MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

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Methodological guidelines

for independent work

on the subject

"ENGLISH"

(for 2-year full-time Bachelor degree students majoring in"
185 – Oil and Gas Industry and Technologies)

Kharkiv – O. M. Beketov NUUE – 2018

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INTRODUCTION

These educational materials are designed for the ESP students of Oil and Gas Industry department of the first year of studies to develop their knowledge and skills in the English language.

This manual is based on the authentic texts from different sources concerning cross-cultural issues. It contains the tasks for reading and translation, vocabulary tasks and grammar exercises.

Each unit contains:

- An authentic text for reading and translation;
- Comprehension exercises;
- Exercises for memorization and mastering new vocabulary;
- Grammar exercises;
- Supplementary reading.

The manual is recommended for independent study.

UNIT 1. Oil depots

Task 1. Read and translate the text

An **oil depot** (sometimes called a **tank farm**, **installation** or **oil terminal**) is an industrial facility for the storage of oil and/or petrochemical products and from which these products are usually transported to end users or further storage facilities. An oil depot typically has tankage, either above ground or underground, and gantries (framework) for the discharge of products into road tankers or other vehicles (such as barges) or pipelines.

Oil depots are usually situated close to oil refineries or in locations where marine tankers containing products can discharge their cargo. Some depots are attached to pipelines from which they draw their supplies and depots can also be fed by rail, by barge and by road tanker (sometimes known as "bridging").

Most oil depots have road tankers operating from their grounds and these vehicles transport products to petrol stations or other users.

An oil depot is a comparatively unsophisticated facility in that (in most cases) there is no processing or other transformation on site. The products which reach the depot (from a refinery) are in their final form suitable for delivery to customers. In some cases additives may be injected into products in tanks, but there is usually no manufacturing plant on site. Modern depots comprise the same types of tankage, pipelines and gantries as those in the past and although there is a greater degree of automation on site, there have been few significant changes in depot operational activities over time.

Task 2. Answer the questions

1. What is an oil depot?
2. Where are oil depots usually situated?
3. What do modern depots comprise?

Task 3. Match the words with their definitions

Tankage	an area of ground on which a town, building, or monument is constructed
Facilities	goods carried on a ship, aircraft, or motor vehicle transportation of bulk cargo
Vehicles	a person who buys goods or services from a shop or business
Site	the storage of something in a tank

Cargo	buildings, pieces of equipment, or services that are provided for a particular purpose.
A customer	things used for transporting people or goods, especially on land, such as a car, lorry, or cart.
An activity	the condition in which things are happening or being done.

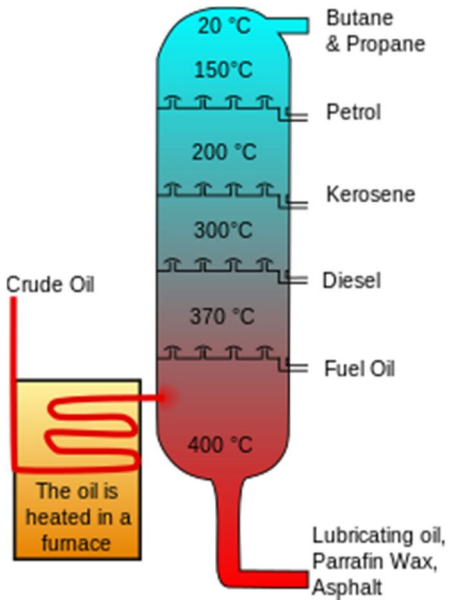
UNIT 2. Oil refinery

Task 1. Read and translate the text

An **oil refinery** or **petroleum refinery** is an industrial process plant where crude oil is processed and refined into more useful products such as petroleum naphtha, gasoline, diesel fuel, asphalt base, heating oil, kerosene, and liquefied petroleum gas. Oil refineries are typically large, sprawling industrial complexes with extensive piping running throughout, carrying streams of fluids between large chemical processing units. In many ways, oil refineries use much of the technology of, and can be thought of, as types of chemical plants. The crude oil feed stock has typically been processed by an oil production plant. There is usually an oil depot (tank farm) at or near an oil refinery for the storage of incoming crude oil feedstock as well as bulk liquid products.

