structure of the Oil Well

The Wellhead

The wellhead is a set of valves designed to withstand high pressures. The first production pipe (the main valve (which has two valves)) and secondly, the second production pipe (the secondary valve (which also has two valves)) are two connected pipes extending from the well. These pipes later meet to form a single pipe production - and are Y-shaped (Y-PIECE). This single pipe contains the choke size valve, which controls the productivity of the well; this is followed by the safety valve. The primary purpose of this valve is to control the flow of the well and to discourage the occurrence of any damage to the line in the carrier oil from the well to the station. The safety valve has three secondary valves: upper, lower, and drain. This is then followed by the gate valve (7).

Figure 2: Oil Well, Nasiriyah Degassing Station

The Process of Opening the Well (7)

1. First make sure of the validity of all the parts associated with the head of the well and verify the flow tube.
2. Determine the size of the slot (chock size valve).
3. One of the main valves is opened for production (either the first or secondary production pipe)
4. Gradually open the secondary valve to even out the pressure of the gas stop.
5. The safety valve is opened when the pressure elevates to a higher level than the operating pressure of the station insulation process. The valve is to be open as follows:
    a. Secondary (upper and lower) valves of the safety valve must be closed.
    b. Open the drain valve to empty the remaining gas, then close it
    c. Open the safety valve.
    d. Open the lower safety valve gradually until the safety valve is completely open.
6. Gradually open the gate valve located on the tube production.
7. Repeat steps 3-6 for other wells (3 and 4).
8. The well is monitored for the purpose of ascertaining the validity of his work

The Process of Closing the Well (7)

1. Close the main valve of one of the two tube productions. Then close the secondary valve.
2. Close the main valves of the other tube production. Then close the secondary valve.
3. Close the safety valve:
    a. Close the upper valve within the safety valve.
    b. Close the lower valve within the safety valve.
    c. Open the drain valve. The safety valve will automatically close. Then close the drain valve.

NOTE: Do not close the main valve. If the well has been closed for a considerable amount of time, or in the case of a need for maintenance and/or reclamation, or any other process that requires a lock for the purpose of preserving it from damage, use the secondary valve and keep the main valve open.

Figure 3: Safety Valve, Nasiriyah Degassing Station

Manifold

The manifold is a collection of pipes and valves through which the amount of oil coming through the oil well is controlled. Oil is distributed to the insulators according to several variables - the most important of which is the capacity of the separator or energy production (bbl/day). Another vital variable is the production of each well of oil - and gas should not load separator capacity of more than operational (7).

Figure 4: Manifold, Nasiriyah Degassing Station

The Separation Stage

The number of separators differs from field to field - and that number depends on the amount of gases and water which are associated with crude oil. Large amounts of gas and water have a significant amount of separators. In this study, the Nasiriyah Degassing Station will be used as an example (7).

The Ideal Separator

The ideal separator is cylindrical or spherical in shape (and either vertical or horizontal) and it is divided in terms of the phase to two-phase or three-phase insulators. Insulators can be used for both horizontal and vertical purposes. The separator containing the inside beams and barriers strung from which to provide a larger surface area is spread by the crude oil inside to the top of the separator - and thus a bigger possible quantity of gas is liberated from crude oil. A simple separator consists of the following parts (7):

1. Located at the top of the separator is the inlet oil and located at the bottom of the separator is the exit oil.
2. Also located near the top of the separator is the Gas Exit Slot.
3. Exit hole and water discharge slot.
4. Contain separator and safety valves that are located at the top of the separator, This works on a gas discharge when it exceeds the pressure, due to the separator.
5. Provide insulation standards of pressure, level, temperature, and dominants.
6. Provide insulation level control valves and pressure control valves, as well as other types of valves of different use.
7. Contain separator slots maintenance and protective barriers.
8. Provide insulating pipes of different diameters both depending on their use.

Nasiriyah Degassing Station

The Nasiriyah Degassing Station consists of four stages (separators). The first stage is composed of two separators (one for standby). They are all horizontal (and cylindrical) in shape. Similar to other degassing stations elsewhere, there are many types of insulators - including vertical, horizontal, and spherical.

The oil enters from the top of the separator. The oil encounters bumpers as it progresses - these bumpers encourage the separating process. The bumpers also prevent the flow of oil from foaming. After the separation, the gas is naturally lifted and separated toward the top. Here it exits from the gas stream through a mesh located (near the start) within the pipe - while the oil moves downward due to the higher density. The oil remains at the bottom of the separator and exits from a pipe to the next stage. The function of the mesh is to strain the oil from the gas and prevent it from leaving - to ensure the exiting gas is free of oil (7).

