STUDY OF RELEASE OF HYDROCARBONS IN THE ATMOSPHERE WHILE LPG AND PROPANE TANKERS LOADING AND ITS OCCUPATIONAL HEALTH EFFECTS

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Dedication

This thesis is dedicated to my parents, wife, son and daughter who have always stood by me and supported me in continuing education and dealt with all my absence from many personal occasions with a smile.

Declaration

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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Date – 26th March 2014

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Thesis Completion Certificate

This is to certify that the thesis entitled ***"Study of release of hydrocarbons in the atmosphere while LPG and Propane tankers loading and its occupational health effects"*** submitted by ***Anant Tandale*** to ***University of Petroleum and Energy Studies*** for the award of the degree of ***Doctor of Philosophy*** is a bonafide record of the research work carried out by him under our supervision and guidance. The content of the thesis, in full or parts have not been submitted to any other Institute or University for the award of any other degree or diploma.

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Anant Tandale

Date: 26th March 2014

Appeal

TO THE STAKEHOLDERS OF HYDRO CARBON TANKERS LOADING AND UNLOADING BUSINESS IN INDIA

I respect national and international standards; their administration and enforcing bodies (including Indian standards and Bureau of Indian Standards, BIS, Oil Industry Safety Directorate) for their contribution to society in providing domain specific standards and guidelines. Also I respect enforcing authority's efforts towards ensuring standard compliance requirement in business. I respect all LPG and Propane producing companies including their procedures for loading and unloading of road tankers for transportation to various destinations across the India. I respect all Indian government oil companies that are marketing LPG and Propane for their untiring efforts, systems and procedures in safe transporting the product through busy roads in a responsible way.

The stakeholders of this business are humbly requested to consider the gaps mentioned in this research work are not to be treated as criticism on any specific clause in any standard or on standards enforcement authority or on

any testing laboratory or on any specific person or on any specific industry or organization.

With due respect, I appeal to all stakeholders to consider the recommendations given in this research work are purely to improve implementation of national standards with noble intentions towards improving the occupational health of the loading operators in a long run.

Anant Tandale

Date: 26th March 2014

Executive Summary

Energy makes change; it does things for us. It moves cars along the road and boats over the water. It bakes a cake in the oven and keeps ice frozen in the freezer. It plays our favorite songs on the radio and lights our homes. Energy makes our bodies grow and allows our minds to think. Scientists define energy as the ability to do work. People have learned how to change energy from one form to another so that we can do work more easily and live more comfortably.

It comes in different forms - heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. Energy is in everything. We use energy to do everything we do, from making a jump shot to baking our favorite cookies to sending astronauts into space - energy is there, making sure we have the power to do it all. There are two types of energy - stored (potential) energy and working (kinetic) energy. For example, the food you eat contains chemical energy, and your body stores this energy until you release it when you work or play.

All forms of energy are stored in different ways, in the energy sources that we use every day. These sources are divided into two groups - renewable (an

energy source that can be replenished in a short period of time) and nonrenewable (an energy source that we are using up and cannot recreate in a short period of time). Renewable and nonrenewable energy sources can be used to produce secondary energy sources including electricity and hydrogen.

Renewable energy sources include solar energy, which comes from the sun and can be turned into electricity and heat. Wind, geothermal energy from inside the earth, biomass from plants, and hydropower and ocean energy from water are also renewable energy sources.

However, we get most of our energy from nonrenewable energy sources, which include the fossil fuels - oil, natural gas, and coal. They are called fossil fuels because they were formed over millions and millions of years by the action of heat from the Earth's core and pressure from rock and soil on the remains (or "fossils") of dead plants and animals. Another nonrenewable energy source is the element uranium, whose atoms we split (through a process called nuclear fission) to create heat and ultimately electricity.

We use all these energy sources to generate the electricity we need for our homes, businesses, schools, and factories. Electricity "energizes" our computers, lights, refrigerators, washing machines, and air conditioners, to name only a few uses.

We use energy to run our cars and trucks. Both the gasoline used in our cars, and the diesel fuel used in our trucks are made from oil. The propane that

fuels our outdoor grills and makes hot air balloons soar is made from oil and natural gas.

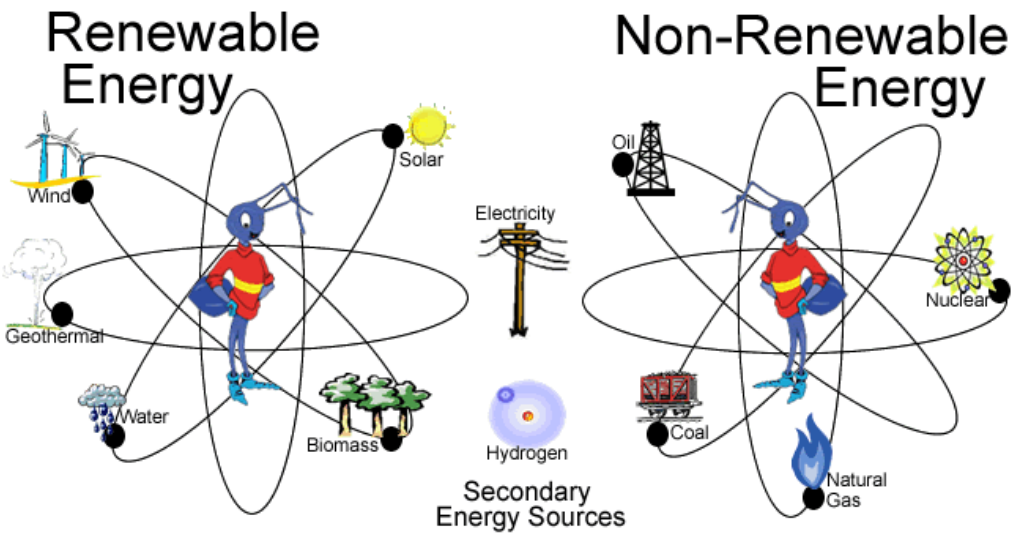

Figure 1 – Renewable and non renewable energy

Liquefied Petroleum Gas is popularly known as LPG. It is used primarily as domestic fuel in cooking ranges and in commercial and industrial installations as a fuel for furnace. It can also be used as feed stock for petrochemical industry. However, since in India, consumption of LPG is more than what we produce indigenously, we are mostly using it as a fuel. LPG is a mixture of hydrocarbons consisting mainly of Propane (C_3H_8) and Butane (C_4H_{10}) in the ratio 50:50 (by weight) with a maximum vapour pressure of 16.87 Kg/cm2g at 65 deg C. It should conform to IS: 4576 specification. LPG today is the most sought after fuel for the domestic sector and demand has constantly out-stripped supply. To meet the GAIL's (GAIL India Limited) objective of utilization of the various fractions of gas apart from transportation and

marketing of natural gas led to the establishment of LPG plants at Vijaipur, Vaghodia, Usar and Lakwa.

LPG and Propane is filled under pressure, stored and transported to the consumer. When the cylinder valve is opened reduction of pressure takes place and the liquid turns into gas. LPG and Propane is in gaseous form at ambient temperature and pressure, and LPG is almost twice as heavy as air. Hence, it always settles down to floor level in case of leakage. LPG and Propane is colorless and odorless. Therefore, a distinctive fuel odor is added before it is filled into cylinder to enable easy detection in case of leakage.

In India there are three ways to transport the LPG and Propane e.g. through underground pipeline, through rail wagons or through road tankers. Transportation through underground pipeline is the safest way to transport but has its limitation. It depends on topography, proximity of the cylinder filling companies etc. For supplying these products to the industries located at remote places or where there is no bulk use or where there is no rail network the easiest way is transportation through road tankers.

While Loading and unloading operation of the Liquefied Petroleum Gas (LPG) and Propane from tanker it is important to check the quantity filled inside the tank. There is no automatic device to measure the liquid level inside the road tankers. This is done with manual intervention to know the liquid level content inside the tank of the tanker lorry. Loading and unloading operation of Liquefied Petroleum Gas (LPG) and Propane tanker is carried out with intermittent checking of liquid level inside the tank with the help of

rotogauge. Rotogauge is a devise fitted in the tanker which is useful in measuring the liquid level inside the tanker in terms of percentage. In the present scenario the rotogauge helps to determine the liquid level inside the tank and liquid level inside the tank is ensured. Maximum allowable liquid level is 95% and Vapour space of 5% is left.

Hydro carbon is released in the atmosphere through rotogauge while loading of LPG and Propane in the tankers contributes occupational health problems to the workers, greenhouse gas effect as well as revenue loss though it is insignificant in case of one tanker but it is significant if we consider loading and unloading of tanker at National level per day and Organizational level per year.

At present in India there are about 10,400 tankers (LPG + Propane) having valid license to carry / transport compressed hydrocarbon from Petroleum and Safety Organisation (formerly Chief Controller of Explosive). These tankers are being filled and emptied out regularly at different locations in India. All these tankers are having the liquid level measuring device called ROTOGAUGE. While filling as well as emptying out these tankers, the standard practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage. Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (approximately hydrocarbon is being released in the atmosphere for total 1 minute through rotogauge). During opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as

vapours). While loading of these tankers, operator has to ensure that the liquid level of LPG / Propane inside the tanker should not exceed 95% . For ensuring the same, operator fixed the rotogauge indicator at 95% mark, so that whenever liquid level reaches that mark, LPG / Propane in the liquid form starts coming out from the 2 mm diameter size orifice of rotogauge. Intermittently they are also checking the exact level of liquid inside the tanker by rotating the rotogauge. Moreover while doing this measurement the operator is standing very near to the rotogauge device for operating it. During this process these operators are exposed to the hydrocarbon. They inhaled the air which contains traces of hydrocarbon. The exposure to these hydrocarbons for longer service periods impacts cholesterol in blood thereby increasing the health risk of these operators. Moreover it was also observed this impact is reversible if these operators are rotated frequently from loading / unloading gantry of offsite areas where there is hydrocarbon atmosphere is available. The impact distance for presence of hydrocarbon traces is verified in the field with the help of monitoring and the results are comparable with that the results obtained through ALOHA software.

The literary contributions from the current research are:

1. The exact process of loading and unloading operation of LPG and Propane tankers were documented. Various factors affecting the occupational health were described in detail.

2. Carried out in-depth study regarding discharge of hydro carbon (LPG and Propane) while loading activities in loading gantries.

3. Carried out in-depth study regarding variation of impact zone in different seasons.

4. Details study was carried out for use of alternate method to measure the liquid content inside the road tankers without releasing the hydro carbon in the atmosphere.

5. Details analysis is done regarding the loss of revenue to the organization because of release of hydro carbon in the atmosphere during loading and unloading activity.

6. Detail study is done regarding the occupational health effect of VOC's (volatile organic compounds) on the loading operators who are involved in loading operations of these tankers over a period of different seasons.

Following advantages are expected from the implementation of research recommendations.

- Occupational health exposure to the loading operators can be eliminated during loading and unloading activities of LPG and Propane tankers.
- Open cold venting of hydro carbon in the atmosphere can be eliminated.
- Contribution in Greenhouse gas effect can be minimized due elimination of release of un-burnt hydrocarbon in the atmosphere.

- Revenue loss of the organization due to release of un-burnt hydrocarbon can be minimized.
- Surrounding area of the loading and unloading gantries can be made free from traces of un-burnt hydrocarbon thereby reduces the risk of fire and explosion.
- Countrywide during many of the road accident of the LPG and Propane tankers the most vulnerable portion rotogauge is easily gave away thereby increased the risk of leakage and fire / explosion. This risk can be eliminated in case rotogauge is replaced with another suggested measuring device.

Thus the research concludes with the solution to address the problem in existing hydro carbon level measuring device inside the road tanker with an aim to improve the occupational health issue to loading and unloading operators, to reduce the revenue loss to the organization and also ratifies the field outcome of the hydrocarbon presence zone against the software results.

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Abbreviations

Acronym	Full Form
DOT	Department of Transportation
ISO	International organization for standardization
LP Gas	Liquefied Petroleum Gas
LPG	Liquefied Petroleum Gas
BIS	Bureau of Indian Standard
OISD	Oil Industry Safety Directorate
NFPA	National Fire Protection Association
GAIL	Gas Authority of India Limited
CIL	Cairn India Limited
MTA	Million Tonnes Per Annum
TPD	Tonnes per day
NG	Natural Gas
MMSCMD	Metric Million Standard Cubic Meter per day
HVJ	Hazira Vijapur Jagdishpur
deg C	Degree Centigrade
SBPS	Special Boiling Point Solvents
LEF	Light End fractionating Column
NGL	Natural Gas Liquid

CCR	Central Control Room
VAR	Vapour Absorption Refrigeration
LFL	Lower Flammable Limit
UFL	Upper Flammable Limit
SBPS	Special Boiling point solvents
NFL	National Fertiliser Limited
K.O. Drum	Knock Out Drum
G T	Gas Turbine
C C R	Central Control Room

Chapter 1.

Introduction

The chapter outlines energy requirement in India. The basis for research, scope and objectives are defined in this section. The methodology to achieve scope and objectives are also described in systematic research framework. Structure of this entire dissertation report is outlined at the end of this chapter as content of the report.

1.1 General

India is the third largest consumer of Liquefied Petroleum Gas (also known as LP Gas or LPG) in domestic sector in the world after china and USA [34]. Over the last fifty years the most significant shift in India's energy consumption was the replacement of non-commercial energy sources with commercial sources such as coal, oil and gas, hydro and nuclear power. The latter's share in total energy is expected to go up to 76.5% by 2011-12 from 29% in 1953-54. Share of oil in the total energy consumption has also shown significant growth from

mere 5 % in 1960 to around 25%, though the share of oil in world energy mix is around 40%. India ranks sixth in the total energy consumption in the world, but in terms of per capita energy consumption, it is only 20% of the global average. This is only the national average. Disparities in consumption are vast between regions and income-groups.

Representative Countries & Energy Usage, 2002

Country	Population in millions	Energy consumption in quadrillion Btu's
China	1295	43.2
India	1050	14.0
United States	288	97.4
Brazil	176	8.6
Pakistan	150	1.8
Russia	144	27.5
Bangladesh	144	0.6
Japan	128	22.0
Nigeria	121	0.9
Mexico	102	6.6
Germany	82	14.3
France	60	11.0
United Kingdom	59	9.6
Italy	57	7.6
South Korea	47	8.4
Canada	31	13.1

Table 1– Energy consumption

Energy consumption in India has also grown at a rate faster than the production and will continue to grow with increasing population which is projected at about 1.20 billion by the end of XIth plan (2011-12). India targets GDP growth rate of two digits over the next two decades.

Considering the linkage between GDP growth rate and energy consumption growth, the economic growth together with increasing population will translate into a very high demand for energy. Presently India is dependent

upon the import of crude oil to the extent of around 72%. Demand for natural gas has also been increasing and at present Liquefied Natural Gas is imported to supplement indigenous gas supplies. Import of natural gas through trans-national gas pipeline is also being pursued. In the down stream sector India has recorded a rapid growth. Its refining capacity has increased to around 132 Million Tonnes Per Annum (MTA) against a demand of around 112 Million Tonnes during 2005-06. Though India imports a large portion of its crude oil requirement, yet it is a net exporter of petroleum products.

Liquefied Petroleum Gas is popularly known as LPG. It is used primarily as domestic fuel in cooking ranges and in commercial and industrial installations as a fuel for furnace. It can also be used as feed stock for petrochemical industry. However, since in India, consumption of LPG is more than what we produce indigenously, we are mostly using it as a fuel. LPG is a mixture of hydrocarbons consisting mainly of Propane (C_3H_8) and Butane (C_4H_{10}) in the ratio 50:50 (by weight) with a maximum vapour pressure of 16.87 Kg/cm2g at 65 deg C. It should conform to IS: 4576 specification. LPG today is the most sought after fuel for the domestic sector and demand has constantly out-stripped supply. Similarly Propane is the most sought after fuel for the industrial sector either as fuel or chilling agent. To meet the GAIL's (GAIL India Limited) objective of utilization of the various fractions of gas apart from transportation and marketing of natural gas led to the establishment of LPG plants at Vijaipur, Vaghodia, Usar and Lakwa.

In this research, reason is established for increase in blood Cholesterol level as exposure of human being to the un-burnt hydrocarbon for prolonged time. Moreover the results of ALOHA software is also established in the field for distance of presence of un-burnt hydrocarbon in case of leakage in different seasons.

An attempt was made to shift the job location of loading operators from hydrocarbon area to non-hydrocarbon area and it was established that after few months the increased blood Cholesterol level has gone down and came within the limit.

1.2 Motivation of Research

Hydro carbon is released in the atmosphere through rotogauge (Refer Figure-1) while loading of LPG and Propane in the tankers contributes occupational health problems to the workers, green house gas effect as well as revenue loss though it is insignificant in case of one tanker but it is significant if we consider loading and unloading of tanker at National level per day and Organizational level per year. In order to overcome the problem of releasing of hydrocarbon through rotogauge (for measuring liquid level inside the tanker) it is necessary to study this topic in detail along with the effect of these hydrocarbons on the workers working in that area. The photograph of releasing of LPG / Propane from rotogauge is given below –

Figure 2 – Releasing LPG /Propane from Rotogauge

1.3 Research Scope

The scope of the current research is "Study of release of hydrocarbons in the atmosphere while LPG and Propane tankers loading and its occupational health effects". The work was carried out in the plants of GAIL (India) Limited. The scope of this research consists of the following –

1.3.1 Distance of presence of hydro carbon in the atmosphere while loading operation is under progress in LPG and Propane loading gantries.

1.3.2 Study of loading and unloading activity across the GAIL (India) Limited sites.

1.3.3 Study the alternate available techniques of level measurement of liquid hydrocarbon inside the tank

1.3.4 Blood Cholesterol analysis of the sample operators during different season.

1.3.5 Study the method of construction of LPG and Propane tankers.

Figure 3: Research Focus – Bird Eye View

1.4 Research Objective

The research scope is further divided into five major objectives and they are

1.4.1 Study the filling mechanism of LPG as well as Propane tankers - Detail study is carried out regarding loading and unloading operation of LPG and Propane in the tankers at various locations of GAIL (India) Limited as well as other petroleum installations.