An oil refinery is considered an essential part of the downstream side of the petroleum industry.

Operation



Crude oil is separated into fractions by fractional distillation. The fractions at the top of the fractionating column have lower boiling points than the fractions at the bottom. The heavy bottom fractions are often cracked into lighter, more useful products. All of the fractions are processed further in other refining units.

Raw or unprocessed crude oil is not generally useful in industrial applications, although "light, sweet" (low viscosity, low sulfur) crude oil has been used directly as a burner fuel to produce steam for the propulsion of seagoing vessels. The lighter elements, however, form explosive vapors in the fuel tanks and are therefore hazardous, especially in warships. Instead, the hundreds of different hydrocarbon molecules in crude oil are separated in a refinery into components which can be used as fuels, lubricants, and as feedstocks in petrochemical processes that manufacture such products as plastics, detergents, solvents, elastomers and fibers such as nylon and polyesters.

Petroleum fossil fuels are burned in internal combustion engines to provide power for ships, automobiles, aircraft engines, lawn mowers, chainsaws, and other machines. Different boiling points allow the hydrocarbons to be separated by distillation. Since the lighter liquid products are in great demand for use in internal combustion engines, a modern refinery will convert heavy hydrocarbons and lighter gaseous elements into these higher value products.

Oil refineries are large scale plants, processing about a hundred thousand to several hundred thousand barrels of crude oil a day. Because of the high capacity, many of the units operate continuously, as opposed to processing in batches, at steady state or nearly steady state for months to years. The high capacity also makes process optimization and advanced process control very desirable.

Oil can be used in a variety of ways because it contains hydrocarbons of varying molecular masses, forms and lengths such as paraffins, aromatics, naphthenes (or cycloalkanes), alkenes, dienes, and alkynes. While the molecules in crude oil include different atoms such as sulfur and nitrogen, the hydrocarbons are the most common form of molecules, which are molecules of varying lengths and complexity made of hydrogen and carbon atoms, and a small number of oxygen atoms. The differences in the structure of these molecules account for their varying physical and chemical properties, and it is this variety that makes crude oil useful in a broad range of several applications.

Once separated and purified of any contaminants and impurities, the fuel or lubricant can be sold without further processing. Smaller molecules such as isobutane and propylene or butylenes can be recombined to meet specific octane requirements by processes such as alkylation, or more commonly, dimerization. The octane grade of gasoline can also be improved by catalytic reforming, which involves removing hydrogen from hydrocarbons producing compounds with higher octane ratings such

as aromatics. Intermediate products such as gasoils can even be reprocessed to break a heavy, long-chained oil into a lighter short-chained one, by various forms of cracking such as fluid catalytic cracking, thermal cracking, and hydrocracking. The final step in gasoline production is the blending of fuels with different octane ratings, vapor pressures, and other properties to meet product specifications. Another method for reprocessing and upgrading these intermediate products (residual oils) uses a devolatilization process to separate usable oil from the waste asphaltene material.

Task 2. Answer the questions

1. What is an oil refinery?
2. Why is an oil depot(tank farm) usually situated at or near an oil refinery?
3. How is crude oil processed?
4. What products are different hydrocarbon molecules used in?
5. What does oil contain?

Task 3. Put the missing letters in the following words:

C..de oil, c.ol.ng to.ers, mo…ular masses, pa..f..ns, a..ma..cs, na….enes (or cy…al..nes), al..nes, d..nes, alky..s ,s.lf.r, n….gen, the h…oca..ons hy…gen, ca..on atoms, o…en atoms, p….cal and c…..al properties, i..bu..ne, pro..lene, bu..lenes, oc…e, alky…..n, di…..ati.n, cata..tic refo.ming, h..ro..n, aro..tics, gas..ls, fluid cata..tic cra…ng, t…mal cr…ing, hydro….king, va.or pres…es.

UNIT 3.Major products

Task 1. Read and translate the text

Petroleum products are usually grouped into four categories: light distillates (LPG, gasoline, naphtha), middle distillates (kerosene, jet fuel, diesel), heavy distillates and residuum (heavy fuel oil, lubricating oils, wax, asphalt). This classification is based on the way crude oil is distilled and separated into fractions (called distillates and residuum).