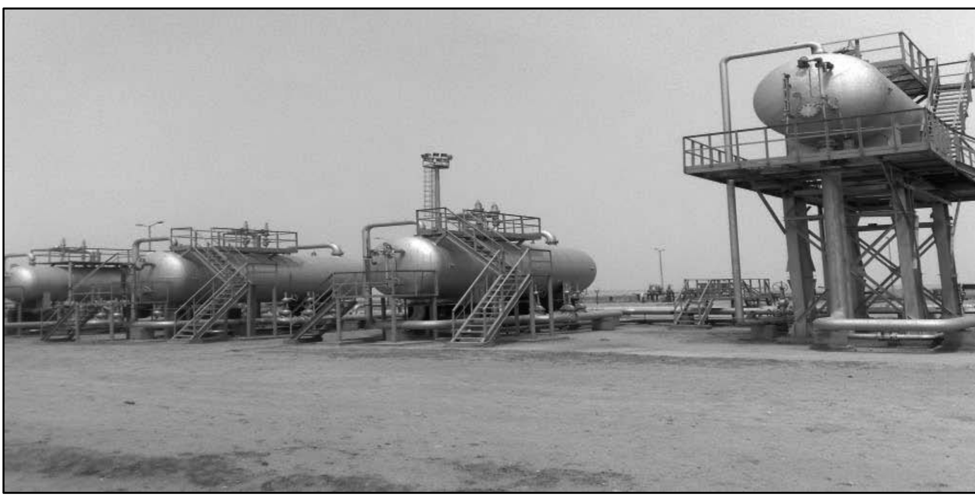

Figure 5: Petroleum Separators, Nasiriyah Degassing Station

Types of Insulators and Insulation Specifications

The first separator is a Canadian-made insulation and it is operational at 28Kg/cm^2 (roughly). This stage is vital since at this station, the majority of gases are separated (7).

Figure 6: Separator – 28 kg/cm^2, Nasiriyah Degassing Station

The second separator is a US-made insulation and it is operational 7Kg/cm^2 (roughly). This separator receives oil from the first separator where it then moves on to the third separator (7).

Figure 7: Separator – 7 kg/cm^2, Nasiriyah Degassing Station

The third separator is a US-made insulation and it is operational 1.8 Kg/cm^2 (roughly). At this time, the separation process releases a large amount of gases. It then moves on to the fourth stage (7).

Figure 8: Separator – 1.8 kg/cm^2, Nasiriyah Degassing Station

The fourth and final separator is a US-made insulation and it is operational 0.4Kg/cm^2 (roughly). At this point, the separation process is complete. It then moves it to the oil storage tank. (7).

Figure 9: Separator, Nasiriyah Degassing Station

Pressures above the operational pressure are the most appropriate and efficient. Put the fourth separator at a convenient height to ensure the smooth flow of oil around the tank. From each insulation stream, gas goes to the flare. We have four flares for each stage of insulation - as well as the containing of all separator valves associated with the security of the cold flare. The purpose of this is so that the discharge pressure, once it goes beyond the operational pressure's established limit for each isolation phase, the safety valves will open. After the pressure reaches operational (and further recedes) the safety valves will automatically close (7).

Contents of each Separator:

- Slot Entry Product (inlet production) - located at the top of the separator.
- Oil Exit Slot - located at the bottom of the separator.
- Gas Exit Slot - located at the top of the separator.
- Exit Water Slot - located at the bottom of the separator.

- Discharge (Drain) Slot - located at the bottom of the separator.
- Two Safety Valves - located at the top of the separators. They are connected to a pipe which in turn connects to the flare.
- Pressure Gauge.
- A measure of the level.
- Temperature gauge and dominants.
  Maintenance and protective barriers containing separator slots (3 and 6).

Features of the Horizontal Separator:

- More economical than the vertical insulators.
- Easy Installation.
- The possibility of transfer.
- Small diameter.
- The possibility of linking more than insulation (7 and 8).