1.4.2 Estimate the quantum of hydro carbon released in atmosphere through rotogauge while checking the liquid level of hydrocarbon inside the tankers.

1.4.3 Study the occupational health effect of VOC's (volatile organic compounds) on the loading operators who are involved in loading operations of these tankers over a period of different seasons.

1.4.4 Use of mathematical modeling to study the of the release of hydro carbons over a years (during different season) with respect to occupational health effect due to exposure to the operator as well as on the organization economy.

1.4.5 Suggest the recommendations for overcoming the problem of release of LPG and Propane in atmosphere/application of technology

1.5 Research Methodology

1.5.1 Theoretical framework –

At present in India there are about 10,400 tankers (LPG + Propane) having valid license to carry / transport compressed hydrocarbon from Petroleum and Safety Organisation (formerly Chief Controller of Explosive). These tankers are being filled and emptied out regularly at different locations in India. All these tankers are having the liquid level measuring device called rotogauge. While filling as well as emptying out these tankers, the standard practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage Refer Figure for procedure displayed at loading gantry. Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (approximately hydrocarbon is being released in the atmosphere for total 1 minute through rotogauge). During

opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as vapours). While loading of these tankers, operator has to ensure that the liquid level of LPG / Propane inside the tanker should not exceed 95%. For ensuring the same, operator fixed the rotogauge indicator at 95% mark, so that whenever liquid level reaches that mark, LPG / Propane in the liquid form starts coming out from the 2 mm diameter size orifice of rotogauge. Moreover while doing this measurement the operator is standing very near to the rotogauge device for operating it.

The proposed study was undertaken to see the occupational health effects on the loading workers due to inhalation of hydrocarbon mixed air, estimate the impact on energy and revenue loss due to release of hydrocarbon in the atmosphere.

1.5.2 Source of data –

Data for study will be collected from various sources like –

1.5.2.1 Data collection for standard operating procedure for loading of tankers is taken from ISO manual of GAIL (India) Limited Vijaipur.

1.5.2.2 Visual inspection with photographs in support of confirming the loading procedure is taken from loading gantry of GAIL (India) Limited Vijaipur.

1.5.2.3 Quantity of hydrocarbon tankers (i.e. LPG and Propane only) is derived from the official web site of Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

1.5.2.4 Material Safety Data sheets and contribution of un-burnt hydrocarbon in greenhouse gas emission through various web sites.

1.5.2.5 Average price of industrial LPG and Propane is collected from GAIL's data bank.(through ERP-SAP)

1.5.2.6 Medical records of the sample loading operators having different years of experience and different age group.

1.5.2.7 Use of ALOHA software for carrying out the mathematical modeling.

1.5.3 Sampling –

1.5.3.1 Crosschecking of the amount of LPG and Propane release in the atmosphere through 2 mm diameter rotogauge hole is done with the help of collecting the content in the sampling balloon and its differential weighment.

1.5.3.2 Blood sample checking and clinical examination of the fixed workers of different age and different years of exposure is done.

1.5.3.3 The data for the study is collected from existing standard operating procedures of loading activities.

1.5.3.4 Data pertaining to number of tankers state wise is taken from the official web site of the Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

1.5.3.5 Survey is carried out for standard tanker loading practices in the other installation of GAIL (India) Limited so as to determine the

impact on health of workers as well as revenue loss at Organizational level on yearly basis.

1.5.4 Statistical tools –

The result of the study with respect to contribution of un-burnt LPG and Propane (due to release from rotogauge) in occupational health effects on the workers as well as revenue loss over a period of time is presented. The quantum of release of hydrocarbon in actual case as well as result came out from statistical tool is compared.

1.5.5 Schematic flow diagram –

The flow diagram for loading of tankers is given below-

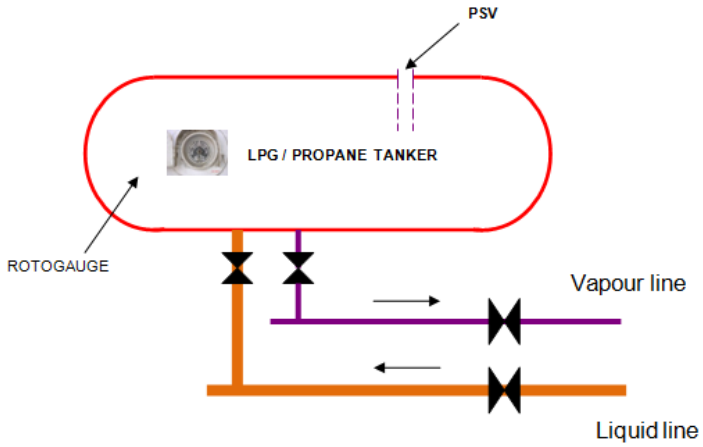


Figure 4 - Flow diagram for loading / unloading of tanker

Figure 5– Tanker with Liquid and Vapor connection

1.6 Content of this report

The content of the thesis is structured in the following manner to achieve stated objectives of the research.

Chapter 1 deals with general introduction of research topics, its scope, objectives, over all research frameworks and research methodology,

Chapter 2 covers overview of process of production of LPG and Propane from Natural Gas and code requirement for fabrication and instrumentation of LPG and Propane tanks for Road transport.

Chapter 3 deals with various tests conducted on field operators and its analysis as well as outcome of each objective and correlation of output from ALOHA software and field readings.

Chapter 4 reviews existing literature in the similar field and allied field under various categories.

Chapter 5 concludes the research with noticeable contributions in occupational health domain for exposure of LPG and Propane for prolonged period.

Chapter 6 includes References

Appendix are consolidated and given at the end for cross reference or verification purpose. The appendix includes experimental data and key documents to support gaps in existing systems and practices. Publications based on research are indexed and given at the end of the report. The work concluded with 2 published research papers This section concludes thesis report.

Chapter 2.

Overview of Process

The chapter outlines the process of production of Liquefied Petroleum Gas (LPG) and Propane from the Natural Gas in GAIL (India) Limited. The ways of marketing these products is also touched upon in this section. Material safety data sheet of LPG and Propane regarding their physical and chemical properties are highlighted. This chapter also highlights the LPG tank trucks: requirements of safety for design/fabrication and fittings.

2.1 Process of LPG and Propane Production

Liquefied Petroleum Gas is popularly known as LPG. It is used primarily as domestic fuel in cooking ranges and in commercial and industrial installations as a fuel for furnace. It can also be used as feed stock for petrochemical industry. However, since in India, consumption of LPG is more than what we produce indigenously, we are mostly using it as a fuel. LPG is a mixture of hydrocarbons consisting mainly of Propane (C_3H_8) and Butane (C_4H_{10}) in the ratio 50:50 (by weight) with a maximum vapour pressure of 16.87 Kg/cm2g at 65 deg C. It should conform to IS: 4576 specification. LPG today

is the most sought after fuel for the domestic sector and demand has constantly out-stripped supply.

To meet the GAIL's (GAIL India Limited) objective of utilization of the various fractions of gas apart from transportation and marketing of natural gas led to the establishment of LPG plants at Vijaipur, Vaghodia, Usar and Lakwa.

GAIL has commissioned its first LPG plant on 11th Feb. 1991 at Vijaipur. The second plant was also commissioned at Vijaipur exactly one year after i.e. on 11th Feb. 1992. These LPG Recovery Plants are the largest Natural Gas fractionation plants in the country. These plants have a designed capacity to process 15 MMSCMD Natural Gas and to produce 1230 TPD of LPG. Lean Gas after LPG extraction is compressed and fed back into the HVJ pipeline.

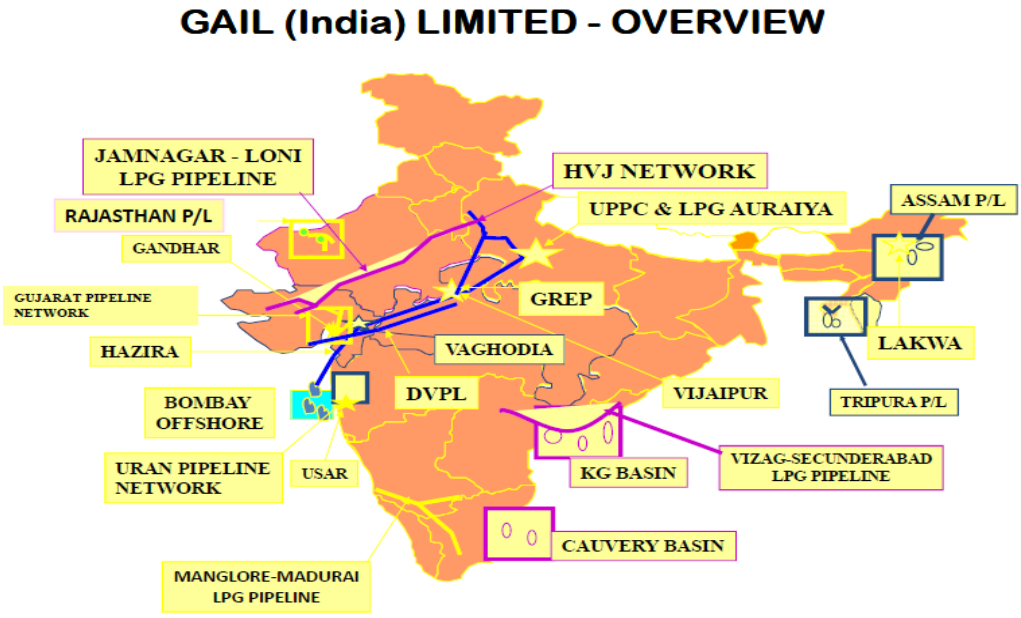


Figure 6 – Overview of GAIL (India) Limited

LPG Recovery Plant at GAIL (India) Limited Vijaipur, with its efficient operation and maintenance practices, have increased production over 1500

TPD which is equivalent to about one lakh LPG cylinders (approx. weight = 14.2 Kg) per day in the domestic circle.

LPG is filled under pressure, stored and transported to the consumer. When the cylinder valve is opened reduction of pressure takes place and the liquid turns into gas. LPG is in gaseous form at ambient temperature and pressure, and it is almost twice as heavy as air. Hence, it always settles down to floor level in case of leakage. LPG is colorless and odorless. Therefore, a distinctive fuel odor is added before it is filled into cylinder to enable easy detection in case of leakage.

LPG is different from natural gas. Natural gas is predominantly a mixture of methane & ethane with small quantities of Propane & butane. Natural Gas cannot be easily liquefied and marketed to consumers in cylinders like LPG. LPG is normally available from two sources:-

(i) Petroleum refineries.

(ii) Gas fields by fractionation of natural gas.

Various processes by which LPG can be separated from Natural Gas are:-

- Oil absorption process.
- Turbo expander process.
- External Refrigeration process.

2.1.1 Alternate Processes:

2.1.1.1 Oil Absorption Process:-

In this process, the desired LPG components are recovered from the gas by absorption in oil such as Naphtha. Rich oil containing absorbed components flows through fractionating column whereby light ends, LPG and Natural gas are separated out. Remaining oil is recycled back to the absorber. The residue gas from the absorber and stripper flows into the consumer gas pipeline.

2.1.1.2 Cryogenic Process using Turbo expander:-

This process involves expansion of gas isentropically through turbo expander. The gas gets cooled and the liquid condensed due to cooling is separated and fractionated to recover LPG, Natural Gasoline and Lean Gas. The energy of expander recovered through the Turbo-Expander is either used to generate power or to drive a compressor for the lean gas.

2.1.1.3 Cryogenic Process using External Refrigeration Process:-

The gas is cooled using external refrigeration system. The condensed liquid is separated and fractionated to recover LPG, Natural Gasoline and Lean Gas. The refrigeration system operates in a closed cycle.

2.1.2 Choice of Process:

The Cryogenic process using turbo-expander has been selected on the following basis:

2.1.2.1 Oil absorption process is uneconomical for light gases as in this case. This process essentially involves very large quantity of absorbing oil like

naphtha from which the desirable LPG components have to be separated out. The total thermal duty in the process is also very high. The worldwide trend for recovering LPG from natural gas is towards the cryogenic route.

2.1.2.2 In the cryogenic process utilizing propane refrigeration the butane recovery is limited by the minimum achievable temperature of -35 deg C to -37 deg C. The only way to increase the recovery is to cascade it with another refrigerant like ethane which will make the process uneconomical. In this case where gas is available at high pressure around 54.2 Kg/cm^{2}g and part of lean gas is required around 44 Kg/cm^{2}g, free pressure drop is available for use, favouring use of turbo expander. Using a turbo expander it is possible to achieve very low temperatures. With a temperature of around -50 deg C it is possible to recover nearly 90% butane.

2.1.3 PROCESS DESCRIPTION

The LPG Recovery Plant consists of the following sections:-

- Gas receiving, drying and regeneration
- Chill down
- Distillation

2.1.3.1 Gas receiving, drying and regeneration:-

Natural Gas is received from HVJ Pipeline at a pressure of around 54.2 Kg/cm2g and temperature of around 30 Deg C. The gas flows to a Knock Out (K.O.) Drum where any liquid present in the gas is knocked off. After this the

gas is dried in molecular sieve dryers to remove water below the 1 ppm level. A two bed system is used - one bed for drying the gas and another one for regeneration.

2.1.3.2 Chill down Section:-

The dried gas is cooled to (-) 65 Deg C in two stages. In the first stage, it is cooled to (-) 35 Deg C in chiller by heat exchange with various cold streams in the chill down system and external Propane refrigeration. The condensed liquid is separated out in Separator - I and vapor is expanded through a single stage turbo-expander. The vapor liquid mixture from the turbo-expander is fed to a second stage separator (Sep-II). The Hydrocarbon liquids from the two separators, after heat exchange are fed to the fractionation section to recover LPG, Propane, Pentane and SBPS.

Vapors (Lean Natural Gas) from the second separator are taken through the chiller to recover refrigeration. Then it is compressed to about 31 Kg/cm2g by the expander compressor. The quantity of lean gas required for NFL (National Fertilizer Plant) and branch line of HVJ Pipeline is compressed in a GT driven Lean Gas Compressor to 45 Kg/cm2g and the rest of gas is compressed to 55.2 Kg/cm2g and sent to Vijaipur Compressor station of HVJ pipeline for further transmission.

2.1.3.3 Distillation Section:-

The distillation section consists of LEF, Propane and LPG Column.

2.1.3.3.1 LEF Column:

Liquid from the two separators flows to chiller to supply cold and is then routed to Light End fractionating Column (LEF). This column removes all Methane, Ethane, and most of Carbon Dioxide as overhead vapors. Bottom stream consists of a part of Propane, Butane and Heavier Hydrocarbons. Reflux is generated by condensing a part of overhead vapors. The refrigerant duty is supplied by vapors from the second stage separators and external Propane refrigeration.

2.1.3.3.2 Propane Column:

Liquid from LEF column bottom is fed to Propane Column where Propane is produced as top product.

2.1.3.3.3 LPG Column:

Liquid from Propane column bottom is fed to LPG Column for separation of LPG and Heavier Hydrocarbons. This column separates LPG as top product.

2.1.3.3.4 SBPS Column:

Liquid from LPG Column bottom is fed to SBP Column where Pentane is produced as top product and SBP Solvent 50/120 as bottom product. Residual heavy hydrocarbon from the column is spiked back into HVJ through NGL Booster & Injection Pumps.

Propane Refrigeration system is provided to supply refrigeration required in chiller and 2nd LEF Condenser in Propane recovery case.

2.1.3.4 Safety facilities:-

Gas detectors are placed in order to detect LEL at critical points of the plant and it's indication comes to CCR. Whenever gas detectors indicate LEL beyond safe limits, the location is checked for any gas leakage. In case of any leak appropriate corrective action is taken.

Like any other gas processing units, LPG Recovery unit of ours also needs certain offsite facilities and utilities systems.

2.1.3.5 The offsite and Utility systems:-

a. Water system (Raw Water, Service Water and Drinking Water)
b. Fire water network for fixed fire protection system.
c. Cooling Water system
d. Compressed Air (Instrument Air and Plant Air) system
e. Inert gas System
f. Product Storage, Handling and Transfer system
g. Steam and Soft Water System
h. Flare and Blow down system
i. Product Loading and Dispatch system
j. Effluent Treatment Plant
k. Chemical Storage and Distribution

a. Raw Water Treatment Plant:-

Raw water is required to meet the cooling water makeup, service water, drinking water & fire water requirement. The raw water system consists of a raw water reservoir, raw water treatment plant, and filtered water reservoir and

various pumps to provide water to the different requirements. Based on the characteristics of raw water the following lines of treatment are adopted namely pre-chlorination of raw water, treatment with alum tocoagulate the suspended impurities, treatment with lime correct the pH, chemical mixing if required, clarification, filtration through a rapid gravity filter bed and stabilization of the filtered water by chlorine for drinking purposes. The water is then supplied through designated pumps as service water, cooling water make up, drinking water and make up for the fire water system.

b. Instrument air:-

It is used for pneumatic instruments and plant air is required for cleaning, blowing and operating pneumatic tools. This system consists of air compressors, twin bed dryers, instrument and plant air receiver.

c. Inert gas:-

It is required in the plant continuously in hot water system to provide inert atmosphere under pressure. Inert Gas also requires during initial startup and after total shutdown for purging the system. It is used intermittently for blanketing methanol tanks. Two inert gas plants each of 150 NM^3/Hr capacities are installed to cater the above needs. Inert gas is produced by combustion of natural gas and air in an Inert Gas Generator.

d. Product Storage and Handling:-

- 8 numbers LPG Horton Spheres of capacity 2500 M^3 each (corresponding to 7 days designed production) have been provided for storage of LPG.

Diameter of Sphere is 17 m. LPG is stored under pressure and at ambient temperature.