- Liquified petroleum gas (LPG)
- Gasoline (also known as petrol)
- Naphtha
- Kerosene and related jet aircraft fuels
- Diesel fuel
- Fuel oils
- Lubricating oils
- Paraffin wax
- Asphalt and tar
- Petroleum coke

Further products also include

- Sulfur
- Olefines
- Heat and electrical energy

Oil refineries also produce various intermediate products such as hydrogen, light hydrocarbons, reformate and pyrolysis gasoline. These are not usually transported but instead are blended or processed further on-site. Chemical plants are thus often adjacent to oil refineries or a number of further chemical processes are integrated into it. For example, light hydrocarbons are steam-cracked in an ethylene plant, and the produced ethylene is polymerized to produce polyethene.

Because technical reasons and environment protection demand a very low sulfur content in all but the most heavy products, it is transformed to hydrogen sulfide via catalytic Hydrodesulfurization and removed from the product stream via Amine gas treating. Using the so-called Claus process, hydrogen sulfide is afterwards transformed to elementary sulfur to be sold to the chemical industry. The rather large heat energy freed by this process is directly used in the other parts of the refinery. Often an electrical power plant is combined into the whole refinery process to take up the excess heat.

Task 2. Answer the questions

1. What are petroleum products usually grouped into?
2. What petroleum products do you know?
3. What various intermediate products do oil refineries also produce?
4. What does environment protection demand?
5. What is hydrogen sulfide transformed to?

Task 3. Put the verbs into appropriate form (Passive)

1. Petroleum products ……..(usually group) into four categories.
2. This classification ……..(base) on the way crude oil …… (distill) and (separate) into fractions.
3. These…….....(usually transport) but instead……..(blend) or (process) further on-site.
4. Light hydrocarbons ……..(steam-crack) in an ethylene plant, and the produced ethylene ……(polymerize) to produce polyethene.
5. Using the so-called Claus process, hydrogen sulfide …….(afterwards transform) to elementary sulfur …….(sell) to the chemical industry.
6. The rather large heat energy freed by this process ……(directly used) in the other parts of the refinery.
7. Often an electrical power plant ……..(combine) into the whole refinery process to take up the excess heat.

UNIT 4. Locating petroleum refineries

Task 1. Read and translate the text

A party searching for a site to construct a refinery or a chemical plant needs to consider the following issues:

- The site has to be reasonably far from residential areas.
- Infrastructure should be available for supply of raw materials and shipment of products to markets.
- Energy to operate the plant should be available.
- Facilities should be available for waste disposal.

Refineries which use a large amount of steam and cooling water need to have an abundant source of water. Oil refineries therefore are often located nearby navigable rivers or on a sea shore, nearby a port. Such location also gives access to transportation by river or by sea. The advantages of transporting crude oil by pipeline are evident, and oil companies often transport a large volume of fuel to distribution terminals by pipeline. Pipeline may not be practical for products with small output, and rail cars, road tankers, and barges are used.

Petrochemical plants and solvent manufacturing (fine fractionating) plants need spaces for further processing of a large volume of refinery products for further processing, or to mix chemical additives with a product at source rather than at blending terminals.

Task 2. Answer the questions

1. What is a refinery?
2. What must be taken into account while searching for a site to construct a refinery?
3. .Why are oil refineries often located nearby navigable rivers or on a sea shore?
4. What transport is used for oil products?

UNIT 5. Corrosion problems and prevention

Task 1. Read and translate the text

Refinery of Slovnaft in Bratislava.

Oil refinery in Iran.

Petroleum refineries run as efficiently as possible to reduce costs. One major factor that decreases efficiency is corrosion of the metallic components found throughout refining process. Corrosion causes the failure of equipment items as well as dictating the maintenance schedule of the refinery, during which part or all of the refinery must be shut down. The corrosion-related direct costs in the U.S. petroleum industry as of 1996 was estimated as US$3.7 billion per year.

