

Risk assessment of a ruptured natural gas environmental sciences essay



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The main purpose of activating this report is to assess the environmental impact due to rupture of a natural gas pipeline, we will have the chance to deal with the (CNG) compressed natural gas. Therefore (CNG) could cause several risks resulting of the possibility of rupture of a pipeline by leading the dispersion for such gases that can be toxic and flammable through the atmosphere. In addition to that Egypt is the second largest natural gas producer in Africa, therefore during our study we must know that the hazard assessment is divided into two cases ignited natural gas which deals with the danger of the toxic and thermal radiation levels of the released (NG), and for sure no flammability hazard evaluation is needed as it is already flammable, while the other which is un-ignited natural gas, and in such case it will deal with the flammability and toxicity hazards of. Moreover the ruptured pipe case, the limits of the following impacts was described as the following:

Limits of flammability for un-ignited NG release. Limits of toxicity for the hydrogen sulphide in un-ignited (NG) release. Limits of toxicity for the sulphur dioxide content inside the ignited and released (NG). Limits of the heat flux produced form the ignited NG and its effect on the surrounding

However accordingly to that we shall use the software on EPA dispersion models where we shall estimate the size and location of the dangerous clouds, also the growth and decay of transient 3D dangerous clouds will be investigated to get an estimate of the size and duration of expected damage. Moreover this research paper consists of six chapters where they are as follows for chapter 1 which is the introduction which consists of the natural gas, pipelines, natural gas pipelines, dispersion of the toxic and the flammable gases and finally the terms we should know towards our case study. For chapter 2 is the literature Review where I talked about <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

Bhopal and other accidents, for chapter 3 calculations, for chapter 4 the Breeze Haz software applications scenarios, for chapter 5 which are the diagrams and figures of software results and last but not least the results and discussion.

Introduction:

Nowadays there is no longer any doubt that natural gas reserves are the world's most readily existing and profuse gaseous fuel resources. Presently, natural gas has become a main manufacturing that transfer fuel all over the country Egypt towards a multifaceted pipeline net. Natural gas consists of anaerobic, or bacterial-assisted, decomposition of organic matter under heat and pressure. Moreover natural gas is consist chiefly of methane, by ranging anywhere from 70% to 99% by volume accordingly to (Applied Combustion, Second Edition), natural gas is a naturally occurring hydrocarbon gas mixture consisting primarily of methane, with other hydrocarbons, carbon dioxide, nitrogen and hydrogen sulfide. However raw natural gas is usually sweetened before selling it to customers, therefore sweet natural gas is particularly colorless and odorless, but for safety reasons, is soured by the familiar rotten egg odor by adding a very small amount of hydrogen sulfide H₂S. Moreover the utilization of natural gas, to put in mind we must be familiarized that natural gas is one of the most important fossil energy sources. Therefore in our daily life we use natural gas by mean natural gas is been activated as a fuel for several life duties for heating cooking, electricity generation, industry and in the production of synthetic materials such as paint, fertilizer, plastic, antifreeze, and others of use. Natural Gas Reserves contains of two types of standings where they are describes as follows

proved reserves and potential resources. Therefore for proved reserves they are quantities of such gas that have been researched by the drill. While they can be proved by the known reservoir characteristics such as production data, pressure relationships, and other data, so that the volumes of gas could be specified with reasonable accuracy. On the other hand the potential resources constitute those quantities of natural gas that are believed to exist in various rocks of the Earth's crust but have not yet been found by the drill. They are future supplies beyond the proved reserves. In addition to that natural gas is divided into three classes' as follows non-associated gas, associated gas, and gas condensate. Therefore for non-associated gas is from reservoirs with minimal oil, for the associated gas is the gas dissolved in such oil under natural conditions in the oil reservoir, last but not least the gas condensate which refers towards gas by a high content of liquid hydrocarbon at the reduction of pressures and temperatures. We must be sure that natural gas is an important energy source to provide heating and electricity. However natural gas processing is a complicated industrial process that been constructed to vacuum raw natural gas by spreading the impurities and various non-methane hydrocarbons and fluids to produce what is known as pipeline quality dry natural gas. Egypt is the second largest natural gas producer, as a matter of fact Egypt produces in Africa for about 48. 3 billion cubic meters of such natural gas out of which 32% are exported accordingly to (Egypt latest updated: Jul. 18, 2012). Furthermore, Egypt plays a vital role in the international energy markets through the operation of the Suez Canal and Suez-Mediterranean (SUMED) Pipeline, important transit points for oil and liquefied natural gas (LNG) shipments from African.