- 3 numbers Propane Horton Spheres have been provided for the storage of Propane.
- 1 Fixed dome type roof cylindrical tank is provided for storage of SBP solvent. SBPS is stored under atmospheric pressure and ambient temperature
- Five numbers Pentane bullets each having capacity of about 100 MT have been provided. Security system has been provided to protect storage tanks from fire. In case of fire on storage tank, the thermal fuses located on various points on each sphere melt at $85^{O}C$, thereby depressurizing the instrument air control loop which in turn activates water spray system on storage tank.

e. Low Pressure Steam:-

It is used in Vapour Absorption Refrigeration (VAR) system for Air Conditioning and in Blow down Vaporiser in plant area. It is also used intermittently for furnace startup. The system consists of Boiler which is fuel gas fired. Steam is generated in a boiler of 5 tons/hr and supplied at a pressure and temperature of about 2.5 Kg/cm^2 and $140^{O}C$ to various locations. Chemicals are dosed in the boiler feed water and the boiler to maintain the quality and to prevent corrosion. Soft water is used as boiler feed water. Service water is treated in a softener unit regenerable by brine solution.

f. A common flare system:-

It is provided for both trains for safe disposal of flammable by various pressure relief units by reducing them to less objectionable compounds by combustion. The common facilities consists of knock out drum, molecular seal, water seal drum and flare stack.

g. Liquid effluent:-

It comprises of oily water, effluent from vessel drain, floor washings and storm water. Vessel drains and washings is of very small magnitude. Effluent treatment system consists of collecting water from OWS in a surge pool from where it is pumped to an API separator. Here the free oil will be skimmed off and stored in a storage tank. The effluent will be treated to MINAS standard for allowable concentration of pollutants for discharge. The system is designed to treat sanitary and process wastes, cooling water blow down and contaminated rain water. The treated water is used for horticulture purposes. LPG Recovery Plant is being operated, monitored and controlled efficiently from a central Control Room having computerized distributed control system. The process parameters are thus achieved/ optimized with the state-of-the-art Digital Control Systems. All process and machine parameters are available at a central control room which are continuously monitored thus ensuring product quality conforming to IS specifications and machine safety.

LPG and Propane storage tank farm is provided with sophisticated in-built safety and security systems. LPG and Propane product is evacuated in bulk both by Road tankers and Rail wagons. LPG and Propane Road evacuation

facilities are provided with 8 bays for simultaneous filling, while LPG Rail loading system has provision for simultaneous loading of 80 Tank wagons, with an in-motion weigh bridge arrangement for custody transfer.

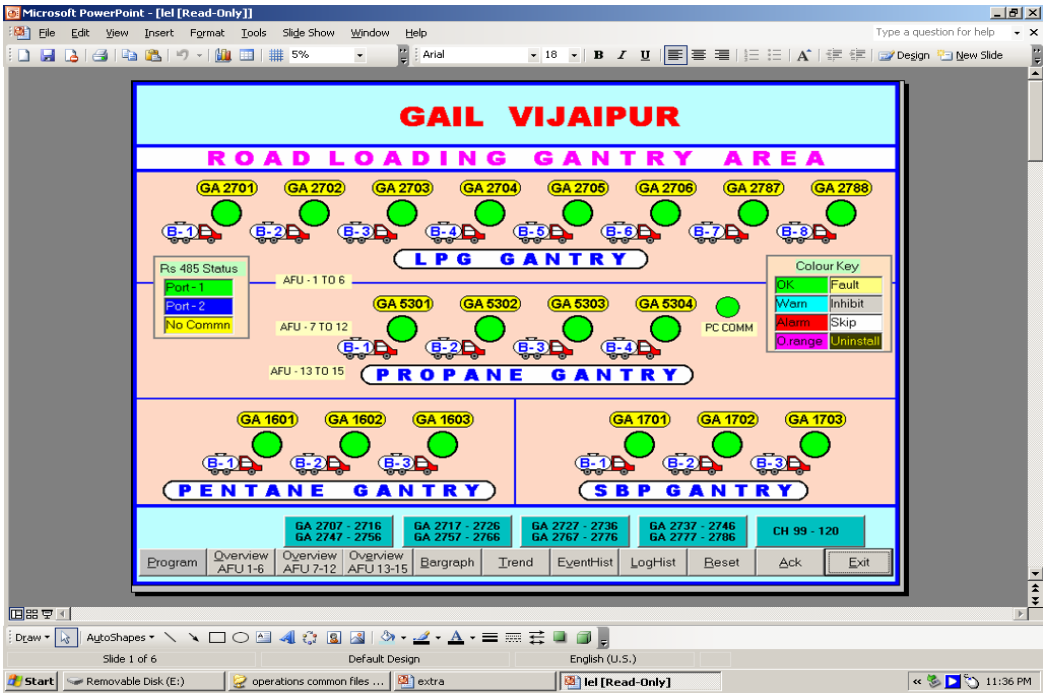


Figure 7 – Screen shot of loading gantries at GAIL (India) Ltd Vijaipur

GAIL has launched two new value added products in the year. 1993-94, viz. Special Boiling Point Solvent (SBP Solvent 50/120) and Pentane mixture. In the following year GAIL introduced Propane, a premier fuel which is projected to substitute LPG in the industrial sector. In order to further augment the availability of LPG in the country to meet the never ending demand of the same, and with the commissioning of the Propane Recovery Plant leading to availability of surplus propane, GAIL took up a new project viz. mixing of propane with imported butane to produce Blended LPG, for the first time in the country, which heralded a revolution by enhancing LPG availability by

more than 1.2 Lakh MT per annum thereby saving substantial Foreign Exchange.

To keep pace with the HVJ up-gradation, Natural Gas processing of the LPG Plants is increased to around 17.5 MMSCMD (i.e. a capacity utilization of 120%). The LPG Recovery Plant at Vijaipur, with its strength of about 417 employees (including contract employees), has consistently displayed exemplary performance year after year, which have fetched National Safety Awards as well as Excellent Rating in achieving and surpassing the MOU targets for the fifth consecutive year, from the Government of India. In July'96 LPG Recovery Plant received international quality system standard ISO-9001:2000 certificate maintaining highest level of quality in the operation and maintenance of its LPG plants.

In India Loading and unloading operation of the Liquefied Petroleum Gas (LPG) and Propane tanker is done with manual intervention to know the liquid level content inside the tank of the tanker lorry. Loading and unloading operation of Liquefied Petroleum Gas (LPG) and Propane tanker is carried out with intermittent checking of liquid level inside the tank with the help of rotogauge. Rotogauge is a devise fitted in the tanker which is useful in measuring the liquid level inside the tanker in terms of percentage. In the present scenario the rotogauge helps to determine the liquid level inside the tank and liquid level inside the tank is ensured. (maximum allowable liquid level is 95% and Vapour space of 5% is left).

Figure 8 - Hydro carbon tanker with rotogauge

Figure 9 - Rotogauge

Figure 10 – Loading activity of LPG tanker

Figure 11 – Rail Loading Gantry

Figure12 – Rail wagon Loading activity

2.2 Properties of LPG and Propane

2.2.1 Properties of LPG / Material Safety Data sheet of LPG

MATERIAL SAFETY DATA SHEET		
I - PRODUCT IDENTIFICATION		
TRADE NAME: LIQUEFIED PETROLEUM GAS (LPG)		
CHEMICAL CHARACTERIZATION: Mixture of Butane and Propane		
FORMULA: Mixture of C_3H_8 & $C_4H_{10.}$		
UN NO: 1075	**HAZCHEM CODE:** 2WE	
USE (S): Product.		
II - HAZARD INGREDIENTS		
MATERIAL OR COMPONENT	**% AGE**	**HAZARD DATA**
Propane	50%	Flammable gas
Butane	50%	Flammable gas
Propylene	NA	
III - PHYSICAL DATA		
BOILING POINT (°C): > -40	**MELTING POINT(°C):** N/A	

SPECIFIC GRAVITY (H2O=1): 0.51 to 0.58 at 50 DegC	**VAPOUR PRESSURE (KPa):** 1311.56 mmHg @ -20 DegF
VAPOUR DENSITY (AIR= 1): 1.5	**SOLUBILITY IN H_2O:** Slight at 30 Deg C.
VOLATILES: N/A	**EVAPORATION RATE:** N/A
APPERANCE AND ODOUR: Colorless odorless gas.	

IV- FIRE AND EXPLOSION DATA

FLASH POINT (°F): -104 Deg C	**AUTO IGNITION TEMP (°C):** 466DegC	
FLAMMABLE LIMITS IN AIR:	**LOWER:** 1.9	**UPPER:** 9.5

EXTINGUISHING MEDIA:	Dry chemical powder, Carbon dioxide and water spray.
SPECIAL FIRE FIGHTING PROCEDURE:	Spray water to keep the container cool. It is preferred to stop the flow of gas.
PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS:	Use breathing apparatus and proximity suit.
UNUSUAL FIRE AND EXPLOSION HAZARD:	Air vapour mixture highly explosive.

V- HEALTH HAZARD INFORMATION

PERMISSIBLE EXPOSURE LEVEL:	Not established permissible exposure limit. TLV (ACGIH+) TWA: 100 ppm, 1800 mg/M3. Odour threshold: 5000 ppm to 20000 ppm. NIOSH PEL TWA: 350 mg/M3. CL = 1800 mg/M3 (15 minutes)

ROUTES OF EXPOSURE	
INHALATION	Asphyxiate/suffocation/difficulty in breathing.
SKIN CONTACT	Irritation
SKIN ABSORBTION	Not Known
EYE CONTACT	Redness
INGESTION	Not known

EFFECTS OF OVEREXPOSURE	
ACUTE OVER EXPOSURE	Practically no toxicity except that it may asphyxiate, highly dangerous fire and severe explosion hazard when exposed to heat flame (or) oxidizer.
CHRONIC OVEREXPOSURE	Not known

EMERGENCY AND FIRST AID PROCEDURES	
EYES:	Immediately flush with water.
SKIN:	Wash with water and soap for at least 15 minutes. Remove contaminated clothes. Keep warm using blankets.
INHALATION:	Shift victim in a fresh air area. If breathing has been leased give artificial respiration first. Consult physician.
INGESTION:	Do not indulge vomiting. Consult physician without delay.
NOTES TO PHYSICIAN:	Continue to administer oxygen under low pressure. There is no known anti dotes for acute exposure.

VI- REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Stable

INCOMPATIBILITY: With oxidizing materials.

HAZARD DECOMPOSITION PRODUCT: Carbon dioxide, Carbon monoxide

CONDITION CONTRIBUTING TO HAZARDOUS POLYMERIZATION: No

VII- SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL RELEASED OR SPILLED:
Do not enter in the gas area without protective wears.
Get the area evacuated.
Stop flow of gas if without risk.
Spray water to keep the container cool.

NEUTRALIZING CHEMICAL: none.

WASTE DISPOSAL METHOD:
Collect the spillage & wash the effected area with plenty of water.
Allow gas to burn under control.

VIII- SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS: adequate ventilation required.

SPECIFIC PROTECTIVE EQUIPMENT
RESPIRATORY (SPECIFY IN DETAILS):
Respiratory protective equipment required.

EYE & FACE: Safety goggles.

HAND & ARM: Hand gloves (PVC synthetic only).

OTHER CLOTHING AND EQUIPMENT: gum boots, PVC apron.

IX- SPECIAL PRECAUTIONS

PRECAUTIONARY STATE MENTS:
Avoid contact with oxidizers olefin impurities may lead to narcotic effect or it may act as a simple asphyxiate a very dangerous hazard when exposes to heat or flammable. If fire is big, keep surrounding area cool by spraying.

OTHER HANDLING AND STORAGE REQUIREMENTS:
Store the container in a cool, dry and well ventilated specified place, away from heat, spark and flame.

2.2.2 Properties of Propane / Material Safety Data sheet of Propane

MATERIAL SAFETY DATA SHEET			
I - PRODUCT IDENTIFICATION			
TRADE NAME: PROPANE			
CHEMICAL CHARACTERIZATION: Dimethyl methane, Propyl hydride.			
FORMULA: C_3H_8			
UN NO: 1978		**HAZCHEM CODE:** 2WE	
USE (S): Product.			
II - HAZARD INGREDIENTS			
MATERIAL OR COMPONENT	**% AGE**	**HAZARD DATA**	
Propane	100	Flammable gas	
III - PHYSICAL DATA			
BOILING POINT (°C): -42		**MELTING POINT(°C):** -217	
SPECIFIC GRAVITY (H2O=1): 0.59		**VAPOUR PRESSURE:** 6840 mmHg @ 20 Deg C.	
VAPOUR DENSITY (AIR= 1): 1.6		**SOLUBILITY IN H_2O:** 65-ml/100ml water at 35 Deg C.	
VOLATILES:		**EVAPORATION RATE:**	
APPERANCE AND ODOUR: Colourless, odour less compressed liquid gas.			
IV- FIRE AND EXPLOSION DATA			
FLASH POINT (°C): -104.4		**AUTO IGNITION TEMP(°C):** 450	
FLAMMABLE LIMITS IN AIR:		**LOWER:** 2.1	**UPPER:** 9.5
EXTINGUISHING MEDIA:	Stop flow gas foam, Carbon dioxide, Dry chemical powder.		
SPECIAL FIRE FIGHTING PROCEDURE:	Stop the flow of gas and keep the containers cool by spraying water if exposed to heat or flame.		
PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS:	Proximity suit with BA set		
UNUSUAL FIRE AND EXPLOSION HAZARD:	Flash back along vapour trail may occur.		
V- HEALTH HAZARD INFORMATION			
PERMISSIBLE EXPOSURE LEVEL:		Not established permissible exposure limit	
ROUTES OF EXPOSURE			
INHALATION	Simple asphyxiant-shortness of breath, headache, drowsiness, unconsciousness.		
SKIN CONTACT	Frostbite, redness, pain, blisters.		
SKIN ABSORBTION	Not known		
EYE CONTACT	Frostbite, redness, pain, and pain-imparted vision.		
INGESTION	Not Known		
EFFECTS OF OVEREXPOSURE			
ACUTE OVER EXPOSURE	Not Known		

CHRONIC OVEREXPOSURE	Not Known
EMERGENCY AND FIRST AID PROCEDURES	
EYES:	First rinse with plenty of water for several min. Remove contact lenses if easily possible, then take to a doctor.
SKIN:	On frostbite, rinse with plenty of water, do not remove clothes. Refer for medical attention.
INHALATION:	Fresh air rest artificial respiration if indicated. Refer to medical attention.
INGESTION:	Do not indulge vomiting. Consult physician without delay.
NOTES TO PHYSICIAN:	Continue to administer oxygen under low pressure. There is no known anti dotes for acute exposure.

VI- REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Stable.

INCOMPATIBILITY: Oxidizers.

HAZARD DECOMPOSITION PRODUCT: none in particular.

CONDITION CONTRIBUTING TO HAZARDOUS POLYMERIZATION:
Does not occur.

VII- SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL RELEASED OR SPILLED:
Shut off leaks if without risk. Warn everybody that air mixture is explosive.

NEUTRALIZING CHEMICAL: Not Known

WASTE DISPOSAL METHOD:
Allow the gas to burn under control.

VIII- SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS:

SPECIFIC PROTECTIVE EQUIPMENT
RESPIRATORY (SPECIFY IN DETAILS):
Provide self-contained breathing apparatus.

EYE & FACE: Safety goggles.

HAND & ARM: provide safety hand gloves

OTHER CLOTHING AND EQUIPMENT: safety shoes.

IX- SPECIAL PRECAUTIONS

PRECAUTIONARY STATE MENTS:
A simple asphyxiant. Flammable gas may cause flash fire.

OTHER HANDLING AND STORAGE REQUIREMENTS:
Keep in a cool dry, well-ventilated area, away from heat, flame or oxidizers.

2.3 Construction requirement of LPG and Propane tank trucks

2.3.1 Introduction:

2.3.1.1 In view of the increase in the number of road accidents involving LPG tank trucks, constraints in the country and experience gained over the years a need was felt to standardise design of bulk LPG tank trucks. This standard has been prepared by a Functional Committee comprising of representatives of Oil Industry, Dept. of Explosives (Govt. of India) and Consultants, constituted for standardisation of the design of bullets along with material specifications, fittings, mounting etc for transportation of LPG in bulk by road. This standard has been formulated based on various engineering codes, standards and draft recommendations prepared by Industry Committee formed for this purpose during 1989.

2.3.1.2 Notwithstanding above, all LPG tank trucks should meet the requirements of the Motor Vehicle Acts and Regulations and Static & Mobile Pressure Vessels (Unfired) Rules, 1981 as amended from time to time.

This standard covers basic requirements of safety in design / fabrication of vessels with material specifications, fittings and mountings, for transportation of LPG conforming to IS: 4576 having maximum vapour pressure not exceeding 16.87 Kg/Sq. cm. at 65 Deg. C. in bulk by road tank trucks. This standard will be applicable for all new LPG tank trucks.

2.3.2 Vessel design:

2.3.2.1 Design Pressure:

Vapour pressure of LPG conforming to IS:4576 at a maximum anticipated service temperature of 55 deg. C. to be considered. Providing an allowance of minimum 5% as per code requirements the minimum design pressure shall be 14.5 kg/sq.cmg. In addition, 3g effect to take into account acceleration/deceleration shall be considered while designing of the vessel.

2.3.2.2 Design Temperature:

The design temperature of the vessel shall be in line with the specification of LPG and as per statutory requirement.

2.3.2.3 Vessel Design Code:

2.3.2.3.1 Vessel shall be designed, fabricated and tested in accordance with requirements of Class I pressure vessels conforming to IS:2825 - 1969 (Latest Edition) BS-5500, ASME SEC. VIII or equivalent codes accepted by Statutory Authority. The vessel shall be designed to withstand shocks normally encountered during transport including those set up by the movement of the contents of the vessel such as acceleration / deceleration of a minimum of 3g to be calculated considering that the vessel is full with LPG at 55 deg. C. Saddle supports and other attachments shall also be designed according to the fabrication code.

2.3.2.3.2 Joints: Joints shall be as required by the code with all undercutting in shell and head material fabricated as specified therein. All longitudinal shell

welds shall be located in upper half of the vessel and shall be staggered when assembling the cylindrical shell from two parts by means of a circumferential joint. The distance between two such staggered joints shall be at least 5 times the thickness of the thicker plate or as specified by code as adopted.

2.3.3 Material Specifications:

Material used in the manufacture of pressure parts of the vessel shall be in accordance with that specified in IS: 2825 (latest edition), BS-5500, ASME SEC. VIII or equivalent code as adopted. A single code shall be adopted for materials, fabrication, inspection and testing.