Types of Separators and Insulators

Insulators can be divided in terms of shape - vertical and horizontal. Vertical separators are used in high pressure stations and vertical insulators are used for high flow rates. Vertical separators use structure duplex to change the track of the flow rate and they achieve a larger amount of insulation between the gas and the liquid (5). Horizontal separators are used in the low pressure stations. Horizontal insulators are used for high flow rates. It also contains the larger interfacial areas for the separation between oil and gas - this will be the largest possible area for the separation of oil and gas. It will be of a higher quality (5). Insulators can be divided in terms of the number of phases (1) - two-phase separators and three-phase separators.

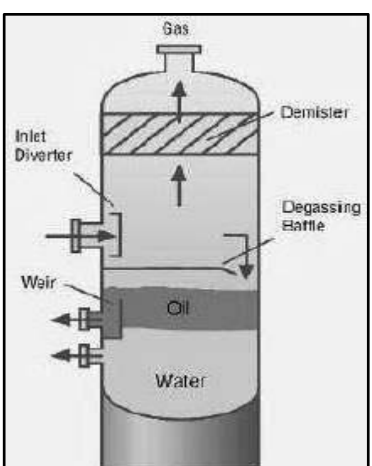

Figure 10: Vertical Separator (5)

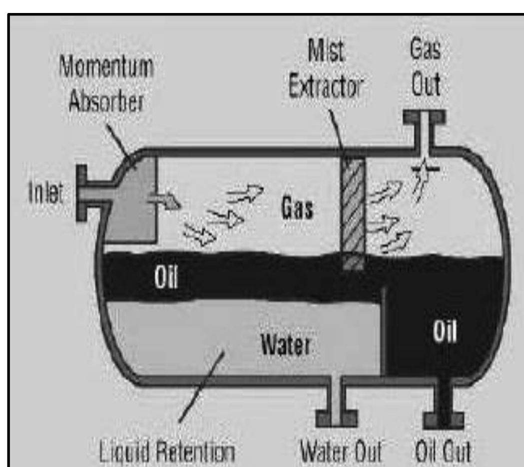

Figure 11: Horizontal Separator (5)

Vapor Demisting

Vapor demisting is used to extract the oil droplets which are carried along with the gas. Vapor demisting is achieved through the use of wire mesh - however, when the oil processor is heavy or contains waxy crude, replace this network by Serpentine Vanes and set up all these types perpendicular to the direction of the flow, this way, the gas flow is now winding which helps the process of separating the drops (5).

Liquid Residence Time

The liquid residence time is frequently used in the three-phase insulators in order for the water and the oil to be separated from each other according to the difference in density. Many of the structures used to isolate these two liquids from each other (and the size of these structures) depend on the time of residence of the fluid in the separator. Residence times can be affected by many factors - such as: specific gravity, operating temperature, and the percentage of water in the oil outside (5).

Crude Oil Treatment Process

Contain the oil coming from the wells according to the type of reservoir, the product of it (in terms of being low or high pressure), and the type of well (in terms of the type of reservoir) - as well as the method of production from the well (raise natural - raise industrial), and the isolation of natural gas from crude oil, are the main objectives of the stations insulation. So it is necessary to know what is happening inside the separator to better understand the overall process. To understand the process of insulation, one must be aware of the following details:

- The crude oil coming from the wells has a high pressure. If, inside, it reaches the station insulation pressure of PSI 170, for example, it will drop in pressure and arrive at the separator with a pressure of 60 PSI. Due to the pressure, the gas will separate from the oil since the gas was dissolved in the oil. When the liquid itself quickly drops in pressure, the gas will dissolve. I will elaborate the process by the use of a sample example:
    - When a soft drink is opened it issues a strong sound accompanied by the exit of the gas - what does that mean? The gas was (under pressure) dissolved in the liquid (soft drink) and when we opened soft drink, it has a drop in pressure which leads to the releasing of gases. This is precisely what happens with the natural gas dissolved in oil at the entry of the separator.
- Secondly, which helps to isolate the gas from the oil, there is a density difference between oil and gas - oil is heavier than gas, which leads to the liberation of gas towards the top and the descent of the oil to the bottom. The internal mechanical design of the separator plays a major role in the process of separation. Additionally the large surface area of the separator, compared to a piped oil tanker, helps the process of isolation to separate the crude oil from the water and the gases (3 and 5).

Separator Efficiency

The separator efficiency is a measure of the amount of gas insulated relative to the total amount of gas in the oil inside. This value cannot be found in a laboratory, but rather it must be calculated on site or at the petroleum field - and this ratio depends on the overall GOR oil inside the separator, the fluid velocity, and the type of flow (1).