Therefore locally Egypt, natural gas is being used as the major source of
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energy for homes, industrial plants, and even in transportation. It is also used as a feed stock for many petrochemical industries. Through the past years, Egypt has launched full development plans, which are based on the utilization of its natural gas resources. In doing so, natural gas has been used as a fuel instead of fuel oil and gas oil as they are a catalyst element in fertilizers, steel industries and finally in petrochemicals. To achieve that, Egypt gas has been supplied major and minor industrial situated in old and new cities throughout Egypt. Thus, several natural several natural gas pipelines have been spread all over Egypt to transport the compressed natural gas (CNG) towards the processing plants and then to the local customers. Accordingly to that we must know what is a pipeline? A pipeline is a long pipe, typically underground, for conveying oil, gas, etc., over long distances. However natural gas have been transported from the wellhead to end consumers through a series of pipelines where there are five different types for such a pipe as the following including flow lines, gathering lines, transmission lines, distribution lines, and service lines which carry gas at varying rates of pressure. Pipelines function as blood vessels serving to bring life-necessities such as water or natural gas and to take away life waste like sewage. And they are considered to be the most favored mode of transportation of gas/liquid in large quantities. Many of the pipelines were built by specific companies to transport commodities to their customers in their respective territories. Furthermore, pipeline companies must continue to operate profitably, and thus pipelines are interconnected at national and global level.

However accordingly to that these are the five types of pipeline as follows:

Flow lines: The main objective for such a flow lines is that it is been attached by a single wellhead in a producing field, which transfer natural gas from the wellhead to nearby storage tanks, transmission compressor stations, or processing plant booster stations. However flow lines are relatively narrow pipes that carry un-odorized raw gas at a pressure of approximately 250 psi (pounds per square inch). Typically, flow lines are buried four feet

underground. To put in considerations flow lines are also prone to methane leakage. **Gathering lines:** For the gathering line which gather the gas from numerous flow lines and transport it to centralized points, such as processing facilities, tanks, or marine docks. Gathering lines are medium size steel pipes (usually under 18" diameter) that carry un-odorized, raw gas at a pressure of approximately 715 psi, accordingly towards (Wendy Lyons Sunshine)

Typically, gathering lines are buried four feet underground. **Transmission**

Pipelines: For the transmission pipelines transport natural gas over long distances and occasionally across interstate boundaries, usually to and from compressors or to a distribution center or storage facility. Transmission lines are large steel pipes (usually 2" to 42" in diameter; most often more than 10" diameter) that are federally regulated. They carry un-odorized gas at a pressure of approximately 200 to 1, 200 psi related to (Wendy Lyons

Sunshine) as for the diameter and pressure approximation. How we must know that transmission pipelines can also fail due to the following: seam failures, corrosion, materials failure, or defective welding. **Distribution**

Pipelines: Towards the distribution pipelines it seems that they are also known as " mains," where they are the middle step between high pressure

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transmission lines and low pressure service lines. Moreover distribution pipelines operate at an intermediate pressure. These kind of pipes are small to medium sized pipes (2" to 24" in diameter) that are federally regulated and carry odorized gas at varying pressure levels, from as little as 0.3 up to 200 psi accordingly to (Wendy Lyons Sunshine) as for the diameter and pressure approximation. However distribution pipelines typically operate below their carrying capacity. Distribution pipelines are made from a variety of materials, including steel, cast iron, plastic, and occasionally copper.

