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FACULTY OF ENGINEERING IN APPLIED SCIENCES

CAREER OF INDUSTRIAN ENGINEERING

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ARTICLE ENGLISH

TOPIC:

"ANALYSIS OF FIRE AND EXPLOSION IN STORAGE AREAS AND TERMINAL OFFICE PRODUCTS OF EP PETROECUADOR AMBATO CLEAN"

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SUMMARY

Industrial safety is an obligation which the law imposes on employers and workers and must also be within certain canons organize and operate within certain procedures.

As safety and industrial hygiene to prevent an entity related accidents, which occur as a result of production activities, therefore, a production that does not address the health and safety measures is not a good production. A good production must satisfy the conditions of the three essential elements, safety, productivity and product quality.

This study was performed in Ambato Terminal EP Petroecuador Clean Products is an operating unit of transportation, storage and marketing under the Northern District Municipality terminals and depots, is located in the province of Tungurahua, Ambato, in sector between the Quitus streets, the Condor, the Atis and Alfredo Jaramillo, basically consists of three major areas of work, spread over about ten acres of land.

This research presents a methodology for application of Fire and Explosion Analysis which uses the techniques of these estates such as the Environmental Protection Agency's (EPA), American Institute of Chemical Engineers (AIChE) and Federal Management Agency Emergency (FEMA) designed to the improving industrial safety in the areas of storage and dispatch of products. The storage area has vertical stationary tanks, properly identified according to the product containing these tanks have valves installed also have bunds or dikes designed to contain the product from the tank in case of a spill.

The storage remains an essential activity in the transportation and handling of hydrocarbons. The type and size of tank is governed by the production-consumption, environmental conditions, tank location and type of fluid to be stored. Storage can be done in three types of facilities: surface, ground and tankers. The capacity of these facilities varies from a few cubic meters to thousands.

The Terminal Ambato, with two fuel loading Islands. The main island has four loading arms 4 inch High Island and four loading arms with similar characteristics, both islands have smithmeters measurement systems, such Accuload electronic counters are of type F - 4, and capabilities flow are between 400 and 480 gallons per minute.

CHAPTER I

1 TERMINAL CLEAN PRODUCTS AMBATO EP PETROECUADOR.

Terminal clean products Ambato EP PETROECUADOR is an operating unit of transportation, storage and marketing under the Northern District Municipality terminals and depots, is located in the province of Tungurahua, Ambato, in the area between the streets Quitus Condor, the Atis and Alfredo Jaramillo, basically consists of three major areas of work, spread over about ten acres of land.

This terminal receipt clean hydrocarbons, stores, quality control, marketing and dispatches to the authorized distribution network and activities meet the same environmental and safety regulations in force in the country for the proper functioning, which have been obtained by an ISO 14001: 2004.

1.1 STRUCTURE OF TERMINAL CLEAN PRODUCTS.

These areas are:

1.1.1 RECEPTION AREA.

The Terminal Ambato, clean hydrocarbons receives envoys from Beaterio facilities located in the city of Quito via pipeline, this product receiving process is performed in the pressure reducing station, the same which consists of several components that are critical for the purpose of this unit. The product starts with receipt of an input pressure of 300 to 360 psi, passes through pressure reducing valves where it is reduced to 30 psi, then the product passes through a filter element, then through a measuring system and this is sent to a distribution manifold, which distributes the same to product storage tanks.

1.1.2 STORAGE AREA.

The storage area of the terminal, with vertical stationary tanks, properly identified according to the product containing these tanks have valves installed also have bunds or dikes designed to contain the product from the tank in case of a spill.

1.1.2.1 Storage tanks.

The storage remains an essential activity in the transportation and handling of hydrocarbons, and selecting the type of tank size is governed by the production-consumption, environmental conditions, the location of the tank and the type of fluid stored.

Storage can be done in three types of facilities: surface, ground and tankers.
Tanks can be manufactured and transported to their place of installation or armed in the same place where they will stay. One way is by tanks classification features of your roof, it's based on fixed and floating roof. These latter have gained acceptance due to the additional advantage of automatically controlling the vapor space.

1.1.2.2 Types of storage tanks.

Exist several types of storage tanks which are classified as follows.

- **Atmospheric and low pressure: p <= 2.5 psig**
    - Hardto
    - Floating Roof
    - Open Top
- **Medium pressure: 2.5 <p <or = 15 psig**
    - Refrigerate
    - Not refrigerated
- **Pressurized: p> 15 psig**
    - Cylinders
    - Spheres

For storage tanks at atmospheric pressures or low pressures and relatively large sizes using the rules of construction and design of one of the following codes.

API

• STD 620. Design and construction of large low-pressure tanks.
• STD 650. Design and construction of atmospheric storage tanks.
• RP 651. Cathodic Protection.
• RP 652. Coverage of the tank bottom.

1.1.2.2.1 Description of fixed roof tanks.

These are used for the storage of crude oil having a high flash point and vapor pressure, ie, those hydrocarbons that do not evaporate easily, thus preventing the accumulation of gases inside the tank which may cause the explosion of this, and therefore the pressure in the tank does not exceed the atmosphere.

They consist of a single body, the roof has no possibility of movement. They have several vent valves that allow the exit of vapors indiscriminate that are continuously formed therein.

1.1.2.2.2 Description of floating roof tanks.

These are containers having a cylindrical body and a roof vertically floating on the liquid surface.

Floating pontoons have the liquid level reducing evaporation. Includes tanks constructed of carbon steel and alloy steel, of various sizes and capacities, and vertical cylindrical walls, designed to store liquid hydrocarbons at pressures close to atmospheric
.

1.1.2.3 Containment dikes.

As mentioned above each storage tank is provided with dams as if there is a spill or a collapse of the tank.

Table No. 2: Area levees

DYKE	AREA
Dyke tanks 2 and 9	2970 m^2
Dyke tanks 3 and 8	3404 m^2
Dyke tanks 4 and 7	2350 m^2
Dyke tanks 1 and 6	3895 m^2

Source: EP-PETROECUADOR
Prepared by: Cristian Chuquín

1.1.3 CARGO AREA AND DISTRIBUTION (FIRM).

Count the Terminal Ambato, with two fuel loading Islands. The main island has four loading arms 4 inch High Island and four loading arms with similar characteristics, both islands have smithmeters measurement systems, such Accuload electronic counters are of type F - 4, and capabilities flow are between 400 and 480 gallons per minute.