2.3.4 Vessel Plate Thickness:

The nominal thickness of the plate material used in fabrication shall not be less than the sum of minimum calculated thickness as per the fabrication Code and corrosion allowance (CA), if necessary and in addition, adequate thinning allowance in case of formed heads. For mobile vessels (for which CA may not be necessary) an allowance of at least 0.5 mm. shall be included in place of CA to safeguard against wear and tear. The nominal plate thickness shall also be not less than the minimum calculated thickness and the under-tolerance as allowed in material specification and in addition the thinning allowance as mentioned above. The minimum actual thickness of the finished formed head shall be physically verified by the Inspecting Authority to ensure that it is not less than the required thickness, as explained above. This shall be indicated in the final certificate issued.

2.3.5 Connecting Joints/Nozzles and Manhole:

Connecting joints / nozzles and manhole shall be constructed in accordance with the applicable design and fabrication code.

2.3.6 Baffle Plates:

Every vessel over 5 cu.m water capacity shall be fitted with baffle plates to minimise the surge, the design of which should facilitate complete internal inspection. Baffle plates shall be provided as follows:

2.3.6.1 Over 230 cms in length shall be provided with baffles, the number of which shall be such that the linear distance between any two adjacent baffles or between any tank head and the baffle nearest it, shall in no case exceed 150 cms.

2.3.6.2 Each baffle shall have adequate strength to sustain without undue stress or any permanent set a horizontal force equal to the weight of so much of the contents of the tank as may come between it and any adjacent baffle or tank head, applied as a uniformly distributed load on the surface of the baffle or tank head. Baffles shall be formed with a curvature of 200 to 300 cms radius.

2.3.6.3 Each baffle shall have at least 2/3rd of the cross-sectional area of the tank. Baffles shall have suitable openings at top and bottom, Openings at bottom should allow access to the other side. Baffles shall be attached to the shell by means of suitably spaced cleats (min. 8 nos.) of minimum size 150 x 150 x 6 mm thick. The weld between baffle to cleat and cleat to the shell shall

meet the applicable design code requirements. No vessel supports or baffle or baffle cleat shall be welded directly to the vessel. All such supports shall be attached by means of pad of the same material as the vessel. The pad thickness shall not be less than 6 mm and shall not exceed the thickness of the shell material. Each pad shall extend atleast 4 times its thickness in each direction beyond the weld attaching the support. Each pad shall be formed to an inside radius not greater than the outside radius of the vessel at the place of attachment. Each pad corner shall be rounded to a radius of at least $1/4^{th}$ width of the pad and not greater than ½ the width of the pad. Weep holes and tell-tale holes if used shall be drilled or punched before the pads are attached to the tank. Each pad shall be attached to the tank by filler material having the properties conforming to the similar filler material used for welding of the vessel. Baffle shall be located away from SRV to facilitate ease of access for fitment / removal and safety of SRV.

2.3.7 Painting:

Vessel external surface shall be sand blasted and painted with two coats of red-oxide primer and two coats of enamel paint of the colour stipulated by statutory authorities.

2.3.8 Marking:

Vessel Identification Plate:

Each vessel shall have a non-corrosive metal plate permanently affixed by brazing or welding on the rear dished end in a place readily accessible for

inspection and maintained legibly. Neither the plate itself nor the means of attachment to the vessel may be subjected to impingement by the tank contents. The plate shall be plainly marked by stamping or embossing or by other means of forming letters to the metal of the plate with the following information in addition to that as required by local regulations:

1. Vessel Manufacturer
2. Vessel Manufacturer's Serial No.
3. Design code
4. Radiography
5. PWHT
6. Design Pressure
7. Design Temperature
8. Hydrostatic test pressure
9. First test date and subsequent test dates
10. Water capacity in liters
11. Licensed Product capacity in tonne and symbol or chemical name.
12. Name of the Inspection Agency with their stamp.
13. Certificate number of Inspecting Agency.
14. a) Shell thickness
    b) Dish End Thickness
15. This vessel shall not contain any product having vapour pressure in excess of 120 RVP at 55 deg. C.
16. Next hydrotest date of the vessel shall be painted on the body of the vessel.

2.3.9 Valves and Accessories:

LPG pipes, fittings and other equipments mounted on the vessel shall be suitable for LPG service i.e. corresponding to Vapour Pressure of LPG at 55 deg.C. and shall be capable of withstanding the most severe combined stresses set up by the following:

a) Maximum vapour pressure of the product in service.

b) Superimposed pumping pressure.

c) The shock loading during transport movements.

2.3.10 Fittings*:*

Fittings to be provided on the vessel shall be as follows:

2.3.10.1 Safety Relief Valve:

There shall be minimum two safety relief valves with each one sized to suit the full relieving capacity of the vessel. The design and operation of Safety Relief Valves shall conform to the provision of SMPV rules as amended from time to time.

SRV shall be so installed that it does not project out of the top surface of the vessel. If necessary, recessed cup formation on vessel shall be made to house the SRV. (Refer OISD Std. 160).The safety relief valves shall be installed at the top surface around the central portion of the vessel.

Safety relief valves shall have following marking punched:

a) Manufacturer’s name and Serial no.

b) Set Pressure

c) Rate of discharge in Cu.M per minute of the gas at 15 deg. C. and at atmospheric pressure.

d) Date of first test

e) Name of the Inspecting Agency with their stamp.

2.3.10.2 Liquid / Vapour Connections:

1 no. 50 mm size liquid inlet / outlet and 1 no. 40 mm size vapour connection shall be provided at the bottom of the vessel. The vapour line shall extend internally with a clearance of 50 mm from the top of the vessel surface.

2.3.10.3 Internal Valve with Excess Flow Check Valve:

Internal valves with EFCV of appropriate ratings shall be installed on LPG liquid and vapour line. `Built in' internal valve shall be remotely operable from drivers cabin/rear end of vehicle manually or pneumatically with a lever through a cable system extending to driver's cabin and fitted with a thermal fuse link. This valve shall have an in-built internal excess flow check valve. (Refer Annexure B).

2.3.10.4 Liquid Level Gauging Device - Roto Gauge:

a. The vessel shall be equipped with a liquid level gauging device for ready determination of liquid level in the vessel at any time. The liquid level gauging device shall be of the direct level gauge type with zero leakage of product to atmosphere. The design shall be such that the unit

encompasses a tough, durable steel shock absorber to prevent transfer of any vibrations sustained in transit.

b. This liquid level gauging device shall be located on the shell near the midpoint /top upper half of the vessel in a recessed cup formation.

c. To avoid damage to this liquid level gauging device, a suitable hinged cover shall be provided.

2.3.10.5 Liquid Level Gauging Device: Maximum Level Indicator:

Suitable fixed level indicator shall be provided.

2.3.10.6 Pressure Gauge:

2.3.10.6.1 One no. dial type (100 MM) glycerine filled pressure gauge with EFCV shall be provided on the rear dished end in the vapour space. This shall be protected by 10 mm thickness U-type shield metal plate.

2.3.10.6.2 The range of the pressure gauge shall be from zero to 21 kg/sq. cm (min.) gauge.

2.3.10.7 Temperature Gauge:

Provision is considered not necessary. However, subject to suitable amendment to SMPV Rules, 1981.

2.3.10.8 Drain:

Suitable drain of maximum 25 mm NPT plug to be provided on the bottom side of vessel with proper shield.

2.3.10.9 Manholes:

One no. manhole of size as per IS 2825 or code followed for design and fabrication of vessel shall be provided on the rear dished end.

2.3.10.10Protection of Fittings:

a) All valves, fittings, safety relief devices and other accessories to the vessel proper shall be protected against such damage as could be caused by collision with other vehicles or objects and due to overturning.

b) The protective devices or housing must be designed to withstand static loading in any direction equal to twice the weight of the tank and attachments when filled with the lading, using a safety factor of not less than 4 based on the ultimate strength of the material to be used without damage to the fittings protected, and must be made of metal at least 5 mm thick.

2.3.11 Filling Capacity:

The maximum quantity of LPG filled into any tank shall be such that the vessel shall not become liquid full due to the expansion of LPG and shall leave a vapour space equivalent to 5% or as stipulated by Statutory authority of its volume with the rise of temperature of its contents to a maximum of 55 deg. C. To arrive at the filling capacity, the maximum filling densities at 15 deg. C. for LPG of various related densities shall be calculated and effected by loading bases as per IS:6044 (Part II), 1972 (Latest Edition). The RLW of the vehicle shall not exceed the authorised Registered Weight of the vehicle by the

concerned transport authority or chassis manufacturer, whichever is less. The Pay Load filled should not exceed the licensed capacity as permitted by the Statutory authority.

2.3.12 Vehicles - general safety considerations:

2.3.12.1 General Safety Considerations:

a. Each tank truck shall be provided with at least one rear robust bumper, designed to protect the vessel and piping in the event of a rear-end collision and minimise the possibility of any part of the colliding vehicle striking the vessel. The design shall be such as to transmit the force of a rear end collision in a horizontal line to the chassis of the vehicle. The bumper shall be designed to withstand the impact of the fully loaded vehicle with a deceleration of 2 “g” using a safety factor of 4 based on the ultimate strength of the bumper material.

b. Extension to chassis, if any shall not be more than 300 mm and the extension piece shall not be welded to the chassis.

c. The maximum width and height of vessel and its service equipments shall be such that these do not project beyond the overall width and height of the rest of the vehicle. The maximum height of the vehicle shall be in accordance with Motor Vehicles Act, 1989 as amended from time to time. Each vessel shall be provided with a height barrier and designed as stipulated in OISD Std. 160.

2.3.12.2 Stability Considerations:

Provided the distance from the center of the vessel to the road surface is less than the distance between the center of the outer wheels of the rear axle then the tank truck will be reasonably stable. This is also essential in order to ensure maximum stability especially where the tank truck is to operate in areas where there are numerous hurdles and the roads are bad. In accordance with IS: 9618, 1969 (latest) the ratio of H/W shall be kept less than 1. (where `H' is the height of the center of gravity of the vessel from the road level and `W' is the distance between the center of the outer tyres of the rear axle).

2.3.12.3. Safety Equipments:

The vehicles shall carry the following:

a) A First Aid box.

b) 2 nos. 10 Kg DCP (ISI marked) and 1 no. 2 Kg CO2 fire extinguishers (ISI marked). Periodicity of testing to be followed as per OISD Std. 142.

c) Leather hand gloves and heat resistant hand gloves.

d) Safety Goggles

e) 2 nos. red flags

The above equipment should be in good working condition.In addition, each vehicle must carry non-metallic tools, wooden plugs of appropriate size and sealing compound for any emergency.

An emergency information board should be displayed on the vehicle mentioning the important telephone nos. of contractor, Oil company's loading base, attached Bottling Plants and easier contact nos. in the event of accident in addition to other details enumerated as above (Ref. OISD Std. 161).

2.3.13 Mountings:

2.3.13.1 Vessel should be securely attached to the chassis.

2.3.13.2 It is recommended to adopt the design of the mountings / drawings as recommended by the manufacturers of the chassis.

2.3.14 Design Safety Requirements - Mechanical:

2.3.14.1 The engine of the vehicle shall be of Internal Combustion (IC) type.

2.3.14.2 Where the fuel system is gravity-fed, a quick action cut-off valve shall be fitted to the fuel feed pipe in an easily accessible and clearly marked position.

2.3.14.3 The engine and exhaust system together with all electrical generators, motors, batteries, switch-gears, and fuses shall be efficiently screened from the vessel or the body of the vehicle by a fire-resistant shield or by an enclosure within an approved fire resistant compartment. All vehicles carrying LPG should be equipped with a spark arrester of approved design from approved manufacturer. As per Static and Mobile Pressure Vessel Rules 1981 and Petroleum Rules 1976, the exhaust of all such vehicles is required to be routed on the front side of the vehicle. The exhaust is to be fitted with an approved spark arrestor.

2.3.14.4 When the equipment referred to in the above Clauses are mounted forward of driving cab, the cab can be considered to act as an acceptable shield, provided the back, the roof and the floor of the cab, are of fire-resisting type construction for the full width of the cab, without any openings in the back or roof, and that the back extends downwards to the top of the chassis. For rear view, in case of trailers, toughened reinforced glass may be provided.

2.3.14.5 When the equipment referred to in above clauses are mounted to the rear of the cab, it shall be contained wholly within an approved fire-resisting compartment.

2.3.14.6 In such cases where the fuel used to propel a vehicle gives off a flammable vapour at a temperature less than 65 deg. C, the fuel tank shall not be mounted behind the shield unless the following requirements are complied with namely,

a) the fuel tank is protected from external blows by stout steel guards or by the under frames of the vehicle.

b) the fill pipe of the fuel tank of the vehicle is provided with:

   i) an arrangement facilitating breathing of the fuel tank and preventing spillage of fuel in the event of over turning of vehicle and

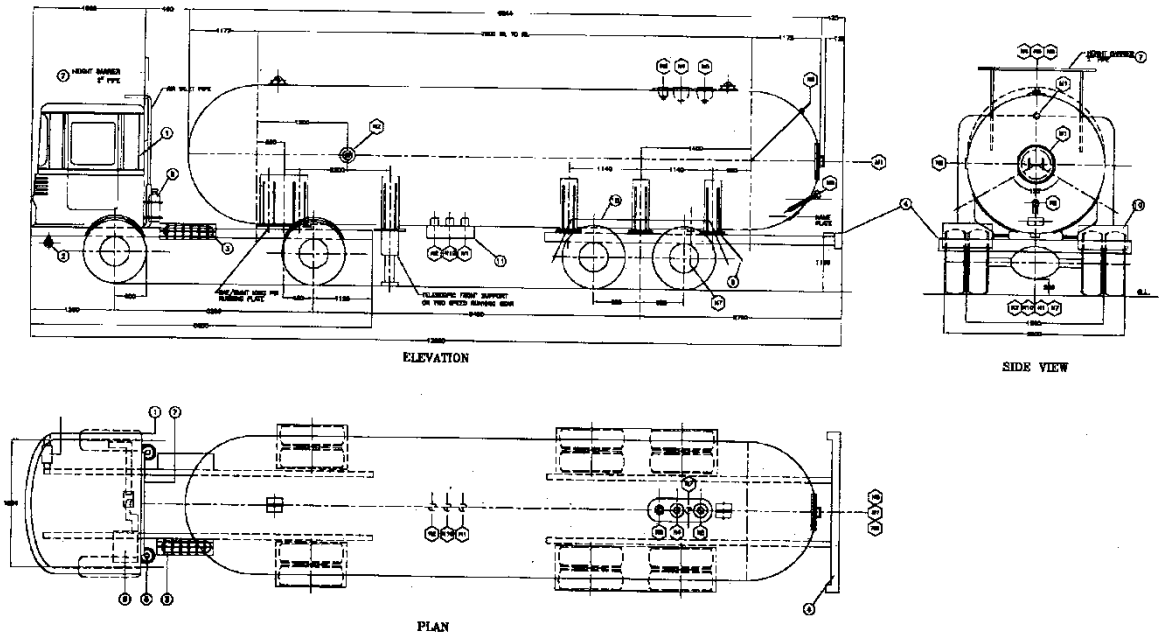
   ii) suitable locking arrangement.

c) the fuel-feed apparatus placed in front of the fire-resisting shield is used to lift the contents of the fuel tank.

2.3.14.7 The cabin shall be painted with color scheme as stipulated by the Transport Authority.

2.3.14.8 The overall height of the vessel shall not exceed the height of the driver cabin including the height barrier if any. For fixed chassis, a guard railing of 2" dia. pipe should be provided along the entire length of the vessel. The height and width, however, shall not exceed as that stipulated by the Transport Authority.

ANNEXURE-V



TYPICAL DRAWING OF LPG TANK TRUCK

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
2. ALL FLANGE BOLT HOLES TO STRADDLE C/C CENTRES LINE UNLESS OTHERWISE SPECIFIED.
3. DISH ENDS SHALL BE MADE BY COLD PRESSING.
4. CIRCUMFERENTIAL & LONGITUDIAL WELD SHALL BE CLEAR ALL COUPLING AND REINFORCEMENT PADS.
5. ALL BUTT WELDS ARE FULL PENETRATION WELD ACCESIBLE FROM OTHER SIDE SHALL BE GOUGED BACK TO SOUND METAL & REWELDED.
6. ALL SHARP CORNERS WILL BE ROUNDED OFF.
7. ALL FITTINGS APPROVED BY CCOE, NAGPUR.
8. ELECTRODES – AWS E – 7018.
9. IS:226 IS WELDABLE QUALITY.
10. ALL PADS TO BE TESTED FOR TIGHTNESS PNEUMATICALLY TO 2 KG/SQ.CM.(G) WITH SOAP SOLUTION ON ATTATCHMENT WELDS.
11. FLANGES TO HAVE SERRATED FINISH.
12. PLATE THICKNESS SHOULD BE +VE TOLERANCE.
13. WELD CAP SHOULD BE NORMALISED AFTER PRESSING.

N O Z Z L E S C H E D U L E					
SR.NO.	SERVICE	QTY.	SIZE	SCH./THK.	REMARKS
M1	MANWAY	1	18" NB	PAD TYPE	WITH COVER
N4,N5	SAFETY RELIEF VALVE	2	2" NPT	HALF CPLG.	WITH S.R.V.
N1	LIQUID INLET	1	2" NPT	HALF CPLG.	WITH E.F.V. + B.V.
N10	LIQUID OUTLET	1	2" NPT	HALF CPLG.	WITH E.F.V. + B.V.
N7	DRAIN	1	1" NPT	HALF CPLG.	WITH PLUG
N2	VAPOUR CONNECTION	1	1–1/2" NPT	FULL CPLG.	WIYH E.F.V. + B.V.
N8	ROTO GAUGE	1	1" NPT	HALF CPLG.	WIYH ROTOGAUGE
N6	PRESSURE GAUGE	1	3/4" 1/4" NPT	HALF CPLG.	WITH E.F.V. + P.G.
N9	FIX LEVEL GAUGE	1	1/4" NPT	HALF CPLG.	WITH FIX LEVEL GAUGE

D E S I G N D A T A	
DESIGN CODE	IS:2825–1969,C.L. 1 SMPV, RULES (UF) 1981.
DESIGN TEMPERATURE	AS PER STATUTORY REQUIREMENT
DESIGN PRESSURE	14.5 KG/CM (g). + 3G. EFFECT = 15.77 KG/CM
RADIOGRAPHY	100%
WELD JOINT EFFICIENCY	1
P.W.H.T.	STRESS RELIEVED
CORROSION ALLOWANCE	0.5 MM
TEST PRESSURE	20.5 KG/CM (g)
SERVICE	L.P.G.
WATER CAPACITY	38290 LITRES (APPROX.)
PAINTING	TWO COATES OF WHITE ENAMAL PAINT
PAY LOAD	18000 K.G.S.