Separator Safety Valves

The main purpose of these valves is to prevent the effects of excess high pressure on the equipment. To prevent the excess high pressure, one must work this valve to drain the excess volume upon the arrival of the pressure to a predetermined degree (thus reducing the pressure in a safe manner). The primary use of the safety valves is to prevent damage to equipment due to the high pressure. High pressure can be caused by the following occurrences: (1) an irregular flow of liquid caused by irregularly closed or opened valves, (2) a malfunction in the cooling system - which leads to an expansion of the liquid or gas, (3) fluctuations in pressure, (4) exposure of lab facility to burn, (5) the reactions emitting heat cannot be controlled (Exothermic Reactions), and (6) fluctuations in temperature. (Note that this valve has a multitude of names (Pressure Relief Valve, Safety Valve, Relief Valve, and Safety Relief Valve (7)). After the completion of the process of isolating the gas from the crude oil, it goes to the reservoirs for the purpose of storage and pumping.

Safety Valves (Level and Pressure Control) within the Separator

The level control valve works through signaled air arriving from the Sent which is installed at the top of the separator. A float is opened which determines the amount of air that reaches the valve. This valve opens the float to increase the amount of air that it had received from the sending and closing that decreases the air valve to control the specific level of oil inside the separator (7).

The pressure control valve is similar to the installation of the first valve - with a difference. It opening decreases the amount of air and closing increases the amount of arriving air. We can install this valve on a specific slot to get the desired pressure of the separator (7).

Figure 12: Level Control Valve, Nasiriyah Degassing Station

Figure 13: Pressure Control Valve, Nasiriyah Degassing Station

Flare system

(System Burners)

There are two kinds of flares in the petroleum separation system. The first of which is the cold torch. Bollards or the pipes are related to the discharge pipe of insulators (which are pipes that are joined between the insulators and the associated valves and piping with the safety of each separator) (7). The second variety of flare is the hot torch. This is the burning gas produced from each stage of the insulation at the station where there is a candle burning for each stage of its own. There is also a candle burning for each common stage to convert them in the event of damage or to perform maintenance work on one of the bollards.

There is another flare related to the storage tanks. The function of this flare is the discharge of the remaining gases in crude oil after the separation - as we know the separation process is not always perfect nor ideal (i.e. there is a small amount of gas that is still not separated from the crude oil). This flare helps the gases to release from the crude oil storage tank. Each tube out of the gas tank has a cold flare that burns any remaining gases (there is also an additional preventive blocker, located within the pipe that connects the cold flare and the tank (it stops the fire from reaching the tank)) (7).

Figure 14: Cold Flare, Nasiriyah Degassing Station

Figure 15: Pipes of the Hot Flare, Nasiriyah Degassing Station

Figure 16: Hot Flare, Nasiriyah Degassing Station

Distillate System

When the gas goes out from the separator, after production insulators and separated from the oil, it passes through the system to separate the distillate oil droplets from the gases passing through a tube going to the flares. This consists of a system of several insulators. The gases (with a small amount of remaining oil) pass through these insulators, and, in turn, are discharged into reservoirs. After closing the oil entry valve and the exit gas valve, next open the exit oil valve. (7).

Figure 17: Distillate Oil, Nasiriyah Degassing Station

Oil Tanks

There are two types of oil tanks. The first is the Tank Inspection (TEST). This is used to store oil while conducting a screening process for the wells. The purpose of this screening process is to measure the amount of oil production. For example, in Nasiriyah Degassing Station there is a test tank-size of 700 m^3 (figure 11).

Specifications of this Tank

Diameter of entry oil pipeline for this reservoir:	16 inches
Diameter of exit oil pipeline:	10 inches
Diameter of oil recycling tube within the tank:	12 inches
Diameter of the oil stirring pipeline within the tank:	8 inches
Diameter of gas discharge tube:	16 inches
Diameter of drainpipe:	8 inches

Properties of this Tank

Diameter:	10.43 m
Capacity:	700 m3
Design Pressure:	200 mm. w
Height:	8.94 m
Design Liquid Level:	8 m
Maximum Operation Temperature:	87 c

Figure 18: Oil Test Tank, Nasiriyah Degassing Station

The second tank is the tank of crude oil production. This tank is used for the storage of crude oil after it has been separated by insulators. There are a multitude of intricate components for this tank (7):

- Crude oil pipeline entry and exit tube.
- Oil drainpipe.
- Safety valve located at the top of the tank.
- Measurement slot at the top of the tank.
- Exit gas tube (to the torch).
- Network extinguishing and cooling.
- Stairs and barriers.
- Maintenance slots.
- Measures of temperature, pressure, and other sensors.
- A tube of water surrounds the top of the tank for the purpose of cooling and amortization.