The fuel delivery is performed according to the guidance issued by marketing referral in case bobtails of dealers who come to refuel for leading urban delivery and transfer tankers.

The main island is used to transfer cargo Ambato, Riobamba. The secondary island is used for release for distributing the oil tankers to the province of Tungurahua and areas close to it.

1.1.3.1 Pumps fuel distribution.

The Ambato Terminal's facilities include an area of pumps that help the distribution and transport of products to load the islands, the main function of this area is to suck the oil from the storage tanks until the discharge is made compartments of tankers, with the help of eight different capacities centrifugal pumps that are installed on a platform known as yard bombs.

1.1.3.2 Loading arms.

A loading arm allows the transferring of a liquid or a liquefied gas tank to another. For transferring from a cistern (truck or rail) of an arm is required upper or lower load.

1.1.3.3 Generic concept of a loading arm upper or lower

These types of loading arms are formed by 3-called inner arm pipes, the outer arm and dip tube. The diameters can range from 2 "to 6". These three tubes are joined together by rotating joints that allow them to turn easily. The arm can be extended to obtain the position of labor required to access the repository to upload or download and be folded to occupy minimal storage space.

1.1.3.3.1 Loading Arm top

The top loading arm is used for loading tanks, both as railway truck. Charging is done by the manhole located on the top of the cistern. Depending on the nature of the product (not dangerous toxic gas without evaporation ....), the load can open, which means that the manhole is not coated.

1.1.3.3.1 Bottom loading arm

Intended for unloading tanks both truck and rail. The connection can be the side or rear of the tank or both. The connection place influences the size of the tubes and a subsequent connection of tubing longer required that a lateral connection.

CHAPTER II

2 FEATURES FIRE AND EXPLOSION.

The risk of fire and explosion is presented in the workplace with an intrinsic potential for significant human and economic losses. They also represent a risk to the general population, not always adopted the necessary measures to prevent or protect against it.

In referring to the provisions to be taken in the implementation phase of any process within the terminal, we only remember the need to act preventively.

2.1 FIRE.

Fire is a chemical reaction of combustion which takes place when combined with oxygen to a sufficient degree, self-powered, with the presence of a solid phase fuel, liquid or gas which emits heat, light radiation, smoke and gases combustion.

1.1.1 COMBUSTION PROCESS (PARAMETERS).

The combustion reaction is exothermic, the reducing reagents constitute the "fuel", the oxidizing agents are the "oxidizing".

For combustion there must concur:

- Fuel
- Oxidising
- Activation energy and
- Chain reaction.

2.1.2 REACTION RATE.

Depending on the speed of the reaction we can establish the following classification:

OXIDATION, if the reaction is slow (iron oxidation, yellowing paper

COMBUSTION, if the reaction is normal, occurs with light emission (flame) and heat, which is perceptible by humans.

DEFLAGRATION, if the reaction is fast, the flame front propagation is smaller than sound.

2.1.3 FIRE.

It is a fast combustion process takes place without control in time and space that destroys large proportions that it is not intended to burn. The emergence of a fire implies that the occurrence of fire is out of control, with risk for people, environment and property.

Chart No. 1: Fire

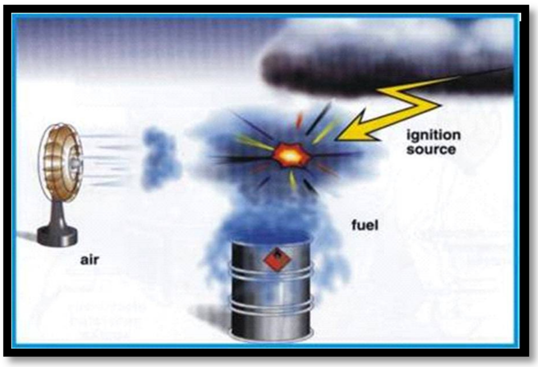
Source: http://www.google.com.ec/imgres?q=incendio&um=1&hl=es&biw
Prepared by: Cristian Chuquín

2.1.4 FACTORS IN THE IGNITION.

All fuels which burn with a flame, are combusted in the gas phase. When fuel is solid or liquid, is required prior contribution of energy to take it to a gaseous state.

The danger of a fuel compared to ignition will depend on a number of variables.

Chart No. 2: Factors influencing autoignition



Source: http://www.google.com.ec/imgres?q=Factores+que+influyen+en+la+ignici% C
Prepared by: Cristian Chuquín

2.1.4.1 According to its temperature.

All combustible material present 3 temperature characteristic as defined below:

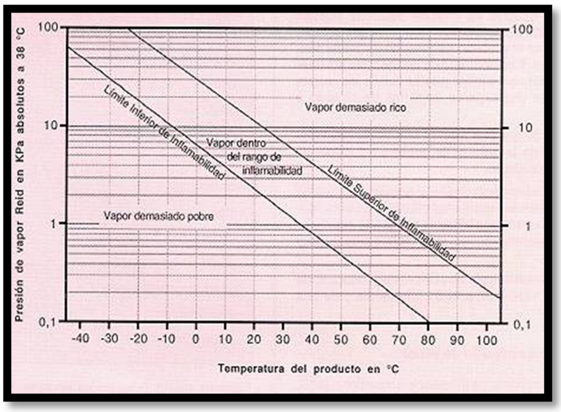
2.1.4.1.1 Flashpoint

Is the minimum temperature at which sufficient fuel vapors emitted in the presence of air or other oxidizing ignite on contact with an ignition source, but is removed off. The ignition points vary from temperatures well below zero degrees Fahrenheit for flammable gases (including LPG, propane or butane), and volatile flammable liquids (such as gasoline), hundreds of degrees above zero for heavy fuel oils.

2.1.4.1.2 Limits of flammability.

It is well known that combustion can not take place in the absence of a minimum amount of oxygen, whether either is available in the air mixed with gases and vapors emanating from a combustible substance or an internal component of the fuel. Similarly, there must be sufficient fuel vapors or gases in the air-fuel mixture to support and sustain combustion.

Chart No. 1: Flammable limits



Source: http://www.google.com.ec/imgres?q=L% C3% admit + to + Flash + and + explosiveness. & um = 1 & hl = en & biw = 1360 & bih = 601 & tbm = isch & tbnid = ArcY1FwJXP0blM: & imgrefurl = http

Prepared by: Cristian Chuquín

The flammability limits which are found in the literature and temperature measurements made at normal atmospheric pressures. Taking into account that there may be considerable variation in these limits at pressures or temperatures above or below normal. The overall effect of increased temperature or pressure is to reduce the lower limit and upper limit increase. The decreases in temperature or pressure has the opposite effect.