Chapter 3.

Abstract of objectives

The chapter outlines the outcome of various objective of the study, process of selection of testing samples, details of medical checkup conducted during the study in various periods. This chapter also highlights the use of ALOHA software and its validation in field. This chapter highlights the detail result of objectives of the study.

3.1 ABSTRACT OF THE VARIOUS OBJECTIVES

There were total five objectives of the study which are discussed in details

3.1.1 To study the filling mechanism of tankers at various installation

3.1.1.1 Study was carried out regarding loading and unloading procedure of LPG and Propane in the tankers at various locations of GAIL (India) Limited like Vijaipur, Vaghodia, Gandhar, PATA and Standard operating procedures are collected.

3.1.1.2 From the procedure at different site, it is established that loading procedure at all the above mentioned installation are similar. During the

loading and unloading activity, rotogauge is being opened to check the liquid level inside the tanker at least 3 three times.

3.1.1.3 While filling as well as emptying out these tankers, the general practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage.

3.1.1.4 Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (hydrocarbon is being released in the atmosphere for 1 minutes through rotogauge). During opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as vapours)

Figure 13 - LPG / Propane tanker with liquid line connection

Figure 14– Opening of rotogauge to check liquid level inside the tanker

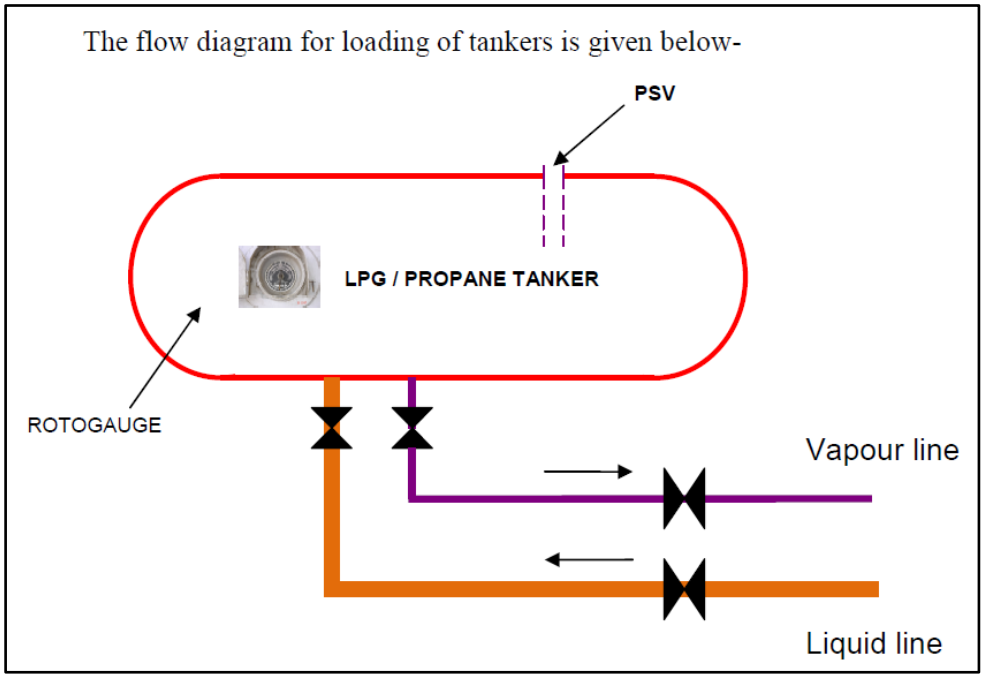


Figure 15– Schematic flow diagram for loading of tankers

Figure 16 – Procedure of loading displayed at loading gantries

3.1.2 To study the quantum of hydrocarbon release through rotogauge

Discharge rate of hydrocarbon (i.e. LPG and Propane) through 2 mm diameter size hole of rotogauge is determined theoretically with the help of software available at following site - http://www.mechengcalculations.com/index.html as well as same is crosschecked practically by collecting the discharge through rotogauge in the sampling balloon. The discharge rate of the LPG / Propane from the 2mm hole is 5.1 Kg/Hr. The same was also established with the help of Tata Consultancy Services (TCS) Mumbai. Screen shot of the communication is appended below –

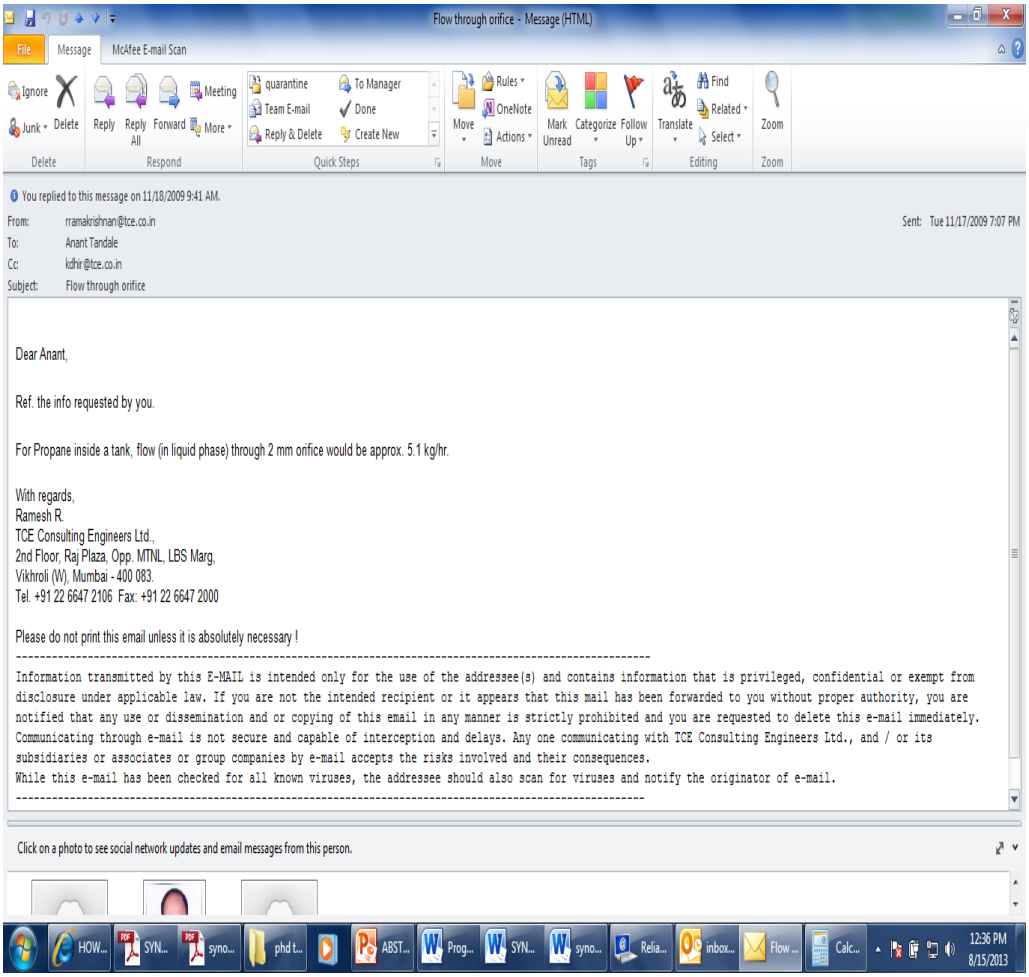


Figure 17 – Screen showing discharge rate of LPG / Propane

3.1.3 To study the occupational health effect of VOC's (Volatile organic compounds) on the loading operators who are involved in loading operations of these tankers over a period of different seasons. carbons

For doing the detail study of occupational health effect of prolonged exposure of the LPG and Propane vapour on the loading operators following activities were done –

3.1.3.1 Total 14 numbers of loading operators of different age groups were selected.

3.1.3.2 Clinical examination of the operators conducted every six months.

3.1.3.3 Total 7 operators each deployed for loading operations in LPG and Propane tanker loading gantry.

3.1.3.4 Following precautions taken during study period for the operators –

a. Living conditions were monitored.
b. Regular food intake of operators.
c. Proper scheduling of duties and rest

3.1.3.5 After a period of six months, pathological tests conducted for certain parameters.

3.1.3.6 Duty locations of all the operators were changed where there is no release of hydro carbon during normal operational activity for next six months. Again pathological tests were conducted after the completion of six month at new work location.

Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was decreased thereby decreased the risk factor.

In order to verify the outcome again all the operators were sent back to the loading gantries for next six months and at the end medical tests were conducted.

Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was increased thereby increased the risk factor.

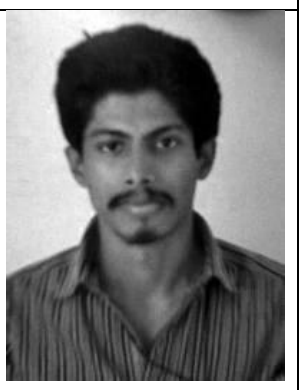
Again duty locations of all the operators were changed where there is no release of hydro carbon during normal operational activity for next six months.

Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was decreased thereby decreased the risk factor

When operators were exposed to the hydro carbon during the winter season, then there is more effect on lipid profile.

The effect of hydro carbon on lipid profile (cholesterol) of human being is found to be reversible when exposure duration and quantity is reduces.

Following loading operators were selected for study –

Sr No	Detail description of the operators	Photograph
1	**Mr Kala Dharan**; Age :- 29 Yrs Local Address:- 5, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh. Permanent Address:- Abhiramapuram 3rd Street, Abiramapuram, Chennai, Tamil Nadu	
2	**Mr Dinesh Kumar Dixit**; Age :- 32 Yrs Local Address:- 5, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh. Permanent Address:- 287 New Nandavan Colony, Nagpur, Maharashtra	
3	**MrGirish Sharma**; Age :- 35 Yrs Local Address:- 5, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- 24, Karmachari Nagar, Near Railway station, Durg, Chattishgarh.	
4	**MrBankeBihari**; Age :- 26 Yrs Local Address:- 5, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:-Kadru-By-Pass Road, Ranchi, Jharkhand.	

Sr No	Detail description of the operators	Photograph
5	**MrPramod Kumar Tiwari**; Age :- 25 Yrs Local Address:- 9, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- E-7, Gandhinagar, Gwalior (M.P.)	
6	**MrVirendra Kumar Tyagi**;Age :- 39 Yrs Local Address:- 9, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- B/34, Sisodiya Colony, Guna, Madhya Pradesh.	
7	**Mr Subhash Desai**; Age :- 48 Yrs Local Address:- Near Awan Gram Panchayat, Awan, DistGuna, Madhya Pradesh. Permanent Address:- Near Awan Gram Panchayat, Awan, Dist Guna, Madhya Pradesh.	
8	**MrHetram**;Age :- 40 Yrs Local Address:- 9, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- Near RTO office, Pardesi Colony, Guna, Madhya Pradesh	

Sr No	Detail description of the operators	Photograph
9	**Mr Vinod Kumar Dhokia**; Age :- 28 Yrs Local Address:- 9, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- Near Asian Paints outlet, Atladara, Vadodara, Gujarat	
10	**Mr Ashish Chaitram**; Age :- 42 Yrs Local Address- Near Awan Post Office, Guna Bhopal Highway, Awan Permanent Address:- Near Awan Post Office, Guna Bhopal Highway, Awan	
11	**Mr Siva Kumar**; Age :- 39 Yrs Local Address:- 9, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:-Kanniyamman Village, Dist Chennai, Tamil Nadu.	
12	**Mr Ram Acharya**; Age :- 27 Yrs Local Address:- 4, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- India Colony, Surendranagar, Gujarat	

Sr No	Detail description of the operators	Photograph
13	**Mr Sri Ram Meena**; Age :- 36 Yrs Local Address:- A-12, Ph-II, GAIL Colony, Vijaipur, Dist Guna, Madhya Pradesh. Permanent Address:- Near Ramubai Ganesh Mal, Govt. Sec. School, Adarsh Stadium Road, Barmer, Rajasthan.	
14	**MrRajpal Singh Sidhu**; Age :- 30 Yrs Local Address:- 4, SADA Colony, Near Metro Hotel, Raghogarh, Dist Guna, Madhya Pradesh Permanent Address:- Raghvendra Nagar, Shivpuri- Jhansi Road, Shivpuri, Madhya Pradesh	

Table – 2 -Detail description of the operators

The pathological test results for all the operators for different season and different locations are conducted at Mahavir Nursing Home and Research Centre at Guna, Madhya Pradesh. Following pathological tests were conducted –

a. Haemoglobin
b. Total Leucocyte count; Total Erythrocyte count
c. Blood group
d. Fasting blood sugar (F.B.S.); Postprandial blood sugar (P.P.B.S.)
e. S. Creatininie

f. Serum Uric Acid

g. Serum Protein

h. Albumin

i. Globulin

j. Lipid Profile (Total Cholesterol, Triglyceride, HDL Cholesterol, LDL Cholesterol, VLDL Cholesterol and Risk Factor).

The result of individual loading operators is mentioned in Annexure. The variation in Lipid profile for all the operators are appended below –

SR NO	PARAMETERS	Dinesh Kumar Dixit (32 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholesterol	387.2	256.4	340.7	255.5
2	Triglyceride	196	135.4	178.3	125.3
3	H D L (High Density Lipoprotein) Cholesterol	57	65	52	56
4	L D L (Low Density Lipoprotein) Cholesterol	150	78	98.3	87.5
5	V L D L Cholestrol	30.2	27.6	25.3	28.5
6	Risk Factor	6.79	3.94	6.55	4.56

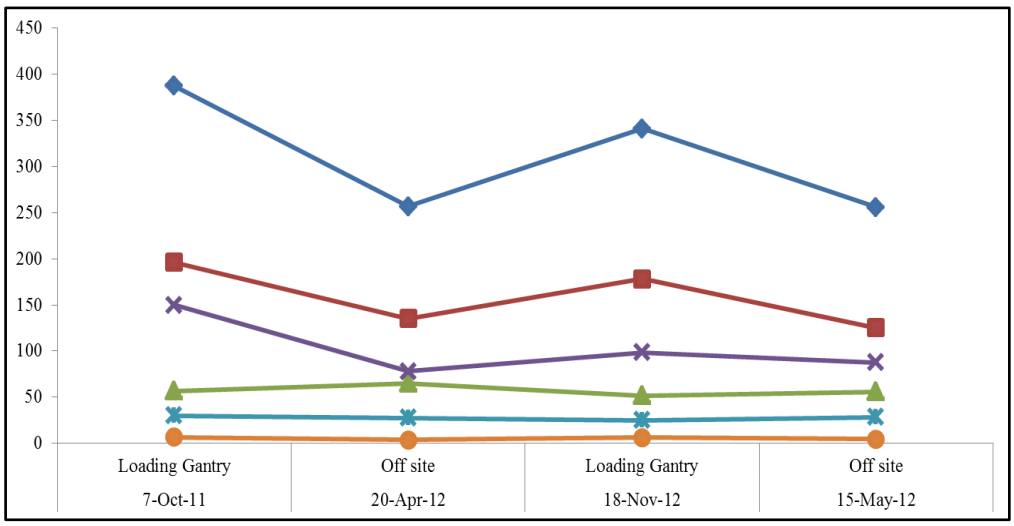


Figure 18 – Cholesterol variation of Dinesh Kumar Dixit

SR NO	PARAMETERS	Girish Sharma (35 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	237	142	220.6	160.4
2	Triglyceride	149	150.2	152.2	147.6
3	H D L (High Density Lipoprotein) Cholestrol	32	35	33	38
4	L D L (Low Density Lipoprotein) Cholesterol	120	112.3	118.4	103.5
5	V L D L Cholesterol	23	20.3	22.6	21.4
6	Risk Factor	7.41	4.06	6.68	4.22

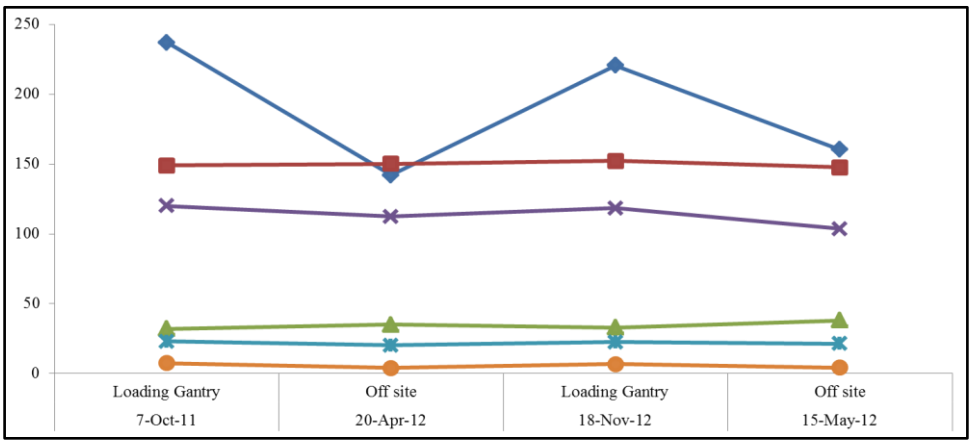


Figure 19 - Cholesterol variation of Girish Sharma

SR NO	PARAMETERS	Virendra Kumar Tyagi (39 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	300.52	255.4	293.5	237.1
2	Triglyceride	192	163.6	189.2	158.9
3	H D L (High Density Lipoprotein) Cholestrol	50.67	53.2	48.5	37.5
4	L D L (Low Density Lipoprotein) Cholesterol	140	118.5	120.4	120.4
5	V L D L Cholestrol	16	18.9	22.1	20.6
6	Risk Factor	5.93	4.80	6.05	6.32