- Tube stirring or recycling.

Tank Safety Requirements

The following list of criteria should be followed to ensure the overall safety of personnel and of the materials:

1. Ensure that only authorized personnel raise tanks.
2. Periodically check and validate valves to determine if they are in working condition.
3. The necessary presence of ladders and protective railings to prevent falling.
4. Wearing masks when measuring the level of oil.
5. The tube to the outside torches provides the inhibitor Fire Back.
6. Electrical inhibitor spark connections on the tanks
7. the periodic inspection of the tanks in terms of measuring thickness and get rid of erosions in the tank and maintenance procedures (7).

Figure 19: Tank Oil, Nasiriyah Degassing Station

Operational Problems in the Isolation of Crude Oil

The modern development of new designs for gas separators has helped to reduce previous operational problems. The majority of the operational problems at this time have been caused by issues such as: carryover, gas pockets, safety valve opening in the separator (without the presence of high oil), replacement LED, closing of the valves in the fourth stage, closing the valve that controls the oil without external influences, and the opening of the valve controlling the gas PCV (without external influences).

Carryover, an operational issue with the separation of crude oil, is the most prominent of operational complications. The exit of the mixture of oil and gas (of a large quantity) will pass to the flare, which will be in the form of black smoke. If personnel is unaware of or not paying attention to the controls in the separators, a large amount of oil will be burned through the torch and potentially lead to a fire (7).

A carryover can occur due to the following reasons: (1) the separator is filled to more than operational capacity through the poor organization of complex valves, (2) the exit oil valve if closed or damaged (or lack of drainage in the unit receiving the oil), (3) damage in the LED dominating level, which leads to a high level of oil in the separator, and (4) a defect in the regulating valve or pressure reducing valve, inadvertently leading to a low pressure separator - thus the rise of the level of oil. The first reason for a carryover is handled through the organization of complex valves as well as regulating the amount of oil entering each separator. In the second case, one must repair or replace the valve oil. In both cases, the third and fourth cause, the separator must stop until the control valves are repaired or collaborated (7).

Another operational issue is the presence of gas pockets. Gas pockets generate pockets of gas in the line of carrier oil to the unit receiving the oil, especially if the pipes carrying the oil from insulation stations to storage tanks located a far distance from the separators, which can negatively affect the work of the insulation. It can also cause high pressure and the inability to control the pressure valve since these pockets of gas are more like a partially closed valve which leads to a pressure opposite (7).

Gas pockets occur due to the following reasons - the low level of oil inside the separator (due to damage in the controlled level or an unintentional change) (7) and high pressure in the separator due to an irregular crude oil flow. In both cases, the station must temporarily shut down while gas pockets drain from the line carrier oil through the vent at multiple points. It should be located at the line and then a processing or calibration or replacement of the damaged valves (7).

If the safety valve opens in the separator without the presence of high oil, this too causes an issue. The reason is that it damages the LED dominating pressure and the safety valve (5). It can be treated by the replacement of the LED valve after diagnosis (5). Overly high pressure in the tank (5) caused by a low level in the third and fourth stage, high pressure in the fourth stage, and/or a blockage in the exit gas tube tank. This must be treated as a case by case - or the with an evaluation of the reason leading to the high pressure.

Additional complications can result from the closing of valves in the fourth stage in the separation system. The reason this causes a complication is because the high pressure tank (more than (7.5)) (5). To solve this issue, it is best to open the valves. Further problems can arise when the valve controlling the oil is closed without external influences - this in turn creates a failure to equip the air, thus valves are to be used until the completion of the defect (5). And finally, if the valve controlling the gas PCV is opened without external influences, a failure to equip the air occurs. Therefore, valves are to be used until the completion of the defect.

Pumps

There are a variety of pumps used in pumping crude oil. Each pump is different in terms of the design as well as the driving force for the oil (5). The first pump is the poster - this pump is working to raise the pressure of the crude oil coming from the tanks to the pressure level (7-15kg/cm^2) (roughly). The main pump comes after the poster. The pressure should be more than (8kg/cm^2) (that is why the poster pump comes before it). The main pump pumps the crude oil from the poster to the carrier oil line and from there it then goes to the oil export ports (7).