2.1.4.2 Autoignition temperatures.

The ignition temperature or autoignition (TAI) of a substance, whether solid, liquid or gaseous, is the minimum temperature to initiate or cause self-sustained combustion in the absence of spark or flame. These temperatures should be viewed as approximations, even more than the ignition points and flammability limits, because of the many factors that may affect test results.

2.2 SAFETY FLASH EFFECTS.

It is obvious that direct contact with a flame of any kind is not a good idea for any length of time because extreme heat can ignite materials or severely burn and destroy living tissue. What can not be fully understood is that fire can cause damage and injuries remotely through thermal radiation, so not much different as the sun warms the earth. This radiation, which is completely different to nuclear radiation, is more potent on the surface of the flame and weakens rapidly with distance in any direction.

Table 7: Criteria burn injuries due to thermal radiation

kw/m2	BTU/hr-ft2	Time to severe pain (seg)	Time for 2nd degree burn (seg)
1	300	115	663
2	600	45	187
3	1000	27	92
4	1300	18	57
5	1600	13	40
6	1900	11	30
8	2500	7	20
10	3200	5	14
12	3800	4	11

Source: Dynamic Heuristics
Prepared by: Cristian Chuquín

These dosages are determined by combining with radiation levels and exposure times are expressed in units of energy per unit time per unit area of a receiving surface.

2.3 CLASSIFICATION AND TYPES OF FIRE.

For best results in fighting an incipient fire, consider the material that is on fire, because there is a part, to use appropriate extinguishing media.

2.3.1 CLASSES OF FIRE.

Fires are classified as follows according to the combustion material.

Class A
These are the types of fires occurring in common solid fuels. Example: paper, wood, resin derivatives.

Class B
These are the types of fires that occur in flammable liquids, petroleum products. This type of fire is always burning flame.

Class C
These are the types of fires that occur in electrical installations (hot).

Class D
These are the types of fires that are declared in combustible metals such as magnesium, titanium, zirconium, sodium, potassium, etc..

Class E
This type of fire should not throw water as a chemical reaction occurs that causes explosions with shrapnel detachment committed material endangering the lives of staff acting.

Class K
These are the types of fires occurring in vegetable oils, which are not included in the class B.

2.3.2 TYPES OF FIRE FROM THE IGNITION.

There are six basic types of fire associated with the discharge of hazardous materials, with the type of fire being a function not only of the characteristics and properties of the spilled substance but also the circumstances surrounding the issuance and / or ignition.

The six types are:

• Jet Flame (Flame Jet)
•Fireballs as results of steam explosions boiling liquid expanding (BLEVE)
• Fires in clouds of vapor or dust
• Fires in ponding of liquids
• Fires involving flammable solids (as defined by the Department of Transportation of the U.S.), and
•Fires involving ordinary combustibles

2.3.2.1 Flame jet.

The gas discharge or ventilation through hole forms a gas jet which "blows" to the atmosphere in the direction in which the hole is, as it enters and mixes with the air. If the gas is flammable and is an ignition source, can form a jet flame considerable length (possibly hundreds of feet long) from a hole less than a foot in diameter.

2.3.2.1 Fireballs as resulting from Bleve.

Exposures steam boiling liquid expanding (Bleve for its acronym in English) are among the most feared events when there closed tanks of hazardous materials in liquid or gas that are exposed to fire.

Although the fireball is usually short-lived, intense radiant heat generated can cause severe burns and possibly fatal to people exposed to relatively large distances in seconds.

The phenomenon that leads to a BLEVE can occur with most liquids heated in excess within a closed container or inadequately ventilated are flammable or otherwise, or are pure materials or mixtures, unless other factors are considered incidental.

2.3.2.1 Fires vapor or dust clouds.

Vapors emitted from a pool of volatile liquid or gases are vented from a perforated container or damaged, if not immediately ignite, form a plume or cloud of gas or vapor which is moved in the direction of the wind. If this cloud or pen comes into contact with an ignition source at a point where its concentration is within the range of their upper and lower limits of flammability may generate a fire wall that is directed towards the source of gas or steam, swallowing whatever is in its path.

2.3.2.1 Fires spills.

A liquid spill fire is defined as a fire that involves a number of liquid fuel as gasoline spilled on the surface of the land or on water. major hazards to people or properties include thermal radiation exposure and / or toxic or corrosive products of combustion.

The primary hazards to persons or property include exposure to heat radiation and / or toxic or corrosive products of combustion. One complication is the liquid fuel can flow depending on the terrain, in descending into sewers, drains, water and other containers.

2.3.2.1 Fires involving ordinary combustibles.

Some hazardous materials, including some of the above described flammable solids, without special risks burn beyond those associated with paper, wood, or other common materials. Once lit, no special threat or unusual. By this we do not mean that this type of fire is not significant or important to consider in planning for emergencies, only that the nature of the threat is often found by fire service personnel and is well known for them.

2.4 PRODUCTS OF COMBUSTION.

In addition to producing heat and thermal radiation, fires involving certain hazardous materials can generate smoke and gases that are more toxic than those arising from ordinary substances. In most cases, the heat from the fire causes the combustion products to rise toward the sky where they are diluted with the air below the danger level before again approaching the ground surface.
However, sometimes their toxicity can be so high that requires the evacuation of the population until the fire is extinguished.

2.3 EXPLOSION HAZARD.

Improper handling or neglect of a flammable material is often be the primary cause of the danger, so that a careful and considered significantly contribute to limit the possibility of an explosion.

2.5.1 DEFINITION

Henceforth we will see first the conditions and factors that define the potential of both types of explosions, both thermal and non-thermal, followed by an explanation of how they can be measured the effects of an explosion and then we will see the different types of explosions that meet criteria above and can be found in accidents involving hazardous materials.

2.5.2 FACTORS INFLUENCING EXPLOSION POTENTIAL.

Within the explosion factors are the thermal and non-thermal explosion.

2.5.2.1 Thermal Explosions.

The set of conditions under which the explosions are more common gases or fumes, comprising igniting the material within the confined space of a building, a drainpipe, a tunnel, a liquid storage tank partially empty (onshore or transport) or other container.