Service Pipelines: Service pipelines where its main objective is that service pipelines are been connected towards a meter that carries natural gas to individual customers. In addition to that service pipelines are narrow pipes (usually less than 2" diameter) that carry odorized gas at low pressures, such as 6 psi which depends on to (Wendy Lyons Sunshine) as for the diameter and pressure approximation. Finally service pipelines are typically made from plastic, steel, or copper. However we must know there are conditions could occur on such a pipeline by causing such rupture, by mean in our project we are dealing with the CNG which related to compressed natural gas this could cause several risk due to the possibility of rupture of such a pipeline which then may lead the dispersion of the toxic and flammable gases in the atmosphere. However accordingly to (Badr and Partheesh 2006) it seems that they have mentioned an assessment method for the environmental impact of natural gas but towards the special case where the natural gas is leaked from a broken pipeline. However undertaking with the released natural gases, the hazard assessment is divided into two cases and comparing between them to choose the least hazardous case: Ignited natural gas, where it is considering the danger of the toxic and thermal radiation

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levels of the released (NG), and for sure no flammability hazard evaluation is needed as it is already flammable. Un-ignited natural gas, and in such case it will deal with the flammability and toxicity hazards of. Moreover the ruptured pipe case, the limits of the following impacts was described as the following:

Limits of flammability for un-ignited NG release. Limits of toxicity for the hydrogen sulphide in un-ignited (NG) release. Limits of toxicity for the sulphur dioxide content inside the ignited and released (NG). Limits of the heat flux produced from the ignited NG and its effect on the surrounding

Furthermore for such a line rupture this could occur due to the pressure which transmission pipelines are been launched, therefore a failure of a pipeline could lead to a turbulent and complicated gas dispersion.

Moreover a rupture there will be a rapid depressurization in the vicinity of the failure. For buried pipelines, the overlying soil will be ejected with the formation of a crater of a size and shape, which influences the behavior of the released gas. Depending on the alignment of the pipe ends in the case of a rupture, the gas will escape to the atmosphere in the form of a jet, or jets.

The start of the release, a highly turbulent mushroom shaped cap is formed which increases in height above the release point due to the source momentum and buoyancy, and is fed by the gas jet and entrained air from the plume which follows. In addition to entrained air the release can also result in entrainment of ejected soil into the cap and plume. Eventually, the cap will disperse due to progressive entrainment & a quasi-steady plume will remain. However we can illustrate numerous of rupture incidences that have happened all accidents been distributed are related towards the (About HInt Dossiers and HInt databases). Therefore as matter of fact there was an

incidence that has taken place in Canada where Ignace, Ontario. A rupture
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has been occurred during a pressure-testing of a section of 1,067 mm (42 inch) gas pipeline. Where the pipe is part of a pipeline used to carry natural gas from Alberta to eastern markets. Labor union representatives blamed the incident on the use of out-of-province contractors who employ non-union labor. Another accident was placed in the USA Jal, NM. Sid Richardson Gasoline Co. A 16-inch-diameter natural gas transfer pipeline, buried about 1m underground, ruptured and burst into flames beneath two tanks at the plant containing methanol and glycol. The explosion created a crater 8m by 7m by 3m deep. Plant personnel where it was reported hearing the rupture, heard the gas escaping and then, within a few seconds, it ignited. The blast, which also caused the two tanks to burn, caused no injuries, but forced the plant to shut down. Pensacola, FL. Gulf South Pipeline in the USA. Energy Services of Pensacola. At least ten persons were injured when two natural gas lines ruptured and exploded after a parking lot gave way beneath a cement truck at a car dealership. The blast sent chunks of concrete flying across a four-lane road, and several employees and customers at neighboring businesses were evacuated. About 25 cars at the dealership and 10 boats at a neighboring business were damaged or destroyed. Gulf South Pipeline employees quickly closed a valve to isolate the larger of the damaged lines, which interrupted service to Pensacola Naval Air Station, and a limited number of other customers. The other line belonged to Energy Services of Pensacola, a city-owned utility. On the other hand we can talk about pipeline corrosion problems where several pipelines deteriorate slowly, and in such certain cases pipeline life has been reliably targeted at 70 years or more. Where other pipelines have been built which have exhausted their useful life after 1 year of operation. Apart from the quality of the