Corrosion occurs in various forms in the refining process, such as pitting corrosion from water droplets, embrittlement from hydrogen, and stress corrosion cracking from sulfide attack. From a materials standpoint, carbon steel is used for upwards of 80 per cent of refinery components, which is beneficial due to its low cost. Carbon steel is resistant to the most common forms of corrosion, particularly from hydrocarbon impurities at temperatures below 205 °C, but other corrosive chemicals and environments prevent its use everywhere. Common replacement materials are

low alloy steels containing chromium and molybdenum, with stainless steels containing more chromium dealing with more corrosive environments. More expensive materials commonly used are nickel, titanium, and copper alloys. These are primarily saved for the most problematic areas where extremely high temperatures and/or very corrosive chemicals are present.

Corrosion is fought by a complex system of monitoring, preventative repairs and careful use of materials. Monitoring methods include both off-line checks taken during maintenance and on-line monitoring. Off-line checks measure corrosion after it has occurred, telling the engineer when equipment must be replaced based on the historical information he has collected. This is referred to as preventative management.

On-line systems are a more modern development, and are revolutionizing the way corrosion is approached. There are several types of on-line corrosion monitoring technologies such as linear polarization resistance, electrochemical noise and electrical resistance. On-Line monitoring has generally had slow reporting rates in the past (minutes or hours) and been limited by process conditions and sources of error but newer technologies can report rates up to twice per minute with much higher accuracy (referred to as real-time monitoring). This allows process engineers to treat corrosion as another process variable that can be optimized in the system. Immediate responses to process changes allow the control of corrosion mechanisms, so they can be minimized while also maximizing production output. In an ideal situation having on-line corrosion information that is accurate and real-time will allow conditions that cause high corrosion rates to be identified and reduced. This is known as predictive management.

Materials methods include selecting the proper material for the application. In areas of minimal corrosion, cheap materials are preferable, but when bad corrosion can occur, more expensive but longer lasting materials should be used. Other materials methods come in the form of protective barriers between corrosive substances and the equipment metals. These can be either a lining of refractory material such as standard Portland cement or other special acid-resistant cements that are shot onto the inner surface of the vessel. Also available are thin overlays of more expensive metals that protect cheaper metal against corrosion without requiring lots of material.

Task 2. Answer the questions

1. What does corrosion cause?
2. What forms does corrosion occurs in?
3. How corrosion is fought?
4. What are types of on-line corrosion?
5. What do materials methods include?

Task 3. Match the left column with the right one

One major factor that decreases	off-line checks taken during maintenance and on-line monitoring.
The corrosion-related direct costs	more expensive metals that protect cheaper metal against corrosion without requiring lots of material.
Carbon steel is resistant to	efficiency is corrosion of the metallic components found throughout refining process.
Monitoring methods include both	the most common forms of corrosion, particularly from hydrocarbon impurities at temperatures below 205 °C.
	On-line systems are a more modern development, and are revolutionizing the way corrosion is approached.
Other materials methods come in	the form of protective barriers between corrosive substances and the equipment metals.
Also available are thin overlays of	in the U.S. petroleum industry as of 1996 was estimated as US$3.7 billion per year.

UNIT 6. Oil reserves

Task 1. Read and translate the text

Oil reserves are the amount of technically and economically recoverable oil. Reserves may be for a well, for a reservoir, for a field, for a nation, or for the world. Different classifications of reserves are related to their degree of certainty.

The total estimated amount of oil in an oil reservoir, including both producible and non-producible oil, is called *oil in place*. However, because of reservoir characteristics and limitations in petroleum extraction technologies, only a fraction of this oil can be brought to the surface, and it is only this producible fraction that is

considered to be *reserves*. The ratio of reserves to the total amount of oil in a particular reservoir is called the *recovery factor*. Determining a recovery factor for a given field depends on several features of the operation, including method of oil recovery used and technological developments.

Based on data from OPEC at the beginning of 2013 the highest proved oil reserves including non-conventional oil deposits are in Venezuela (20% of global reserves), Saudi Arabia (18% of global reserves), Canada (13% of global reserves), and Iran (9%).

Because the geology of the subsurface cannot be examined directly, indirect techniques must be used to estimate the size and recoverability of the resource. While new technologies have increased the accuracy of these techniques, significant uncertainties still remain. In general, most early estimates of the reserves of an oil field are conservative and tend to grow with time. This phenomenon is called *reserves growth*.