The force or a thermal explosion potential, however one wishes to express, is a function of three factors:

- The amount of fuel.
- The amount of energy available.
- Friction of available energy (known as the efficiency factor) is expected to be released at the time of the explosion.

2.5.2.2 Explosions nonthermal.

The simplest type of thermal explosion not understand is it is due to over-pressurization of a container of any kind, sealed inadequately ventilated. So much like a balloon burst if too much air is injected, the walls of a sealed tank or other container may rupture violently if introduced too much gas or liquid, if an internal chemical reaction produces excess gases or vapors, or if a reaction heat or other source of steam increases the internal pressure of the contents to the point where the walls are stretched beyond its breaking point.

2.5.3 TYPES OF EXPLOSION.

Most of the basic types of explosions have been described previously, but it is convenient to list them again and provide a more formal definition of the terms.

2.5.3.1 Explosion overpressure of a vessel or container.

As mentioned above, these events are the result of excessive pressure within a sealed tank or other container and are called non-thermal explosion.
They occur when excessive pressure causes the violent rupture of the walls of the tank or container, as when a balloon explodes when too much air is injected.

2.5.3.2 Dust explosion.

A dust cloud of fuel that is in the air and has a concentration that is within its upper and lower explosive may explode when turning. The explosions usually occur when the dust fills the greater part of an enclosure of some type.

2.5.3.3 Explosions of gas or vapor.

As in the case of dusts in the air, a gas or vapor is within the concentration limits of flammability or explosion can cause deflagration or detonation explosion if ignited. These events can occur when the air-fuel mixture is confined wholly or partially or fully released, but the confinement definitively increases the likelihood of injury or significant property damage. Note that the material can be released directly to the environment vulnerable or can be developed from evaporation or boiling liquids that have entered the area.

2.5.3.4 Explosion or detonation of condensed phase.

As previously comendaba when it explodes or detonates substance is a liquid or solid, the event is often referred to as an explosion or detonation of condensed phase. Those who use this term are more likely to denote events involving gases or vapors in the air as explosions or detonations diffuse phase or gas phase.

2.5.3.5 steam explosions by boiling liquid expanding.

In the previous section describes in detail BLEVEs explaining concerning fire hazards, which stated that they were not associated with strong shock waves in most cases. Obviously, this means that sometimes may occur or impact shock waves powerful enough to cause damage or injury.

CHAPTER III

3 ANALYSIS OF FIRE AND EXPLOSION (EPA, AICHE AND FEMA).

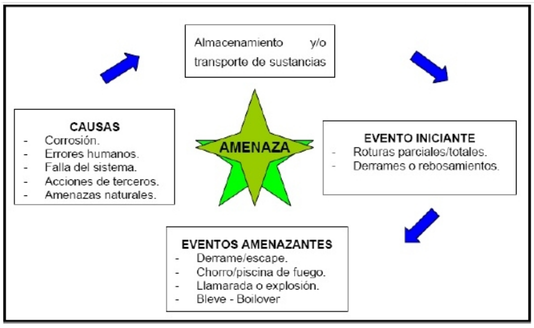
The fire and explosion analysis is performed according to the methodology of the Environmental Protection Agency, American Institute of Chemical

Engineers and the Federal Management Agency Emergency whom are American.

3.1 GENERAL OF FIRE AND EXPLOSION.

Risk analysis is a set of qualitative and quantitative methods to assess the risk from the establishment of the initiating events, threatening events, characterization of risk scenarios and estimate their impact.

Figure No. 32: Flow diagram for the threat



Source: Dynamic Heuristics
Prepared by: Cristian Chuquín

3.1.1 CHARACTERIZATION OF THE RISK SCENARIOS.

The risk scenarios are defined as locations or physical areas under specific operating conditions, maintenance and environmental trigger undesirable accidents or damage to personnel, assets, continuity of operations and the environment.

3.1.1.1 Events beginners.

The initial causes or initiating events of a risk scenario is defined as the release of material and / or energy, contained in vessels, piping or equipment flow. Each brings a different threat facilities, therefore it is necessary to detail the causes which may alter normal each.

3.1.1.1 Storage tanks.

Failures in storage tanks that occur most often are due to operational errors and other causes such as fires or explosions in neighboring teams. For small storage tanks the most common reasons for failure are leaks and blockages in pipes and transfer output. The break, as a factor in failure, is usually caused by external events such as shocks, pressure or fire.

3.1.1.1 Process Equipment.

Among the causes of failure for process equipment must:

• Inadequate maintenance.
• Failure by overpressure.
• Movement in structures.
• Faulty seals, valves and flanges.
• Static.
• corrosion or erosion.
• Vibration that causes fatigue.

3.1.1.1 Process lines.

The causes of failure in process line sections correspond to blockages, leaks or ruptures. Only in extreme cases be a cause corrosion lock. The main causes of failure are for deposits, impurities or foreign bodies especially in the low points of a section of line or flows are markets. Leaks or breaks in process lines may be caused by:

• Corrosion or erosion
• Overvoltage,
• Efforts to expand,
• Movement in structures.
• excavation processes that may affect underground lines.
• Explosions or internal or external overpressure.

3.1.1.1 Sources of ignition.

Any heat source natural or artificial products capable of igniting flammable, combustible or flammable gases. In the facility object of study leading ignition sources are:

- Vehicles.
- Matches / cigarettes.
- Static electricity.
- atmospheric discharges (lightning).
- Shorts.

3.1.2 FONT.

SCRI-SLAB model considers four types of source (IDSPL);

1. - Issuance of a spill in evaporation;
2. - Horizontal jet emission;
3. - Vertical jet emission;
4. - Instant issuance or issuance of a spill in short evaporation.

CHAPTER IV

4 PROCESS AND FLOW DIAGRAMS STORAGE AND DISPATCH.

EP Petroecuador, is responsible for the transportation, storage and marketing of hydrocarbons (as Special Law State Petroleum Company of Ecuador and its subsidiaries), it must define the proper and normal compliance activities related to the movement of hydrocarbons from receipt of products from refineries and / or imports, custodian transfer product between pipelines, terminals and storage tanks, to shipping the product to the end customer.

3.1 PROCESS CHART STORAGE AND DISPATCH.

The flow diagrams are a way to visually represent the flow of data through information processing systems. Flow charts describe it and in what sequence operations required to solve a given problem.