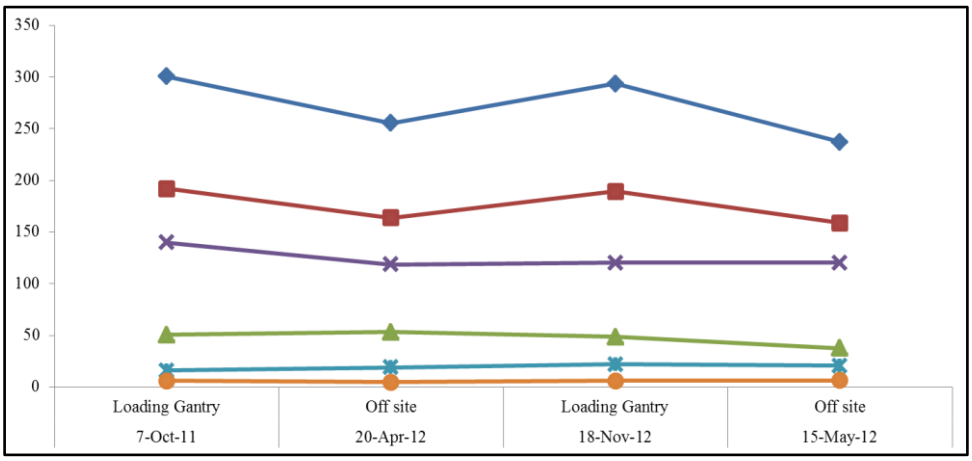


Figure 20 - Cholesterol variation of Virendra Kumar Tyagi

SR NO	PARAMETERS	Kala Dharan (29 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	250	189	261	210
2	Triglyceride	180	157	152	137
3	H D L (High Density Lipoprotein) Cholestrol	40	43	45	51
4	L D L (Low Density Lipoprottein) Cholestrol	138	124	132.3	121.2
5	V L D L Cholestrol	29	23	32	25
6	Risk Factor	6.25	4.40	5.80	4.12

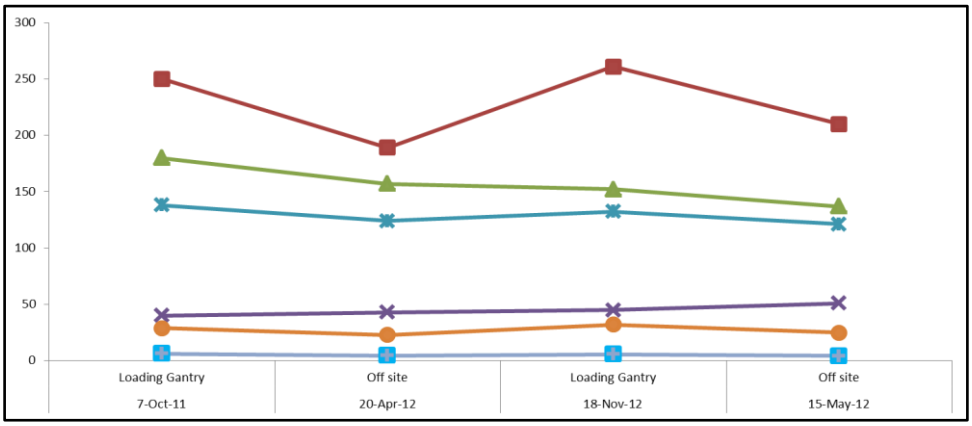


Figure 21- Cholesterol variation of Kala Dharan

SR NO	PARAMETERS	Banke Bihari (26 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	199.1	169.2	189.14	160.7
2	Triglyceride	123.2	113.4	112.8	110.8
3	H D L (High Density Lipoprotein) Cholesterol	47.9	50.2	54.4	49.2
4	L D L (Low Density Lipoprottein) Cholestrol	126.56	104.2	117.4	110
5	V L D L Cholestrol	24.64	34.2	28.8	34.1
6	Risk Factor	4.16	3.37	3.48	3.27

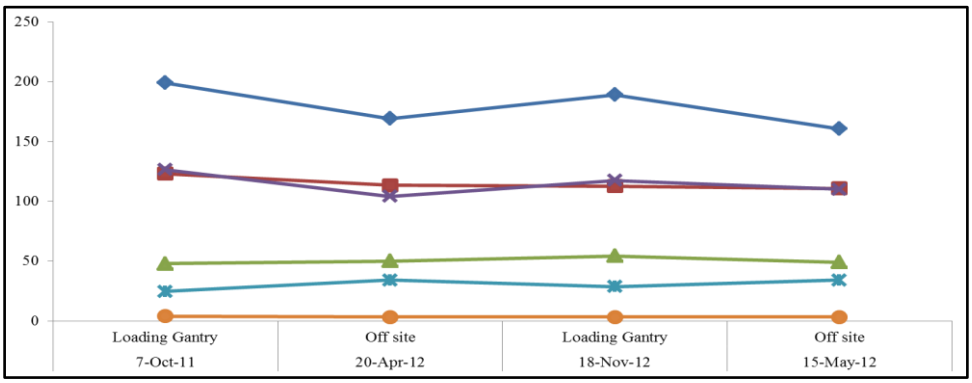


Figure 22 - Cholesterol variation of Banke Bihari

SR NO	PARAMETERS	Subhash Desai (48 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	250	212.5	256.25	192.1
2	Triglyceride	157	153.9	145.2	153.9
3	H D L (High Density Lipoprotein) Cholesterol	43.2	45.36	42.6	46
4	L D L (Low Density Lipoprottein) Cholestrol	190	156.7	175.8	138.3
5	V L D L Cholestrol	31	32.1	31.1	30.2
6	Risk Factor	5.79	4.68	6.02	4.18

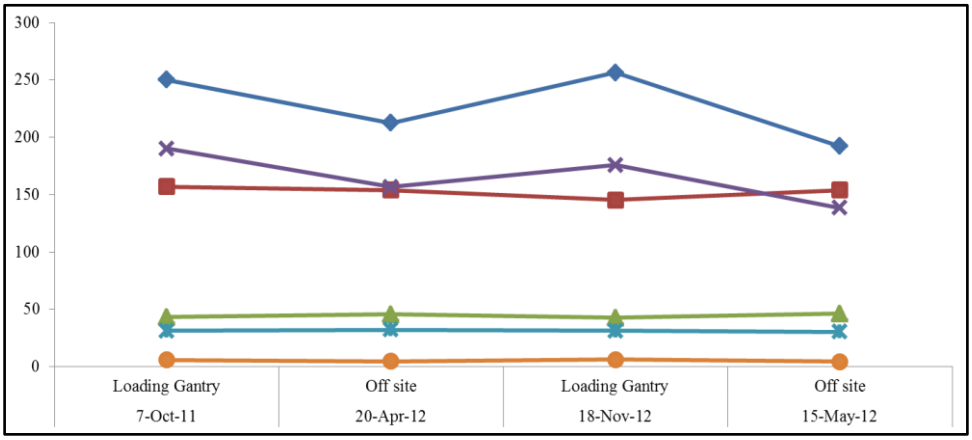


Figure 23 - Cholesterol variation of Subhash Desai

SR NO	PARAMETERS	Pramod Kumar Tiwari (25 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	204	173.4	214.6	175.9
2	Triglyceride	170	154.7	165.9	154.7
3	H D L (High Density Lipoprotein) Cholestrol	45	47.25	42.7	45.8
4	L D L (Low Density Lipoprottein) Cholestrol	120	99.4	117.3	94.9
5	V L D L Cholestrol	30	23	32.1	21
6	Risk Factor	4.53	3.67	5.03	3.84

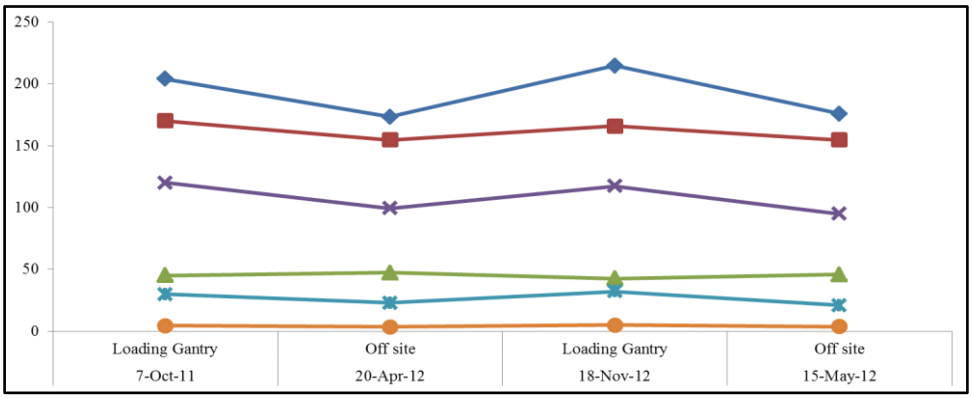


Figure 24 - Cholesterol variation of Pramod Kumar Tiwari

SR NO	PARAMETERS	Hetram (40 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	234.45	199.2	252.5	196.87
2	Triglyceride	150.3	142	114.9	148.3
3	H D L (High Density Lipoprotein) Cholestrol	34	35.7	42	36.4
4	L D L (Low Density Lipoprottein) Cholestrol	130.7	100.3	102.3	100.4
5	V L D L Cholestrol	24	29.3	19.2	26.7
6	Risk Factor	6.90	5.58	6.01	5.41

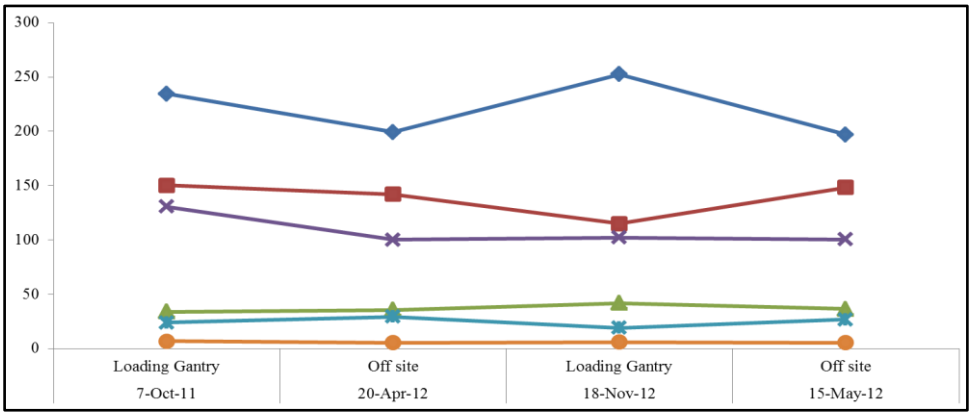


Figure 25 - Cholesterols variation of Hetram

SR NO	PARAMETERS	Vinod Kumar Dhokia (28 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholesterol	190	161.2	193.8	164.7
2	Triglyceride	110.4	103.2	112.4	100.5
3	H D L (High Density Lipoprotein) Cholesterol	45	44.2	45.8	45.7
4	L D L (Low Density Lipoprottein) Cholestrol	76.3	80.6	82.7	81.4
5	V L D L Cholestrol	23	11.3	24.8	12.6
6	Risk Factor	4.22	3.65	4.23	3.60

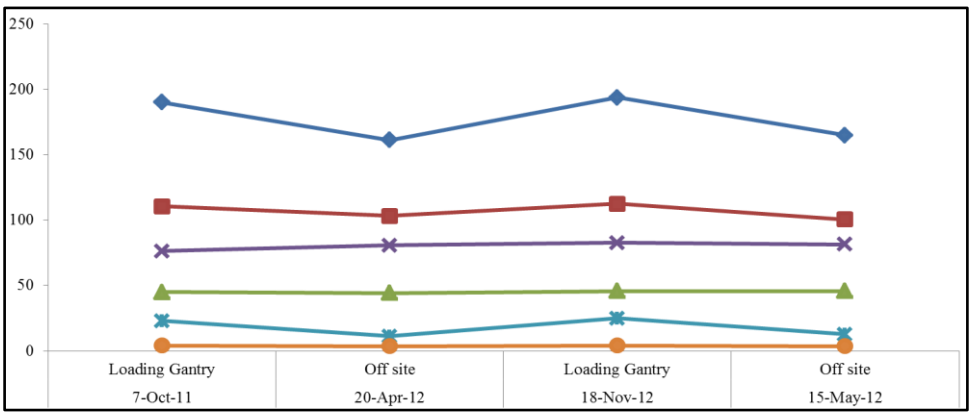


Figure 26 - Cholesterols variation of Vinod Kumar Dhokia

SR NO	PARAMETERS	Ashish Chaitram (42 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholesterol	200.5	170.4	198.5	176.4
2	Triglyceride	98.5	67.3	100.4	68.7
3	H D L (High Density Lipoprotein) Cholesterol	36	35.3	39.4	38.2
4	L D L (Low Density Lipoprottein) Cholestrol	85.6	90.8	95.3	89.6
5	V L D L Cholestrol	32	21.3	29.1	19.8
6	Risk Factor	5.57	4.83	5.04	4.62

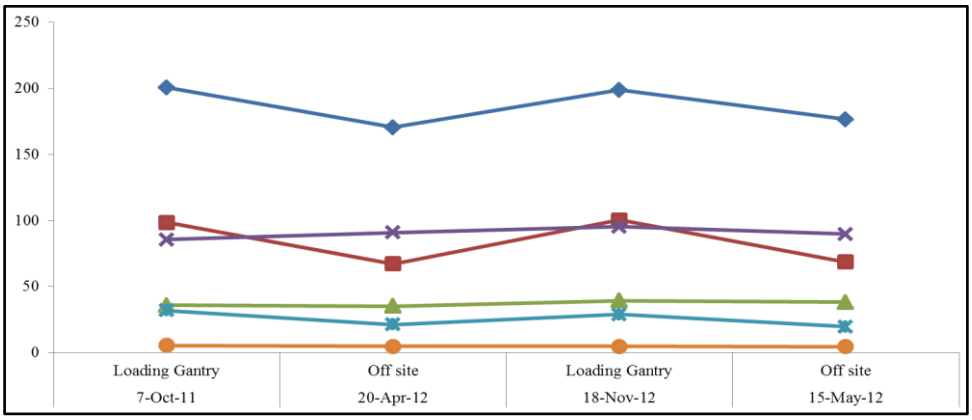


Figure 27 -Cholesterols variation of Ashish Chaitram

SR NO	PARAMETERS	Siva Kumar (39 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholesterol	187.47	159	191.7	152.7
2	Triglyceride	79.3	110.2	76	110
3	H D L (High Density Lipoprotein) Cholesterol	40.2	36.3	45.2	40.2
4	L D L (Low Density Lipoprotein) Cholesterol	94.3	68.4	84.2	74.3
5	V L D L Cholesterol	25	19.4	27.3	18.2
6	Risk Factor	4.66	4.38	4.24	3.80

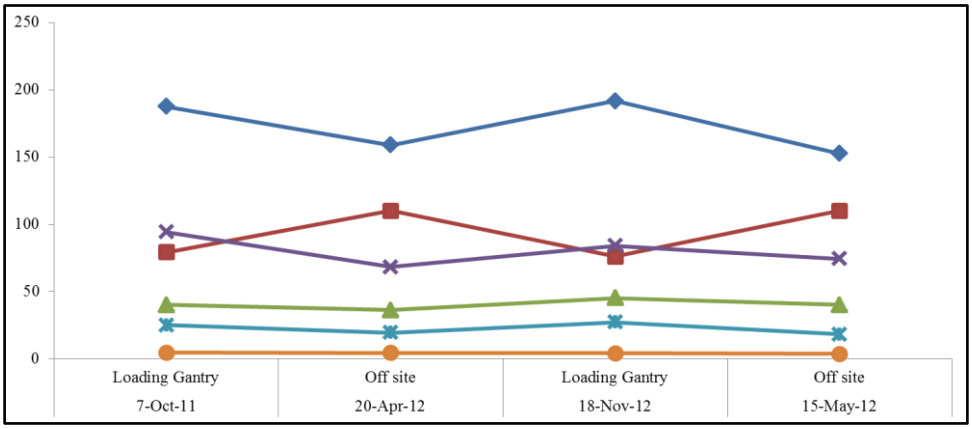


Figure 28 -Cholesterols variation of Siva Kumar

SR NO	PARAMETERS	Ram Acharya (27 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	167.48	142.2	198.4	148.8
2	Triglyceride	100.3	89.7	82.3	78.3
3	H D L (High Density Lipoprotein) Cholestrol	34.2	56	38.3	36.5
4	L D L (Low Density Lipoprottein) Cholestrol	87.4	90.8	110.4	89.3
5	V L D L Cholestrol	34.9	35.3	32.1	32.9
6	Risk Factor	4.90	2.54	5.18	4.08

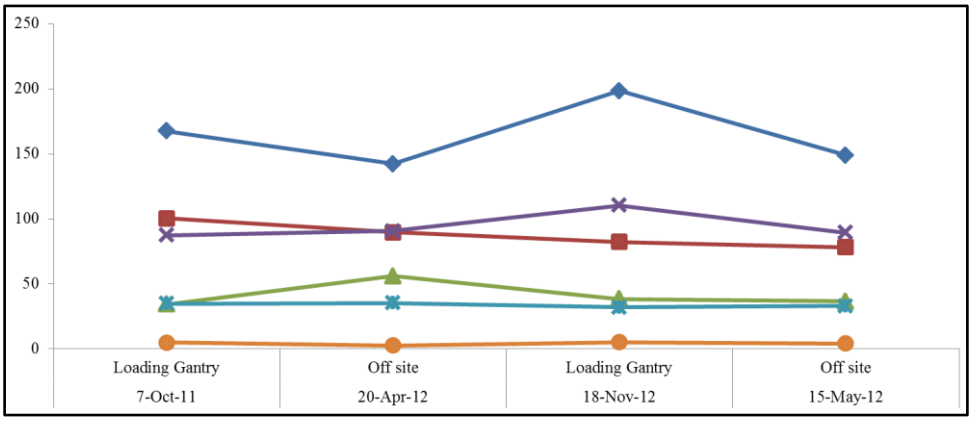


Figure 29 - Cholesterols variation of Ram Acharya

SR NO	PARAMETERS	Sri Ram Meena (36 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	298.3	150.2	262.5	170.6
2	Triglyceride	174.67	138.2	168.8	135.6
3	H D L (High Density Lipoprotein) Cholestrol	45.2	42.5	46.2	41.6
4	L D L (Low Density Lipoprottein) Cholestrol	120.4	134.2	125.6	134
5	V L D L Cholestrol	26.3	33.8	23.1	30.1
6	Risk Factor	6.60	3.53	5.68	4.10