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construction, coatings, CP systems etc, the factors which affect pipeline life include nature of the product, nature of the external environment, operating conditions and quality of maintenance. However during the beginning of 1990s there were appeared lots of concerns due to the increasing threat towards the corrosion of the pipeline integrity where corrosion was the major cause of several conditions as shown below: Corrosion was the major cause of reportable incidents in North America. Corrosion was the major cause of pipeline failures in the Gulf of Mexico. Corrosion in one pipeline in North America required over \$1 billion in repairs. Therefore due to the corrosion which is also can produce a severe condition for such an accident related to (HInt Dossier) there where an accident where took place in USA Pecos River, NM. El Paso Energy. Eleven campers were killed when an underground natural gas pipeline exploded. Two people were in critical condition after being transported to hospital. The explosion left a large crater and its flames were visible 32 km away. The 30-inch pipeline, which carries gas to customers in Texas, New Mexico and California, runs 2.5 to 5 meters underground at the rupture point. The pipeline company, El Paso Energy, says the pipeline was installed in 1950, and was inspected earlier this month. A company spokesman also said: " It goes into an area where a transition to go across the river and there are a lot of valves and turns in the pipeline. This part of the pipeline is not capable of being inspected internally." Investigators revealed on 08. 22 that they have found a significant amount of corrosion and some wall thinning in a 22-foot section of pipe ejected in the blast. Therefore accordingly the table below shows several nature accidents by the date, location, and finally the damage caused for example in 28 august 1988 where it took place in Juan De Los Reyes, Mexico therefore the <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

accident was described as having 76. 2 inch pipeline ruptured along 4 km length, where caused fire of 4. 8 km radius due to that the damage caused fire burned for 5 hours and 20, 000 barrels of crude oil lost, where 80 injured and 12 deaths. Table 1 A listing of some of the major accidents relating to pipeline rupture Pipeline shut down emergency valves in order to separate and thereby limit the amount of inventory which may be released as a result of pipeline rupture, it is now a statutory requirement that all pipelines larger than 40mm diameter conveying a gases or liquids which must be equipped with emergency shutdown valves (ESDV). However there are two types of valves which may be employed for emergency shutdown. These include ball valves which are self-activating on sensing a drop in pressure, or check valves which allow flow in one direction only. Associated with each valve, there are two characteristic time domains which govern their performance. Having this large network of compressed natural gas pipelines produces risk of accidental rupture of such pipes. Therefore the emitted gas in atmospheric air may lead to two types of environmental problems; namely toxicity and flammability. Natural gas pipelines have been spread out all over Egypt to be transfer as a compressed natural gas (CNG) towards industrial plants, local, and finally customers. However we must know that when we apply the CNG it seems that it will result numerous risks due to the appearing of rupture of pipeline which may cause the dispersion of the toxic and flammable gases in the atmosphere. However having this large network of a compressed natural gas (CNG) it seems that pipelines produces a risk of accidental rupture of such pipes. The emitted gas in atmospheric air may lead to two types of environmental problems: namely as toxicity and flammability. Furthermore, in our study towards the problem, we shall assess <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

the environmental impact due to the rupture of natural gas pipeline that may have been caused by several situations. In addition to that the present project consists of two gases that we will focus on H₂S and methane, moreover the H₂S gas is related to toxicity situation while the methane related to the flammability situation. In order to achieve the project we must be familiarized with natural gas pipeline systems, because natural gas is toxic, flammable and explosive handling of that fuel requires us to be careful with having highly efficient transportation system with least possible losses. However we must know briefly about the two gases for H₂S and methane gas as follows: H₂S gas: For (H₂S) gas hydrogen sulfide is such a heavier than air, which is an explosive when the concentration in air is between 4.3% and 45.5%. However at very low concentrations, hydrogen sulfide can be spotted by its rotten egg smell. Therefore it quickly paralyzes the olfactory senses so it can no longer be spotted by smell, H₂S can cause long lasting health effects and have a penalty of death due to the high concentrations. Methane gas: for the methane gas which one of the most dangerous gases we are dealing with that is related to flammability, therefore methane gas is odorless colorless gas which can prevent explosive when such the concentration in air is between in a range of 5% and 15%. The paper is divided into several parts where it talk about the natural gas, pipelines, natural gas pipelines and the dispersion of toxic and flammable gas and also the accidents of natural gas pipelines due to rupture we now have the ability to say that accordingly to the reports and analysis it is a fact that Bhopal case is the worst accidental release of dangerous gases in history. Over the history of the humanity, a lot of strong accidents of gas pipeline rupture and dispersions have taken place. Among the most famous <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