3.1 CONSTRUCTION PROCESS DIAGRAM GOODS YARD AREAS AND OFFICE.

This is governed by a series of symbols, conventional rules and guidelines which are:

1. The skeleton of the flowchart format or be divided into parts representing the departments, sections or units involved in the procedure.

2. It should show the same unit more than once in the flowchart actions even when returning to the same procedure.

3. The flowchart indicator lines should be thinner than the lines of the format, straight and angular, equipped arrows at the terminals.

4. Each step of the procedure or action should clearly listed and briefly described in a few words.

5. When a document is retained in a dependency of the flow chart as shown.

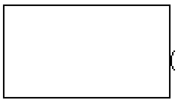
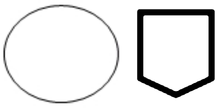
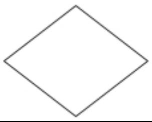
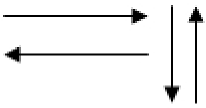
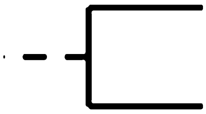
6. When a document has to be destroyed after being used in the process is indicated by an (X) large.

7. When a document procedure gives rise to another is indicated in the flowchart interrupted by an arrow.

8. As we saw in the charts in the flowcharts where several lines intersect without relationship is indicated by an inflection in any of them.

3.1.1SYMBOLS.

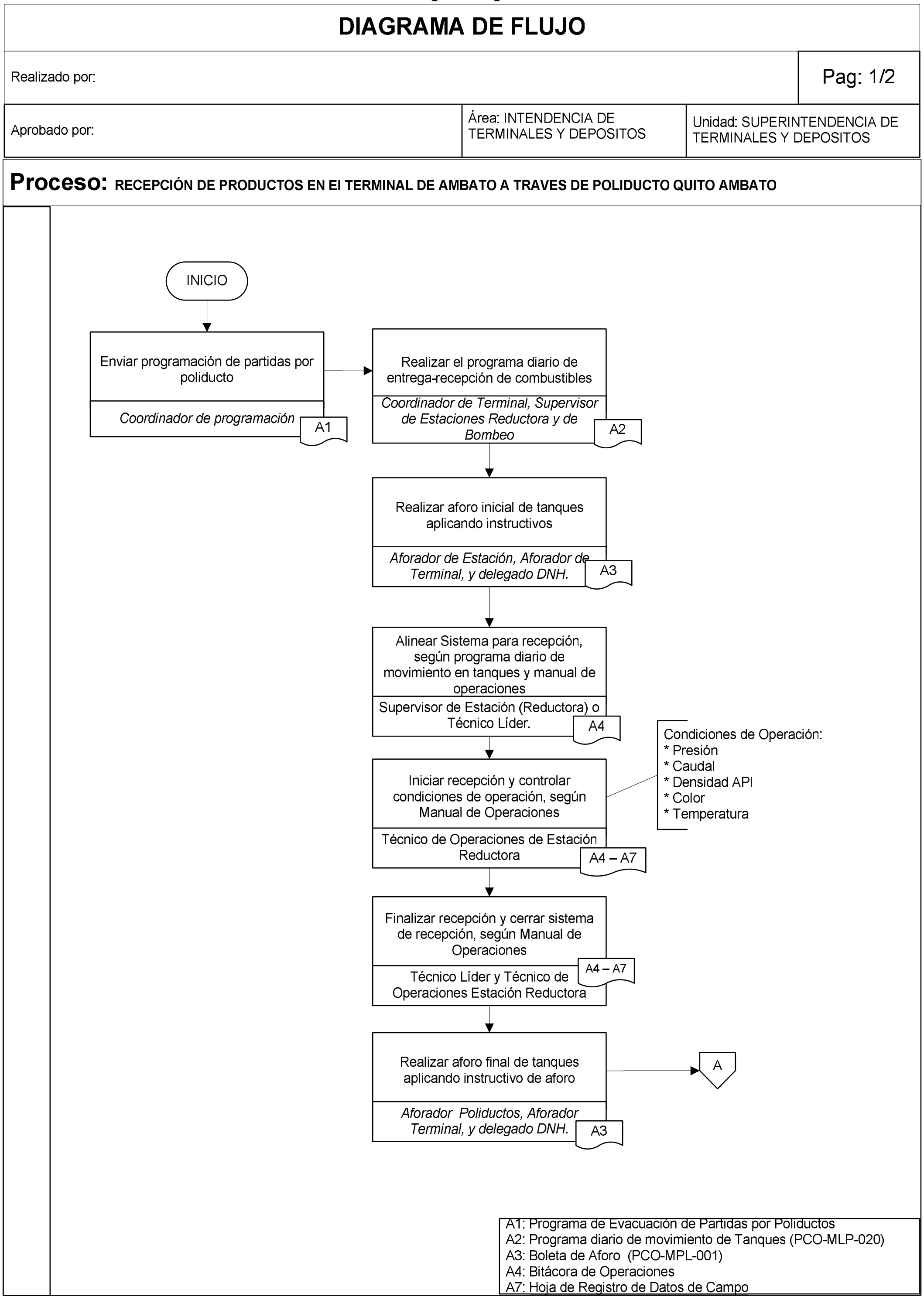
Table No. 15: Symbology flowcharts

Symbol	Name	**Explanation**
	Terminator (beginning or end of the process)	Inside we place materials, information or actions to start or to show at the end of it
	Process (activity)	Task or activity carried out during the process. It can have many inputs but only one output.
	Connector (connection with other processes)	We appointed an independent process that sometime seems related to the main process.
	Decision (decision / fork)	Indicate points at which decisions are made: whether or not open closed.
	Document	It is used to reference a document or query a specific point in the process.
	Process	Shows the process to be performed or which is derived from the diagram.
	Flow line (step connections or arrows)	Shows the direction and sense of the process flow, connecting the symbols.
	Clarification	Not part of the flowchart, is an element that is added to an operation or activity for explanation.