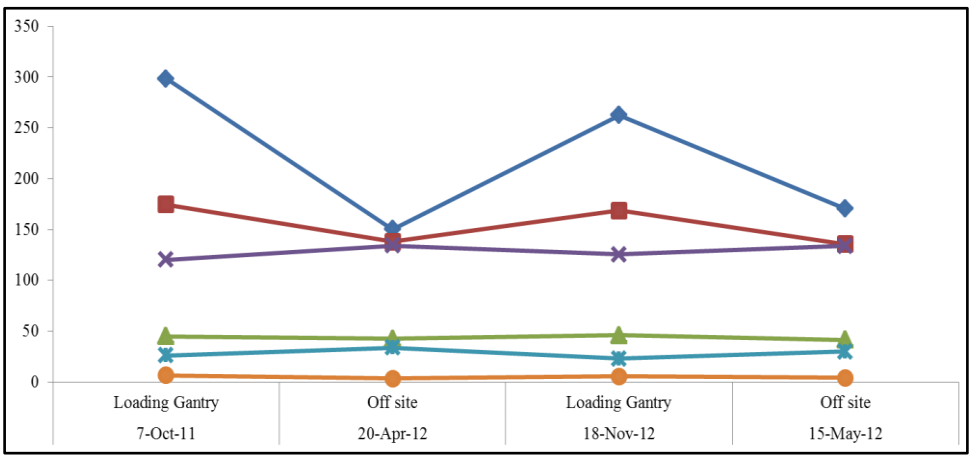


Figure 30 –Cholesterols variation of Sri Ram Meena

SR NO	PARAMETERS	Rajpal Singh Sidhu (30 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	230.3	195.7	240.3	183.9
2	Triglyceride	126.4	129.1	113.4	147.8
3	H D L (High Density Lipoprotein) Cholesterol	49.5	39.3	51.7	50.2
4	L D L (Low Density Lipoprottein) Cholestrol	87.4	109.2	98.8	110
5	V L D L Cholesterol	13	14.2	15.2	15.3
6	Risk Factor	4.65	4.98	4.65	3.66

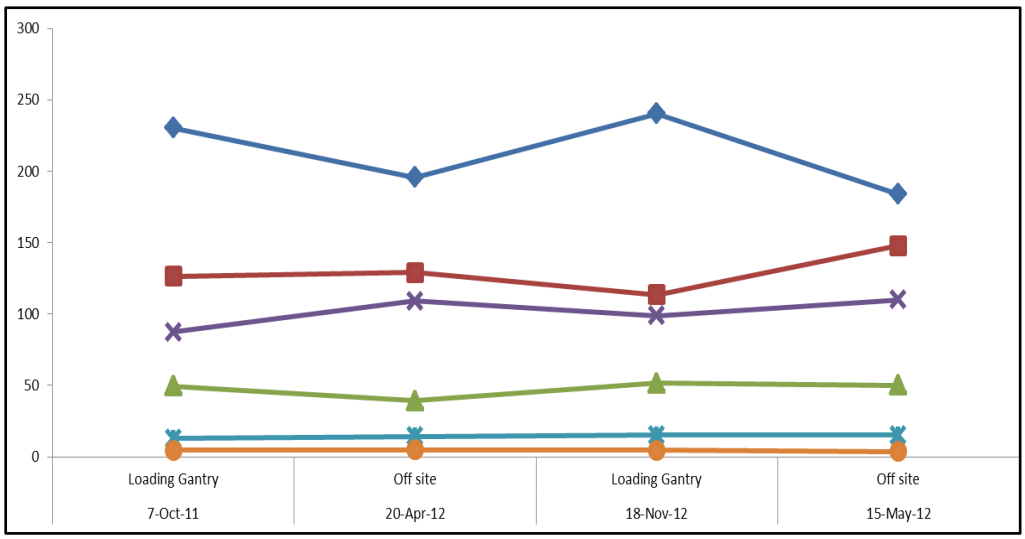
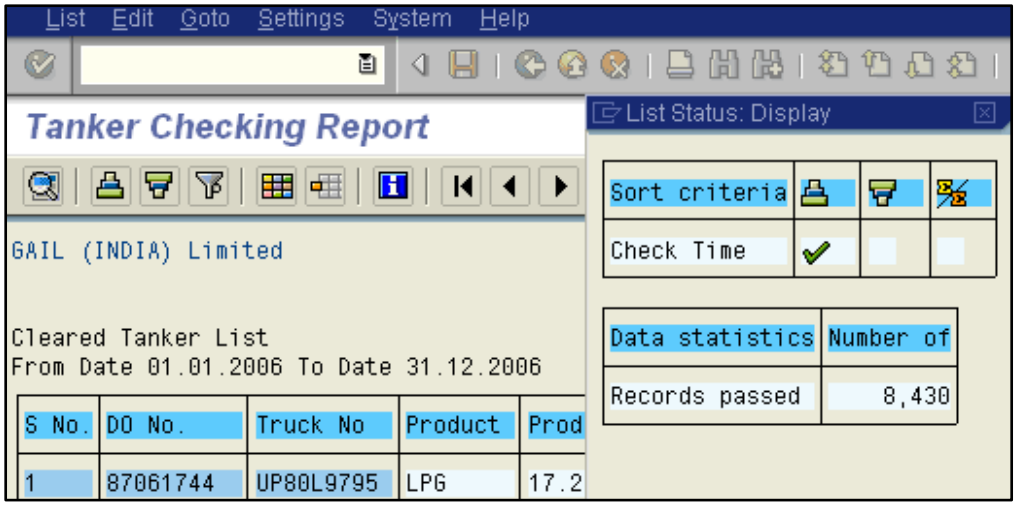
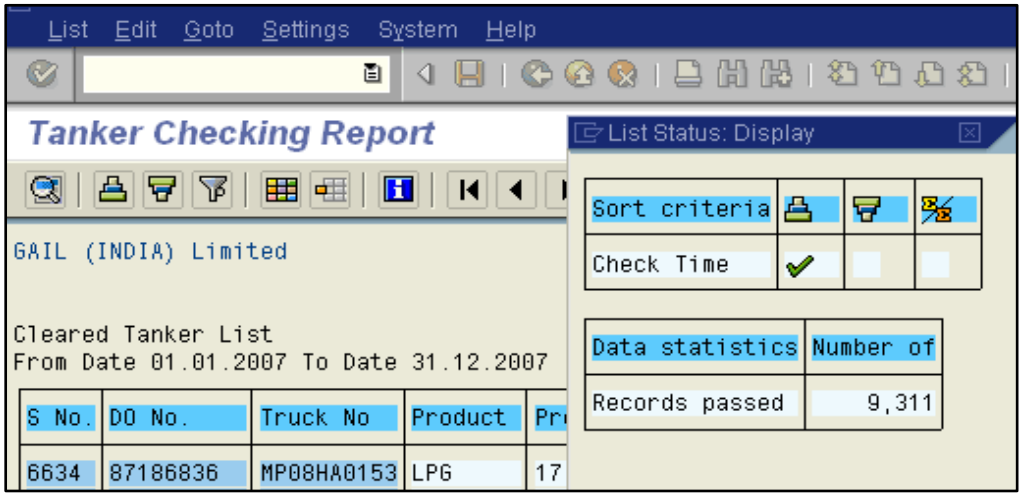


Figure 31 - Cholesterol variation of Rajpal Singh Sidhu

3.1.4 Use of mathematical modeling to study the of the release of hydrocarbon over a years (during different season) with respect to occupational health effect due to exposure to the operator as well as on the organization economy

All the data of loading of tankers of LPG and Propane is captured in ERP-SAP software of the company. The exact number of tankers loaded at GAIL (Inida) Limited Vijaipur is derived from the same. The screenshot of SAP-ERP for different tankers loading is depicted below –


List Edit Goto Settings System Help
Tanker Checking Report
List Status: Display
Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2006 To Date 31.12.2006
Data statistics
Number of
Records passed
8,430
S No.
DO No.
Truck No
Product
Prod
1
87061744
UP80L9795
LPG
17.2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Tanker Checking Report
List Status: Display
Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2007 To Date 31.12.2007
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Number of
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S No.
DO No.
Truck No
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6634
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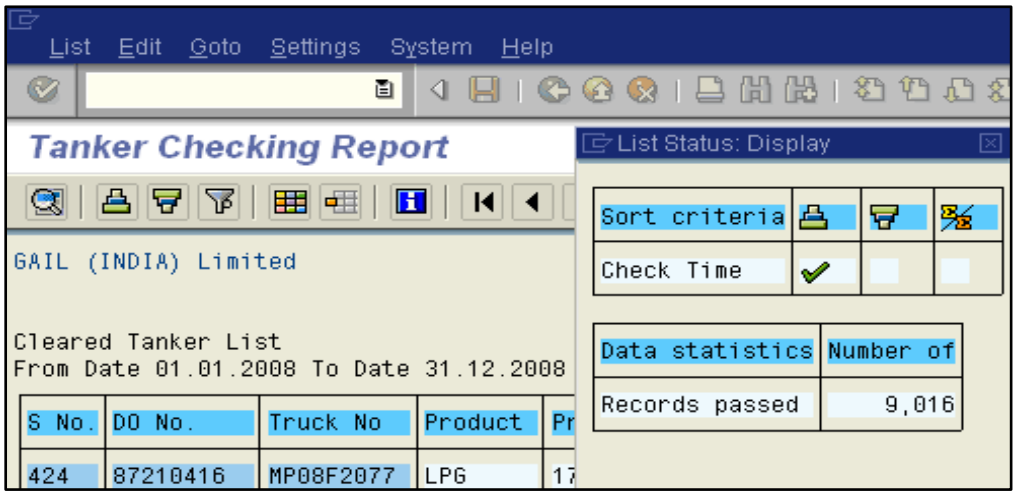
LPG
17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Tanker Checking Report
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Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2008 To Date 31.12.2008
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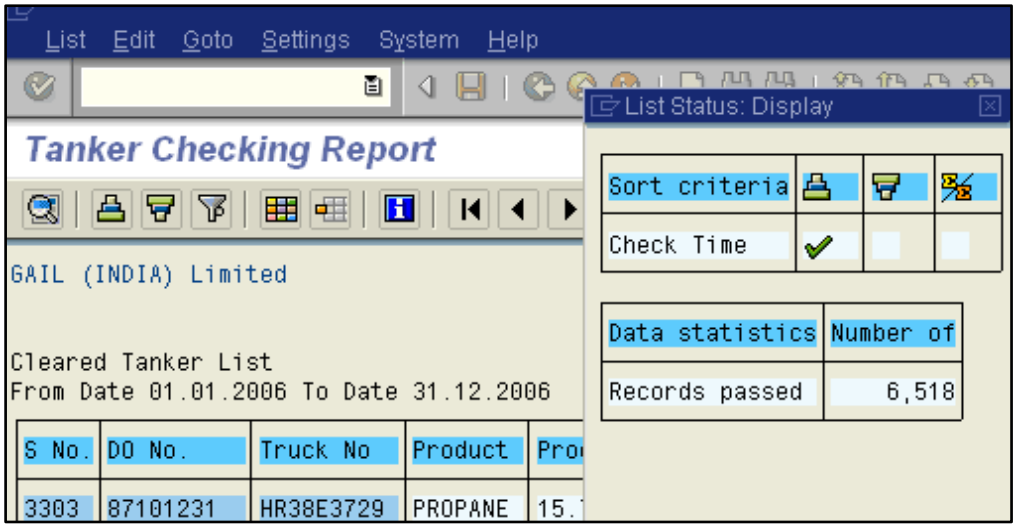
DO No.
Truck No
Product
424
87210416
MP08F2077
LPG


List Edit Goto Settings System Help
Tanker Checking Report
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Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2006 To Date 31.12.2006
Data statistics
Number of
Records passed
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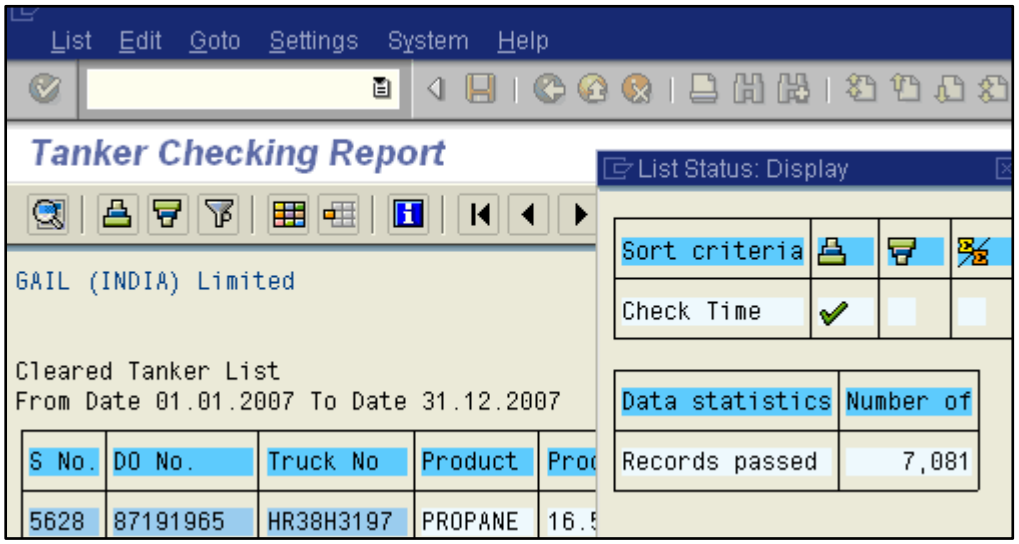
S No.
DO No.
Truck No
Product
3303
87101231
HR38E3729
PROPANE


List Edit Goto Settings System Help
Tanker Checking Report
List Status: Display
Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2007 To Date 31.12.2007
Data statistics
Number of
Records passed
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DO No.
Truck No
Product
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87191965
HR38H3197
PROPANE

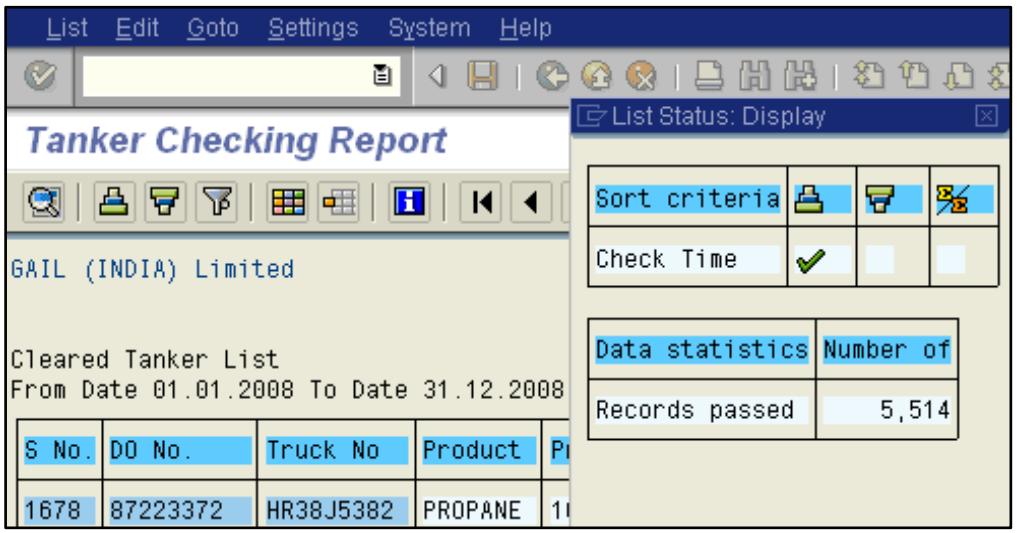

List Edit Goto Settings System Help
Tanker Checking Report
List Status: Display
Sort criteria
Check Time
GAIL (INDIA) Limited
Cleared Tanker List
From Date 01.01.2008 To Date 31.12.2008
Data statistics
Number of
Records passed
5,514
S No.
DO No.
Truck No
Product
1678
87223372
HR38J5382
PROPANE

Table – 3 – Tanker checking report

Accordingly the data of last seven years regarding quantity of LPG and Propane tankers loaded at GAIL Vijaipur is depicted below in the table –

Sr No.	Year	LPG	PROPANE	TOTAL
1	2006	8430	6518	14948
2	2007	9311	7081	16392
3	2008	9016	5514	14530
4	2009	9067	6702	15769
5	2010	9039	7008	16047
6	2011	9080	6908	15988
7	2012	9042	7047	16089

Table – 4 – Seven years data for tanker loading

Mathematical modeling for the release of hydrocarbon (LPG and Propane) is done with the help of ALOHA Software for the following weather conditions–

a. **Season** was considered as Winter, Summer and Rainy
b. **Wind Speed** of 2 Meter per Second; 5 Meter per Second and 10 Meter per Second.
c. **Wind Direction** was considered as ESE – East to South East
d. **Cloud cover** was considered as complete cover; Partially cloudy and Clear.
e. **Air Temperature** was considered as 15 Deg C in winter; 30 Deg C in Rainy season and 46 Deg C in summer season.
f. **Stability class** of D was considered.
g. **Humidity** was considered as Wet, Medium and Dry.