Poster Pump Specifications (7):

Type	:- MMA1280D
VOLT	:- 380
HZ	:- 50
R O M	:- 2975

Figure 20: Poster, Nasiriyah Degassing Station

Main Pump Specifications:

Type	:- p
VOLT	:- 380 V
HZ	:- 50
R O M	:- 2975 r/min
Weight	:- 950 Kg

Figure 21: Main Pump, Nasiriyah Degassing Station

Variety of Valves used in the Separation System

A vital piece of the station is the crush valve. The crush valve is used to directly shut down the station without returning to the valves of oil wells in emergency situations. (Emergencies such as sudden high pressure in a separator, when the safety valve is unable to discharge the pressure, and/or high pressure in the tank production as it reaches the signal directly from the tank valve to the crush valve (4 and 8). Additionally there is the check valve. This valve works to prevent the return of oil or gas. There are different sizes of this valve according to the type of operation (4 and 8). There are other varieties of valves that are used, such as gate valves and mechanical spherical valves.

Figure 22: Crush Valve, Nasiriyah Degassing Station

Figure 23: Check Valve, Nasiriyah Degassing Station

Figure 24: Irreversible Gate Valves, Nasiriyah Degassing Station

Figure 25: Irreversible Gate Valves, Nasiriyah Degassing Station

Conclusion

This study is encouraged to be used as a manual for chemical engineering personnel and students alike. This study provides its readers with substantial information regarding the overall separation of crude oil in the petroleum system - as well as presenting and discussing the necessary equipment involved in the process (such as the separators, various valves (safety valve, crush valve, check valves, etc.), pumps (poster pump, main pump), and specifications of the oil tanks. This study also offers forth discourse on the standard complications and malfunctions frequently seen of the separation process as well as any standard issues with equipment. Examples of operating complications are offered alongside explanations for why they may occur, how they can be avoided, and possible treatment options. Complications such as carryover, gas pockets, the safety valve opening in the separator (without the presence of high oil), etc. are discusses in detail. Thus this study provides safety precautions and how best to handle and prevent dangerous and potentially situations while operating the process.

The aspect of my own personal involvement and research for two years as a personnel member at the South Oil Company substantiates this analysis. I have established an open and useful description of the entire process of crude oil separation - from the initial steps of extraction from the ground to the additional and remaining processes of separating the oil from the gases, water, and other numerous chemicals as well as the storage process. If used properly, this study will provide its readers with vital and detailed information and analysis of the equipment as well as the process itself - and finally, how to establish a process for enabling the best procedure for the separation of oil with a high efficiency.

References

(1) Backhurst, J., & Harker, J. (2002). Coulson & Richardson's Chemical Engineering, J.M. Coulson and J.F. Richardson Solutions to the Problems in Chemical Engineering, Vol. 2 (5th ed.) and Vol. 3 (3rd ed.) (Revised/Expanded ed., p. 352). Oxford: Butterworth-Heinemann.
(2) Coulson, J., & Richardson, J. (1977). Chemical Engineering. (Revised/Expanded ed., Vol. 1, p. 908). Oxford: Pergamon Press.
(3) Coulson, J., & Richardson, J. (1977). Chemical Engineering. (Revised/Expanded Ed., Vol. 2, p. 1208). Oxford: Pergamon Press.
(4) Coulson, J., & Richardson, J. (1977). Chemical Engineering. (Revised/Expanded Ed., Vol. 6, p. 1062). Oxford: Pergamon Press.
(5) Dickneider, T. (n.d.). A Green Chemistry Module. Retrieved August 6, 2014. http://cann.scrantonfaculty.com/industrialchemistry/industrialchemistrymodule.html
(6) Dickneider, T. (n.d.). “Petretec – Dupont’s Technology for Polyester Regeneration”, A Green Chemistry Module. Retrieved August 19, 2014. http://cann.scrantonfaculty.com/industrialchemistry/industrialchemistrymodule.html
(7) Nasiriyah Degassing Station: http://www.nasiriyah.org/ara/oil/home
(8) Nelson, W. (1958). History and Development of Refining in Petroleum Refinery Engineering. (Revised/Expanded Ed., p. 960). New York: McGraw-Hill.
(9) Perry, R. (1984). Perry's Chemical Engineers' Handbook. (Revised/Expanded Ed., pp. 27-19). New York: McGraw-Hill. http://petroil-tec.blogspot.com/2012/06/blog-post.html. Retrieved August 6, 2014. (n.d) بترويل مدونة.