Source: http://www.monografias.com/trabajos60/diagrama-flujo-datos/diagrama-flujo-datos2.shtml
Prepared by: Cristian Chuquín

3.1.2 DEVELOPMENT OF CONSTRUCTION.

Chart No. 33: Process receipt of products, terminal Ambato

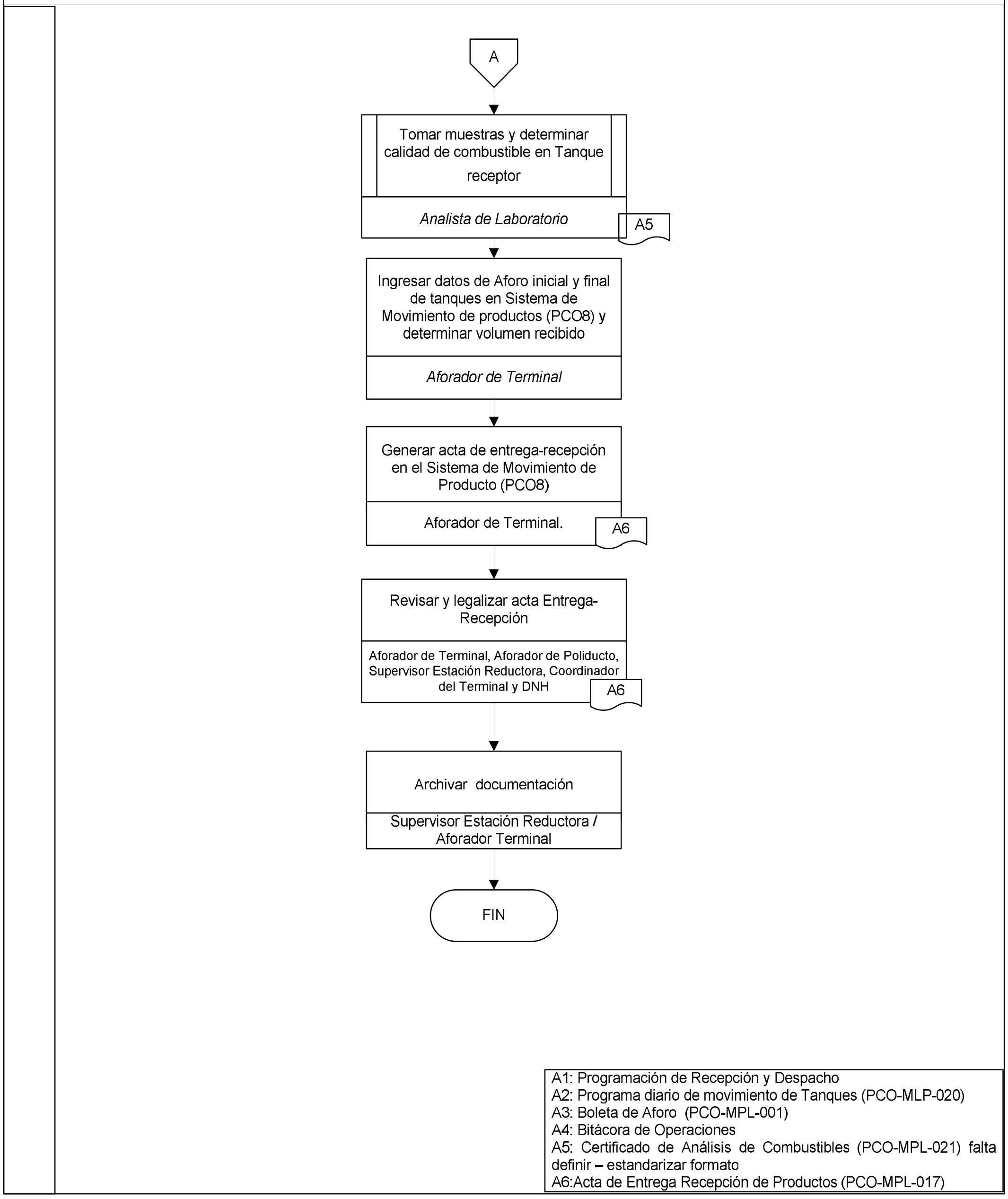


Source: EP-PETROECUADOR
Prepared by: Cristian Chuquín

Chart No. 34: Continuation of the receipt of products, terminal Ambato

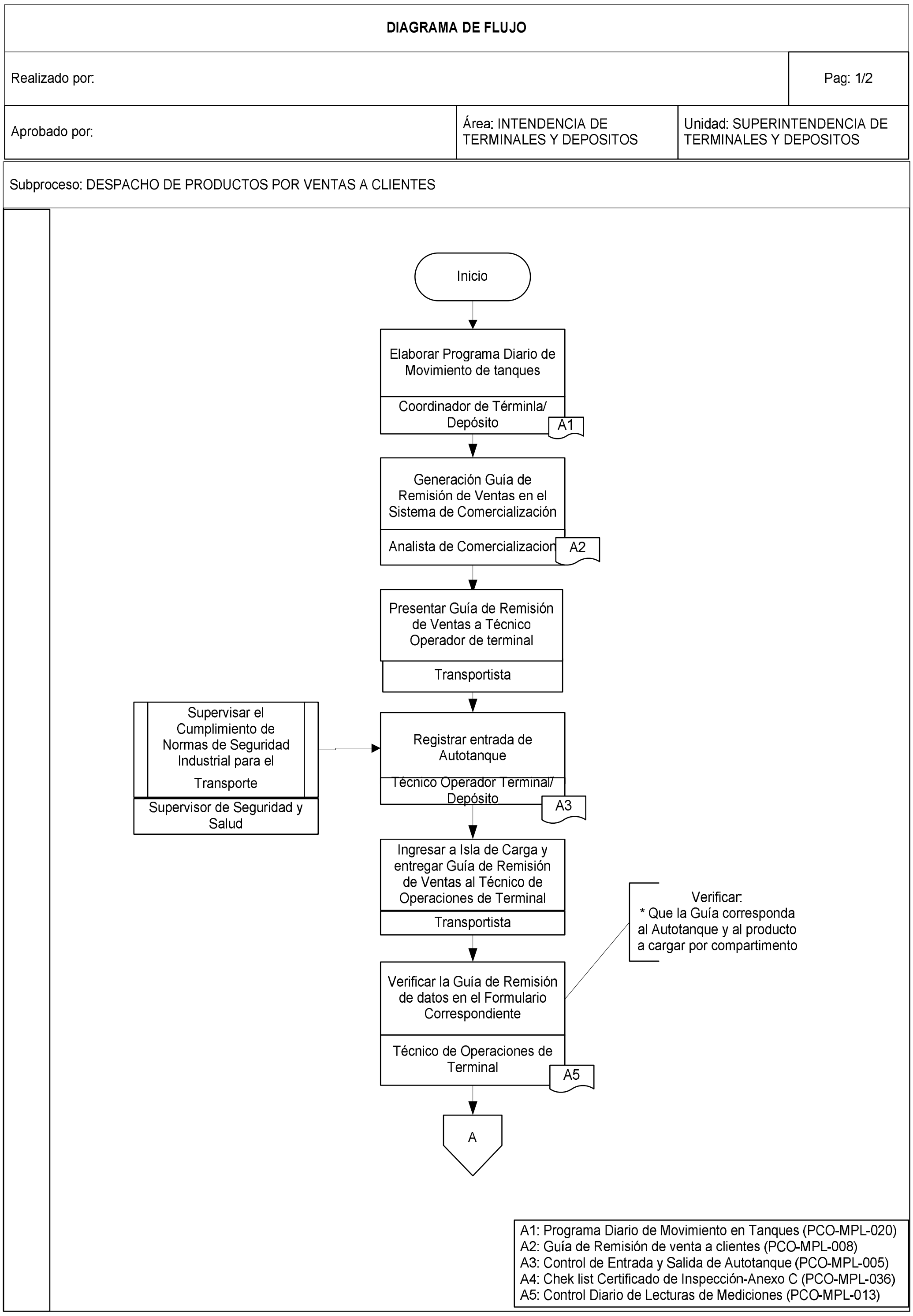
DIAGRAMA DE FLUJO		
Realizado por:		Pag: 2/2
Aprobado por:	Área: INTENDENCIA DE TERMINALES Y DEPOSITOS	Unidad: SUPERINTENDENCIA DE TERMINALES Y DEPOSITOS