Many oil-producing nations do not reveal their reservoir engineering field data and instead provide unaudited claims for their oil reserves. The numbers disclosed by some national governments are suspected of being manipulated for political reasons.

Task 2. Answer the questions

1. What are oil reserves?
2. What classifications of reserves do you know?
3. What is the recovery factor?
4. What is called oil in place?
5. What phenomenon is called *reserves growth*?

Task 2. Put the appropriate preposition into the proper place

1. Reserves may be … a well, … a reservoir, … a field, … a nation, or … the world.
2. Different classifications … reserves are related to their degree …certainty.
3. The ratio … reserves to the total amount … oil … a particular reservoir is called the *recovery factor*.
4. Determining a recovery factor … a given field depends … several features … the operation, including method …oil recovery used and technological developments.
5. . … general, most early estimates …the reserves …. an oil field are conservative and tend to grow ….. time.
6. The numbers disclosed … some national governments are suspected …being manipulated …. political reasons.

UNIT 7. Classifications of reserves

Task 1. Read and translate the text

All reserve estimates involve uncertainty, depending on the amount of reliable geologic and engineering data available and the interpretation of that data. The relative degree of uncertainty can be expressed by dividing reserves into two principal classifications—"proven" (or "proved") and "unproven" (or "unproved"). Unproven reserves can further be divided into two subcategories—"probable" and "possible"—to indicate the relative degree of uncertainty about their existence. The most commonly accepted definitions of these are based on those approved by the Society of Petroleum Engineers (SPE) and the World Petroleum Council (WPC) in 1997.

Proven reserves

Proven reserves are those reserves claimed to have a *reasonable certainty* (normally at least 90% confidence) of being recoverable under existing economic and political conditions, with existing technology. Industry specialists refer to this as **P90** (that is, having a 90% certainty of being produced). Proven reserves are also known in the industry as **1P**.

Proven reserves are further subdivided into "proven developed" (PD) and "proven undeveloped" (PUD). PD reserves are reserves that can be produced with existing wells and perforations, or from additional reservoirs where minimal additional investment (operating expense) is required. PUD reserves require additional capital investment (e.g., drilling new wells) to bring the oil to the surface.

Until December 2009 "1P" proven reserves were the only type the U.S. Securities and Exchange Commission allowed oil companies to report to investors. Companies listed on U.S. stock exchanges must substantiate their claims, but many governments and national oil companies do not disclose verifying data to support their claims. Since January 2010 the SEC now allows companies to also provide additional optional information declaring "2P" (both proven and probable) and "3P" (proven + probable + possible) provided the evaluation is verified by qualified third party consultants, though many companies choose to use 2P and 3P estimates only for internal purposes.

Unproven reserves

Unproven reserves are based on geological and/or engineering data similar to that used in estimates of proven reserves, but technical, contractual, or regulatory uncertainties preclude such reserves being classified as proven. Unproven reserves may be used internally by oil companies and government agencies for future planning

purposes but are not routinely compiled. They are sub-classified as *probable* and *possible*.

Probable reserves are attributed to known accumulations and claim a 50% confidence level of recovery. Industry specialists refer to them as "P50" (i.e., having a 50% certainty of being produced). These reserves are also referred to in the industry as "2P" (proven plus probable).

Possible reserves are attributed to known accumulations that have a less likely chance of being recovered than probable reserves. This term is often used for reserves which are claimed to have at least a 10% certainty of being produced ("P10"). Reasons for classifying reserves as possible include varying interpretations of geology, reserves not producible at commercial rates, uncertainty due to reserve infill (seepage from adjacent areas) and projected reserves based on future recovery methods. They are referred to in the industry as "3P" (proven plus probable plus possible).

Task 2. Answer the questions

1. What are two principal classifications of reserves?
2. What are proven reserves? unproven reserves?
3. What reserves are proven reserves subdivided into?
4. What cases are unproven reserves used in?
5. What reserves are unproven reserves subdivided into?

Task 2. Match the left column with the right one

The relative degree	is required
to have	of uncertainty
The most commonly	a *reasonable certainty*
minimal additional investment	accepted definitions
to support	optional information
to provide additional	their claims
Reasons for	methods
future recovery	classifying reserves

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для організації самостійної роботи

з дисципліни

«Іноземна мова»

(англійська мова)

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