ones that come to our minds is the " Bhopal catastrophe" comes no doubt on top of the list. This disaster happened in India December 3rd, 1984. And precisely in the UCIL company (Union Carbide India Limited). However the accident has been resulted in the emanation of gas of methyl which isocyanate that was widely used in the production of carbonyl at the period of time. This gas consisted of a mixture of methane that is considered the major component of the explosive natural gas, including concentrations of carbon dioxide with toxic H₂S. The consequence of that accident involved the death of 3000 and severe injuries of about 300, 000 these numbers were taken from ((National Information center, Madhya Pradesh., 2010)The main objective of the project is to study the effect and behavior and concentration profile of the released gases of a famous gas pipeline rupture case. This will be performed by using one of the CFD software (computation dynamics). These include the FEM3 (finite element in 3D) and SLAB (for analysis of dispersion models) of heavy gases. Also we will activate the software Breeze Haz on EPA dispersion modes where can illustrate from it the size and location of the dangerous clouds. However we will also use the growth and decay of transient 3D dangerous clouds to investigate to produce an estimation of size and duration of the expected damage.

Literature Review:

Towards accident it quite seem that Bhopal accident was one the most catastrophic accident along the human race, how Bhopal case isn't our track towards our study we can mention it accordingly towards the dispersion for such released gas. Therefore the Bhopal accident was assessed as an environmental impact assessment due to the dispersion of such abnormal

release gas which was natural gas. In addition to that our cases should be related towards the environmental risk assessment of a ruptures natural gas pipeline which may lead the release of toxic and flammable gases in the atmosphere. However, during the year of 2004 July 30 an accident have been token place in Ghislenghien industrial park, in Belgium. Therefore we must know that the pipeline was located under the factory car park, however it was been reported that there were about 24 been dead, and 120 been injured. Moreover the type of this accident was a gas pipeline explosion, therefore due to the improperly done construction work lead to a horrible accident of pipeline rupture that was carrying highly pressurized natural gas. As a consequence, a big number of fatalities took place; most of them were policemen and fire-fighters that were in charge to control the situation after the explosions occurred. However there accordingly to the Fluxys organization which is a Belgian gas pipeline operator that detected a line which ruptures runs from Zeebrugge, on the North Sea coast, to the French frontier, due the rupture of the line it seems that a gas leakage been occurred which caused the explosion. After the accident been declared the pipeline that been exploded was returned to service by reducing the pressure, accordingly to Fluxys spokesman said that the pressure would increase to normal range from (70-75 barg). By that about 75m (240 feet) of the pipeline had been changed and hydraulically been examined to 40 % overpressure. However we must know that Bhopal disaster was the worst industrial accident of all time in the history of mankind which I called " Bhopal catastrophe. Bhopal disaster happened in India December 3rd, 1984. And precisely in the UCIL company (Union Carbide India Limited). However the accident has been resulted in the emanation of gas of methyl which <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

isocyanate that was widely used in the production of carbonyl at the period of time. This gas consisted of a mixture of methane that is considered the major component of the explosive natural gas, including concentrations of carbon dioxide with toxic H₂S. The consequence of that accident involved the death of 3000 and severe injuries of about 300,000 these numbers were taken from (National Information center, Madhya Pradesh., 2010). In addition to that studies that were performed during the investigation and that were done with the target of determining the level of danger of the pollutant at various distances from the source of LNG (liquid natural gas) spillage.

Investigations considered out by Yassin and F. at 2009 showed that: the aerodynamic flow and concentration of the pollution were function of the shape of the building and weather conditions. They claimed the original valve of LNG after its spillage took place under normally operating conditions of atmospheric pressure was approximately of -160 °C, as spillage occurred for a wall consisting of a 2 layered wall with the outer layer made of carbon steel while the inner one made of aluminum that is essential for cryogenic purposes (which is physics study at low temperature substances). The Gaussian dispersion model which has as a task to show the concentrations profiles shape and behavior by means " Breeze Haz" software, showed that the stack which the gases were released was of about 10 m height, and that the hole size in the tank was no more than 12 m². In 2007, Moussa and Eid rated the atmospheric conditions after a well performed study of the meteorology as an " F" grade (very unstable conditions). In 2007, Woodmark used the same model of Gauss but with the addition of studying the dynamic forces acting on the dispersion prototype of the LNG pool and took the momentum into consideration as well. In 1993, Tunnel and Hardegee and <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

Hicks stated that the possible ways that could be used to clean the spillage natural gas include (burning, clipping, flushing, absorption) of elements around it. Schmidt number which is a dimensionless number used as a parameter to deduce to rate of evaporation was estimated to be = 1, 251 for 70% of the methane. However its value depends on the % of the released gases out of the ruptured pipelines.