Proceso: RECEPCIÓN DE PRODUCTOS EN EI TERMINAL DE AMBATO A TRAVES DE POLIDUCTO QUITO AMBATO



Source: EP-PETROECUADOR
Prepared by: Cristian Chuquín

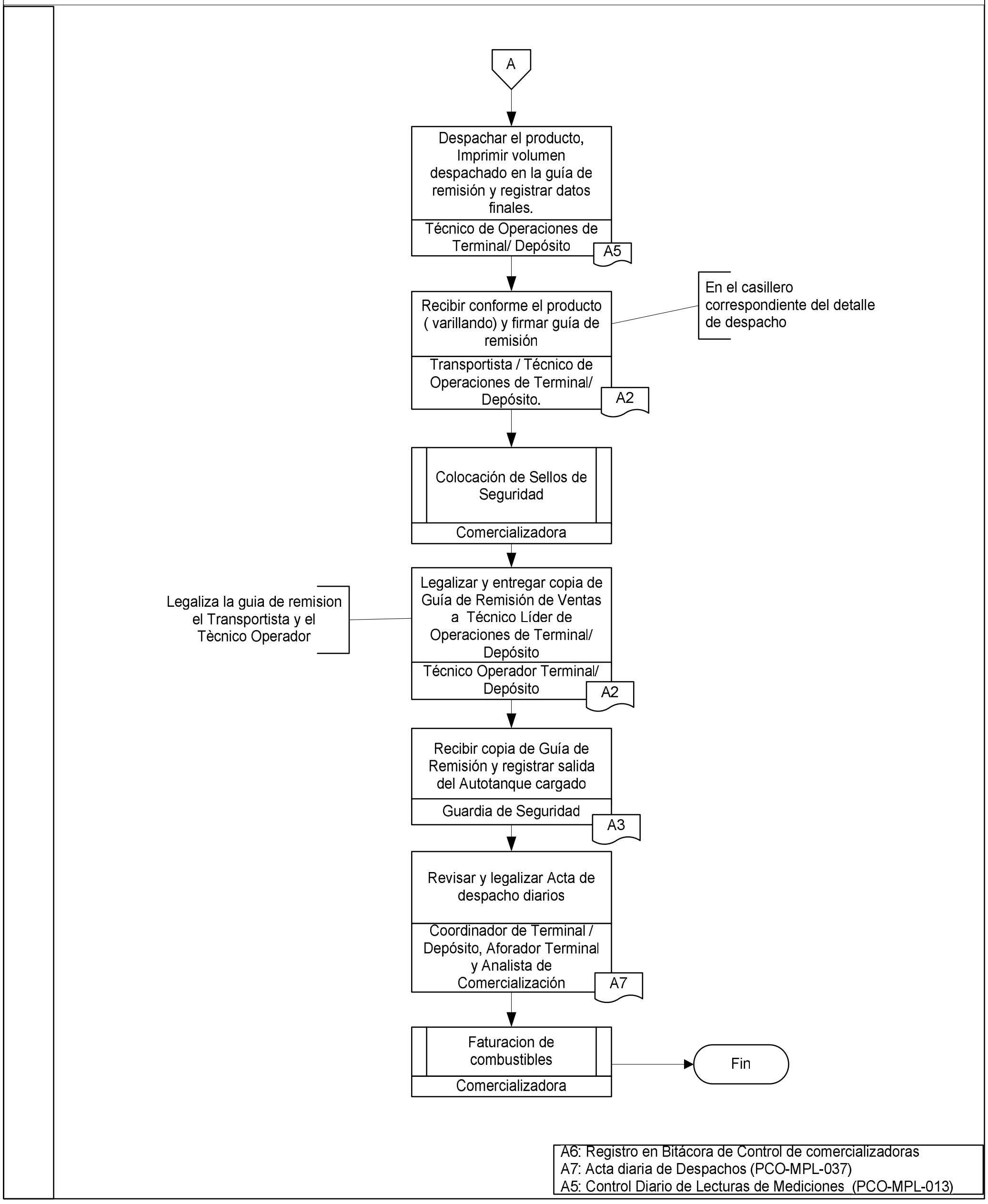
Chart No. 35: Process Product office Ambato terminal



Source: EP-PETROECUADOR
Prepared by: Cristian Chuquín

Chart No. 36: Continuation of the terminal office products Ambato

DIAGRAMA DE FLUJO		
Realizado por:		Pag: 2/2
Aprobado por:	Área: INTENDENCIA DE TERMINALES Y DEPOSITOS	Unidad: SUPERINTENDENCIA DE TERMINALES Y DEPOSITOS
Subproceso: DESPACHO DE PRODUCTOS POR VENTAS A CLIENTES		



Source: EP-PETROECUADOR
Prepared by: Cristian Chuquín

CHAPTER V

4 SIMULATION AND ANALYSIS OF FIRE AND EXPLOSION MODELS IN STORAGE AREA AND OFFICE.

He performed the simulation models according to the different conditions encountered in Ambato Clean Products Terminal EP Petroecuador.

3.2 FIRE-GASOLINE SPILL, DIKE IN TA-01.

Then be conducted simulating Pool Fire (fire spills) TA-01 gasoline.

3.2.1 FIRE-FUEL SPILL.

To simulate fire model spills need to enter the following data into the system as they are.

Report simulating gas in the tank-01.

This window shows the input data and model results, organized in tabular form, the first radiation at specific distances calculated and / or of interest, followed by the data radiation levels at ground level so as the equivalent dose depending on exposure time and duration of the fire.

Modelo de radiación térmica por fuego en un derrame (POOLFIRE)

TÍTULO DEL MODELO
Fuga de Gasolina del Tanque-01
DESCRIPCIÓN
Una emisión de gasolina escapa de una fuga de una tubería con un flujo volumétrico de 0.5 m3/s. Un dique de 41 por 95 m contiene el derrame. Si el líquido se incendia, estime el flujo térmico del receptor a 35 m de la orilla del dique. (Esto es a 50 m a nivel de piso del centro del dique). Utilice una densidad de la gasolina de 740 kg/m3. Considere un tanque con el nivel oprativo de 4187,78 m3, con el flujo volumétrico de 0.5 m3/seg y calcule las distancias en que un receptor se expone a una dosis de 5 kw/m2 por 40 segundos. Esto da una duración de la fuga de 1800 segundos. Considerando una temperatura ambiental, humedad relativa y velocidad promedio de 15 °C, 72% y 0,83 m/s respectivamente de la ciudad de Ambato.

DATOS DE LA SUSTANCIA			
Nombre	GASOLINA	No. CAS	8006-61-9

PARÁMETROS DE ENTRADA	
Calor de combustión	43700,00 kJ/kg
Tasa de combustión	0,055 kg/m2 s
Fracción de energía radiada	0,4
Temperatura ambiente	288,2 K (15,0 °C)
Humedad relativa	72,0 %
CARACTERÍSTICAS DEL FUEGO	
Longitud del área	95,00 m
Ancho del área	41,00 m
Área del derrame	3895,00 m2
Altura de la base del fuego	0,00 m
Tasa de combustión total	214,23 kg/s
Altura de flama	61,41 m

RADIACIÓN CALCULADA A DISTANCIAS ESPECÍFICAS

Distancia a nivel de piso (m)	Distancia a fuente puntual (m)	Transmisividad	Radiación (kW/m2)
3,00	30,85	0,78	244,72
4,00	30,97	0,78	242,85
5,00	31,11	0,78	240,50
6,00	31,29	0,78	237,67
8,00	31,73	0,78	230,77
10,00	32,29	0,78	222,45
20,00	36,65	0,77	170,80
30,00	42,93	0,76	122,70
40,00	50,43	0,75	87,65
50,00	58,68	0,74	63,86

DISTANCIA CALCULADA A NIVEL DE PISO DE NIVELES DE RADIACIÓN ESPECÍFICOS

Radiación (kW/m2)	Distancia (m)	Dosis (W/m2)^4/3 s tiempo de exposición= 40,0s	Dosis (W/m2)^4/3 s tiempo de duración= 1800,0 s
5,05	195,24	3,466 E+06	1,560 E+08
12,60	123,86	1,173 E+07	5,278 E+08
31,50	76,37	3,979 E+07	1,791 E+09

DISTANCIA CALCULADA A NIVEL DE PISO DE DOSIS DE RADIACIÓN ESPECÍFICAS

Dosis (W/m2)^4/3	Distancia (m)
3,466 E+06	774,20
1,173 E+07	499,31
3,979 E+07	321,21

CONCLUSIONS

This project has analyzed the risks of fire and explosion in storage areas and office which is concluded.

• We performed the simulation model of fire in a spill of gasoline and diesel, with real data and information storage and offloading pressure product, obtained from storage areas and office, generating results with a great approach to reality in the event of an incident of this nature.

• By Fire model simulation in a spill of diesel and gasoline loading docks and main island of radiation was determined vs distance, dose vs distance, radius and incidence of radiation doses from the center of the spill to the receiver, generating the data for this model.

• Once the simulation of pool fire (fire in a spill) concludes that the event materialize these islands loading and storage tanks incidence radios are generated by radiation affecting products terminal facilities and buildings clean Ambato nearest these radii being the following:

	RADIACIÓN kw/m^2	**TANQUES**		**ISLAS**	
		Diesel (m)	Gasolina (m)	Diesel (m)	Gasolina (m)
Zona riesgo máximo	31,5	45,72	76,37	18,2	17,26
Zona de intervención	12,6	74,57	123,86	30,86	29,89
Zona de alerta	5,05	117,79	195,24	49,37	48,16

Report gasoline leak in the tank-01 page 140, report leaking diesel tank-04 page 156, gas leak report main island page 172, diesel leak report main island page 188.

• Diagrams processes studied during the development of this research project are an important tool with which account, to create a more sophisticated design process and updated storage and distribution

• In establishing operating procedures for storage and dispatch of Ambato Clean Products Terminal, it has been concluded that at present all the oil industries should have standardized procedures in order to perform activities of these without any risk.

RECOMMENDATIONS

• For the simulation of different models of fire and explosion data must consider temperature, relative humidity, fuel density, area, weather scenario, which must be real so that the simulation is closer to reality.

• In case of such an event materialize should activate the alarm to stop all operations within Terminal Ambato, and then both the company personnel, and all persons not present at the Terminal must abide by the regulations issued by the staff of security, in this case handed over to the meeting as soon as possible.

• The Terminal security area Ambato, before radiation data and thermal dose reports generated in each of the simulations of Fire of a spill, should take appropriate measures and actions, and updating the contingency plan to reduce risk.

• You must perform the design and installation of a fire suppression system in the secondary island, is vital to the smooth operation of the Ambato Clean Products Terminal.

• Should be trained properly to staff working in the areas of storage and dispatch of products, this will contribute to greater control within Terminal Clean Products Ambato, to thereby maintain current knowledge of workers on processes or changes made in them.

• Keep in mind when making a flow chart of a specific process, this is as clear as possible so that anyone interested can clearly understand and interpret.

• Conduct periodic drills in the areas of storage tanks and loading islands to prepare staff Terminal Clean Products Ambato to a potential emergency and that they can respond quickly and effectively.

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