Other famous accidents:

The release of light hydrocarbon during the famous pipeline failure. This may lead to huge explosions as the pipelines were carrying about 16800 lbs of hydrocarbons that have an effect equivalent to 1 ton of explosive TNT.

According to Louvran in 2002, 2 people died, 9 were injured and economic loss was of 15.6 million \$. The ethane release of petrochemical Canadian power plant gas pipelines on the 8th April, 1982, this led to a huge explosion because of the association of electric ignition. However for all of these reasons the OSHA (occupational safety and health association), held a formal investigation in order to deduce the different reasons that contributed to that horrible accident causation. Therefore they also pointed to the crucial importance of setting strict unbreakable regulations that restrict the use of such hazardous substances that threaten the lives of human beings without ensuring enough safety precautions and safety to the pipelines against risks of dispersions and rupture, and the great importance of making an environmental impact assessment after such catastrophe to learn from the mistakes and recover in the future.

The tasks that been done of the project for semester 1 are been distributed below:

Accordingly to our tasks of the project we must review the purpose of this project which is to assess the environmental impact due to rupture of a natural gas pipeline that leading to the release of toxic and flammable gases in the atmosphere. However I our tasks that I have covered towards this semester as follows: An introduction that divided into four parts and each part divided into different sections the four parts are talking about natural gas, pipelines, natural gas pipelines, dispersion of the toxic and the flammable gases. However in each of these parts there are sections as follows: Natural gas: The utilization of natural gas, natural gas reserves, natural gas resources, Natural gas processing and finally natural gas in Egypt. Pipelines: Pipelines types, pipeline rupture, pipeline corrosion, and pipeline shut down emergency vales. Natural gas pipelines: Multi-attribute risk assessment for risk ranking of natural gas pipelines, failure analysis of natural gas pipes, natural gas pipeline leak, (CNG) compressed natural gas and the event tree for accidental release of natural gas from pipelines. Dispersion of the toxic and the flammable gases: H₂s gas, methane gas the worst accidental release of dangerous gases in history (Bhopal case). Terms we should know towards our case study: Shock wave, wind, accident leak, emergency shut valves due to crack pipe line, procedures for causing the rupture gas pipelines, and finally the dispersion models. Literature Review: In the literature review I will talk about the " Gas Pipeline Explosion at Ghislenghien, Belgium" accordingly to that a pipeline was been ruptured which caused a gas pipeline to explode in Ghislenghien industrial park where it took 15 dead and three missing. However also I will talk about the Bhopal <https://assignbuster.com/risk-assessment-of-a-ruptured-natural-gas-environmental-sciences-essay/>

accidents and other accidents that related to our objective in different countries. The obstacles that I could face in my project is actually the software or the package due to the lack of experience in it I can solve it by taking the user guide of the software may help. The planning of the different application that will be done in semester 2: for the second semester we will actually deal with calculations and the (Breeze Haz) software in order to specify the concentration of the spreading of gases and thus the size of the dangerous zones, also we will use the Breeze Haz to assess the size for dangerous zones due to the parameters of wind speed, atmospheric stability and accidental studies. However for the calculations we will apply which will be related into three parameters are the area, temperature and mass. In addition to that we need to know the metrology of the atmospheric stability, wind speed and wind direction.

The Gant chart (Time table of tasks):

Task

OctNovDecJan

Feb 10 deadline progress S1

MarchAprilMay

Introduction of ENVIRONMENTAL RISK ASSESSMENT OF A RUPTURED NATURAL GAS PIPELINE

Literature review

Objectives

Calculations

Breeze Haz software applications scenarios

Diagrams and figures of software results

Results and discussion

The achievements I did is that understanding the objective of the project by dividing it into parts that each part of it is related to other as sequence way from scratch till the end. The introduction I explain natural gas basically then I have tried to get the reader information about natural gas in Egypt, pipelines, dispersion of dangerous gasses also I talked about the worst accident and other accidents that related the rupture. For the literature review i also talked about the Bhopal accident and other accidents in our case. Also I have been able to know a bit about Breeze Haz the software that I apply on it, last but not least I have been familiarized towards some calculations we will use depending on the area, temperature and mass.