The result of mathematical modeling is summarized in the appended table

#	SR NO	WIND SPEED	WIND DIRECTION	MEASUREMENT HEIGHT	CLOUD COVER	AIR TEMP	STABILITY CLASS	HUMIDITY	TANK DIA	TANK LENGTH	VOLUME	TANK CONTAINS	CHEMICAL STORED AT	MASS IN TANK	LEAK SIZE	BOTTOM OF LEAK	60% LEL DISTANCE	10% LEL DISTANCE	5% LEL DISTANCE	LEL showing 60% in portable gas detector	LEL showing 10% in portable gas detector	LEL showing 5% in portable gas detector
1								WET									11 M	21 M	92 M			
2					COMPLETE COVER			MEDIUM									11 M	21 M	90 M			
3								DRY									11 M	21 M	90 M			
4								WET									11 M	22 M	91 M			
5	WINTER	2 M/S	ESE	2 M	PARTLY CLOUDY	15 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	18 DEG C	95%	0.2 CM	1.6 M	11 M	22 M	91 M			
6								DRY									11 M	22 M	91 M			
7								WET									11 M	22 M	91 M			
8					CLEAR			MEDIUM									11 M	22 M	91 M	9 M	20 M	87 M
9								DRY									11 M	22 M	91 M			
10								WET									10 M	16 M	49 M			
11					COMPLETE COVER			MEDIUM									10 M	16 M	49 M			
12								DRY									10 M	16 M	49 M			
13								WET									10 M	16 M	49 M			
14	SUMMER	10 M/S	ESE	2 M	PARTLY CLOUDY	46 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	45 DEG C	95%	0.2 CM	1.6 M	10 M	16 M	49 M			
15								DRY									10 M	16 M	49 M			
16								WET									10 M	16 M	49 M			
17					CLEAR			MEDIUM									10 M	16 M	49 M			
18								DRY									10 M	16 M	49 M			
19								WET									11 M	22 M	92 M	12 M	20 M	89 M
20					COMPLETE COVER			MEDIUM									11 M	22 M	92 M			
21								DRY									11 M	22 M	92 M			
22								WET									11 M	22 M	96 M			
23	RAIN SEASON	5 M/S	ESE	2 M	PARTLY CLOUDY	30 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	32 DEG C	95%	0.2 CM	1.6 M	11 M	22 M	96 M			
24								DRY									11 M	22 M	96 M			
25								WET									11 M	22 M	96 M			
26					CLEAR			MEDIUM									11 M	22 M	96 M			
27								DRY									11 M	22 M	96 M			

Table – 5 – ALOHA software outcome & field verification

Some of the sample mathematical modeling results for different season is depicted below -

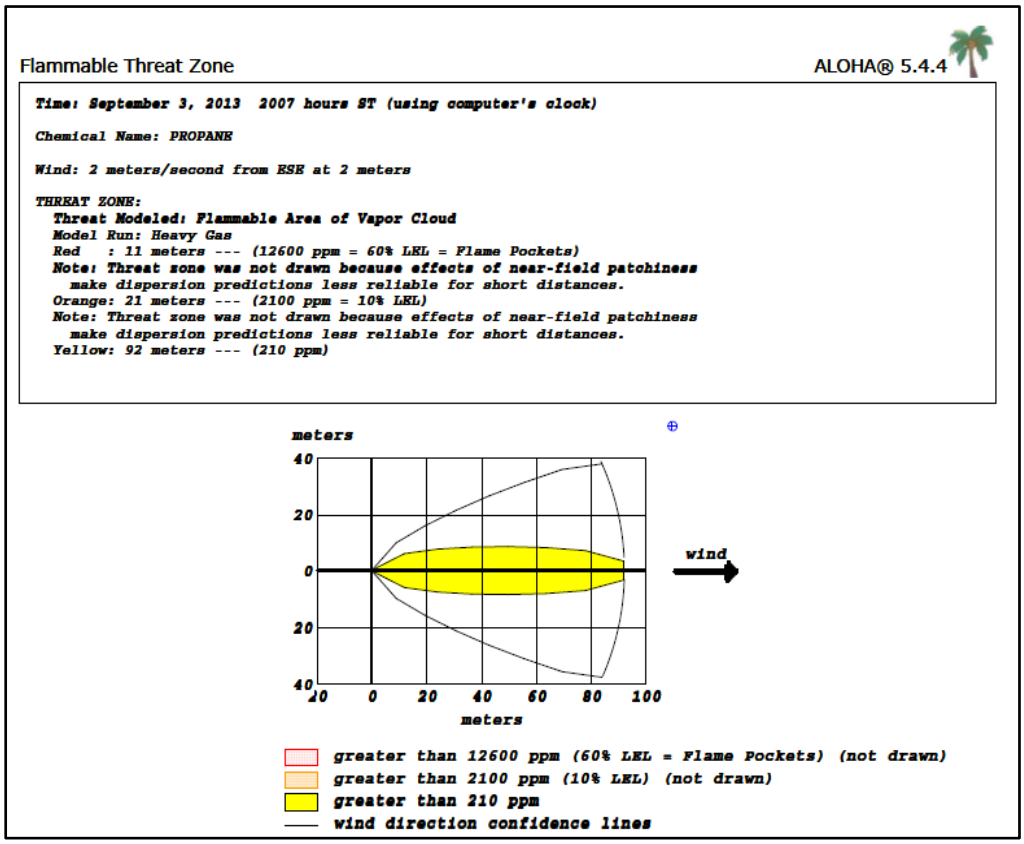


Figure 32 – Flammable threat Zone for wind speed 2 m/s

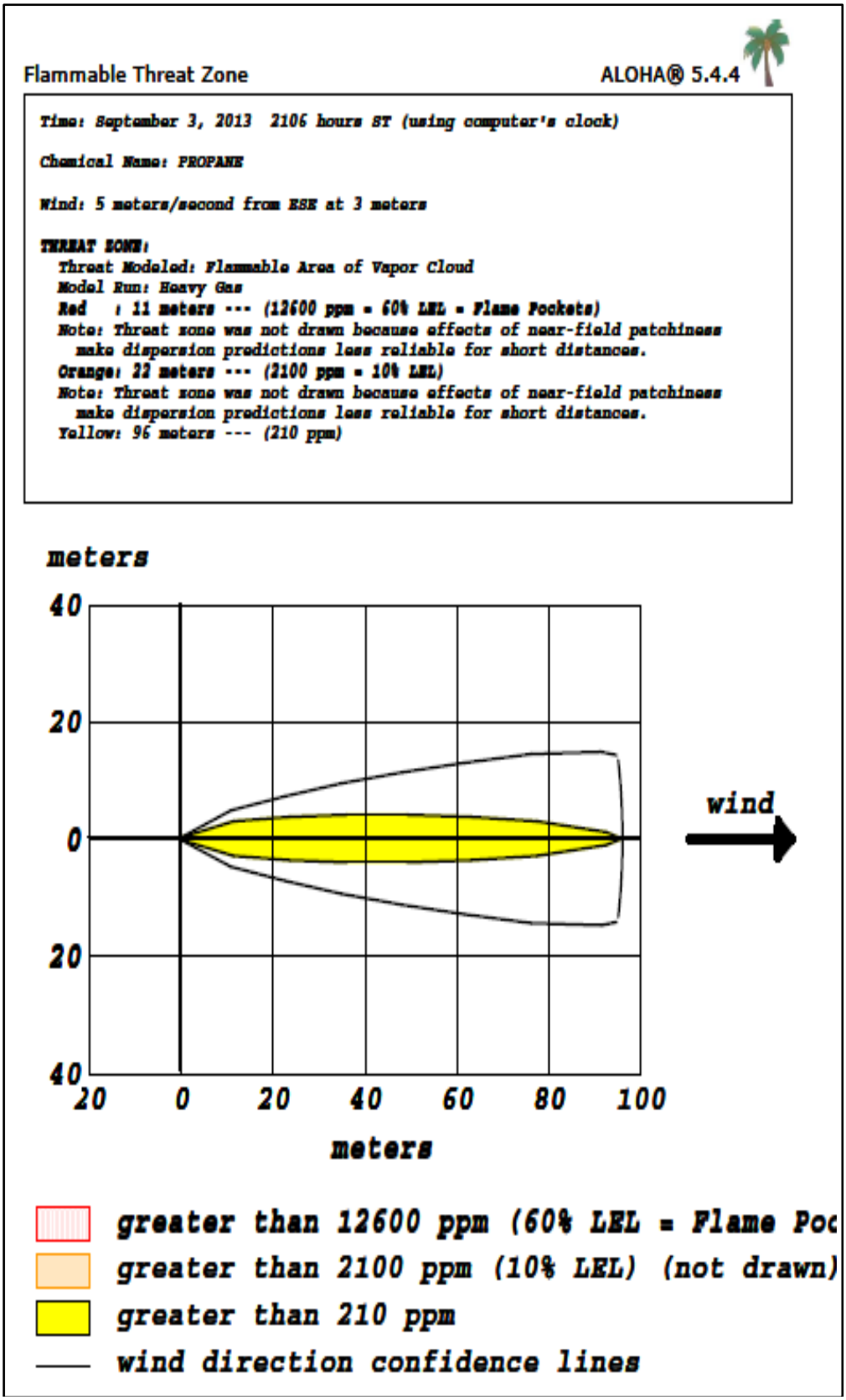
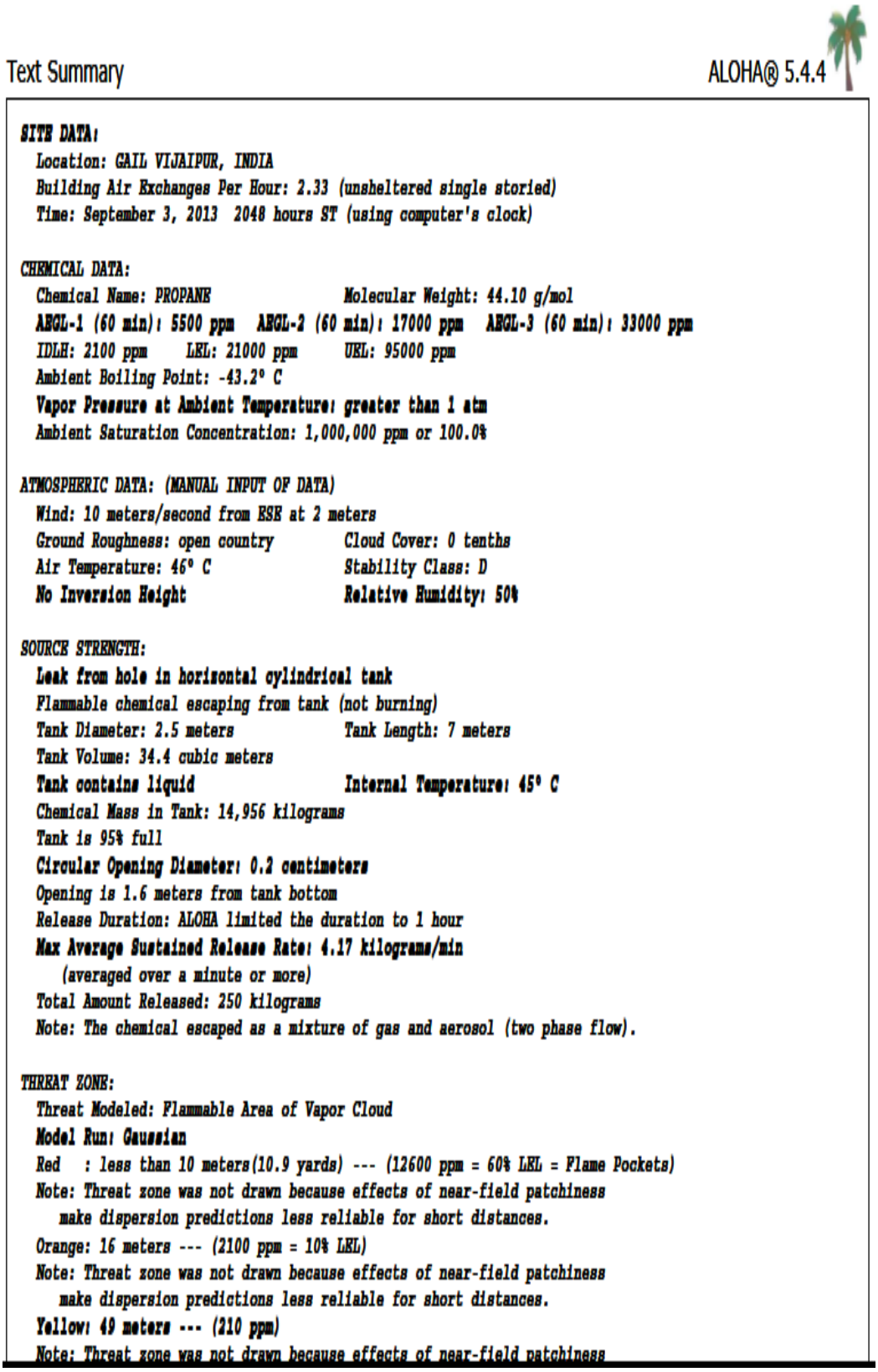


Figure 33 – Flammable threat Zone for wind speed 5 m/s



Text Summary ALOHA® 5.4.4

SITE DATA:
Location: GAIL VIJAIPUR, INDIA
Building Air Exchanges Per Hour: 2.33 (unsheltered single storied)
Time: September 3, 2013 2048 hours ST (using computer's clock)

CHEMICAL DATA:
Chemical Name: PROPANE Molecular Weight: 44.10 g/mol
AEGL-1 (60 min): 5500 ppm AEGL-2 (60 min): 17000 ppm AEGL-3 (60 min): 33000 ppm
IDLH: 2100 ppm LEL: 21000 ppm UEL: 95000 ppm
Ambient Boiling Point: -43.2° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 10 meters/second from ESE at 2 meters
Ground Roughness: open country Cloud Cover: 0 tenths
Air Temperature: 46° C Stability Class: D
No Inversion Height Relative Humidity: 50%

SOURCE STRENGTH:
Leak from hole in horizontal cylindrical tank
Flammable chemical escaping from tank (not burning)
Tank Diameter: 2.5 meters Tank Length: 7 meters
Tank Volume: 34.4 cubic meters
Tank contains liquid Internal Temperature: 45° C
Chemical Mass in Tank: 14,956 kilograms
Tank is 95% full
Circular Opening Diameter: 0.2 centimeters
Opening is 1.6 meters from tank bottom
Release Duration: ALOHA limited the duration to 1 hour
Max Average Sustained Release Rate: 4.17 kilograms/min
(averaged over a minute or more)
Total Amount Released: 250 kilograms
Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
Threat Modeled: Flammable Area of Vapor Cloud
Model Run: Gaussian
Red : less than 10 meters(10.9 yards) --- (12600 ppm = 60% LEL = Flame Pockets)
Note: Threat zone was not drawn because effects of near-field patchiness
make dispersion predictions less reliable for short distances.
Orange: 16 meters --- (2100 ppm = 10% LEL)
Note: Threat zone was not drawn because effects of near-field patchiness
make dispersion predictions less reliable for short distances.
Yellow: 49 meters --- (210 ppm)
Note: Threat zone was not drawn because effects of near-field patchiness

Figure 34 – Flammable threat Zone for wind speed 10 m/s

The LEL distances were actually measured with the help of MSA make Altair 5X model hand held portable gas detector at site during three different seasons as considered for mathematical modeling by actually opening the rotogauge for 1 minute. The results of the same are mentioned in the Table No- . The details of the MSA make Altair 5X model hand held portable gas detector is mentioned below –

Figure 35 – Portable Gas Detector

The hand held portable gas detector is having following features –

a. The ALTAIR 5X can measure up to six gases simultaneously.

b. Instrument is small, portable in size, handy, compact and impact resistant. The enclosure of the instrument is of non-corrosive high strength, which prevents spark generation.

c. Weight of the equipment is less than 650 gms with NiMH battery, in pump mode. Battery of the instrument is equipped with a rechargeable Li-ion battery pack as well as charger. The instrument run time is minimum 16 Hours with rechargeable batteries.

d. Instrument is rated to IP 65 protection levels for dust and water ingress (water spray and fine particle dust).

e. Display of the equipment is Continuous LCD (Liquid Crystalline Display) with large, easy to read characters. It is provided with back light for low light viewing.

f. Instrument works in the humidity range of 15-90%. Instrument works in the temperature range -10 deg Centigrade to 50 deg. Centigrade

g. Instrument is with following sensors i) Catalytic combustion Type for combustible gases and IR type (both separately installed in same instrument). ii) Electrochemical types for Oxygen. Sensors must be having over-range protection.

h. Instrument is capable of measuring minimum two gases, including combustible gas and oxygen simultaneously at a time with the help of both IR and CAT sensor with the following range –

   LEL (IR- CH4) – Range 0-100% Vol and accuracy = 1% Vol

   LEL (CAT) – Range 0-100% LEL and accuracy = 1% LEL

   Oxygen – Range 0-30% Vol and accuracy = 0.1%

i. The detector is intrinsically safe and UL approved for Class I, Division I, Groups A, B, C & D and have PESO (CCOE) approval.

LEL distances table for various atmospheric condition in case of Propane leakage is attached in Annexure.

Sample calculation for the revenue loss & energy loss due to discharge of LPG and Propane in the atmosphere during loading activity at GAIL Vijaipur is discussed below -

- Discharge rate of LPG & Propane from
  2 mm diameter hole of rotogauge = 0.085 Kg / Min
- No of LPG + Propane tankers loaded at GAIL Vijaipur in the year 2012
  = 1608 9
- Total amount of Hydro carbon discharged through rotogauge in the year 2012 at GAIL Vijaipur = 0.085 x 16089
  = 1367.56Kg
- Average cost of LPG& Propane
  in the year 2012 = Rs. 36,766.9 perMT
- Revenue loss for GAIL Vijaipur only for LPG
  for the year 2012 = 1.36x 36,766.9
  = Rs. 50281.12
- Calorific Value of LPG / Propane = 11950 KCal/Kg
  (50032.26 KJ/kg)
- Total amount of Hydro carbon dischargedthrough rotogauge in the year 2012 at GAIL Vijaipur = 1367.56Kg

- Energy loss for GAIL Vijaipur only for LPG & Propane

  for the year 2012 = 11950 x 1367.56

  = 16342342 Kcal

  = 68422117 KJ

The extrapolation of the results of revenue and energy loss due to release of hydrocarbon (LPG and Propane) over a period of year is given below –

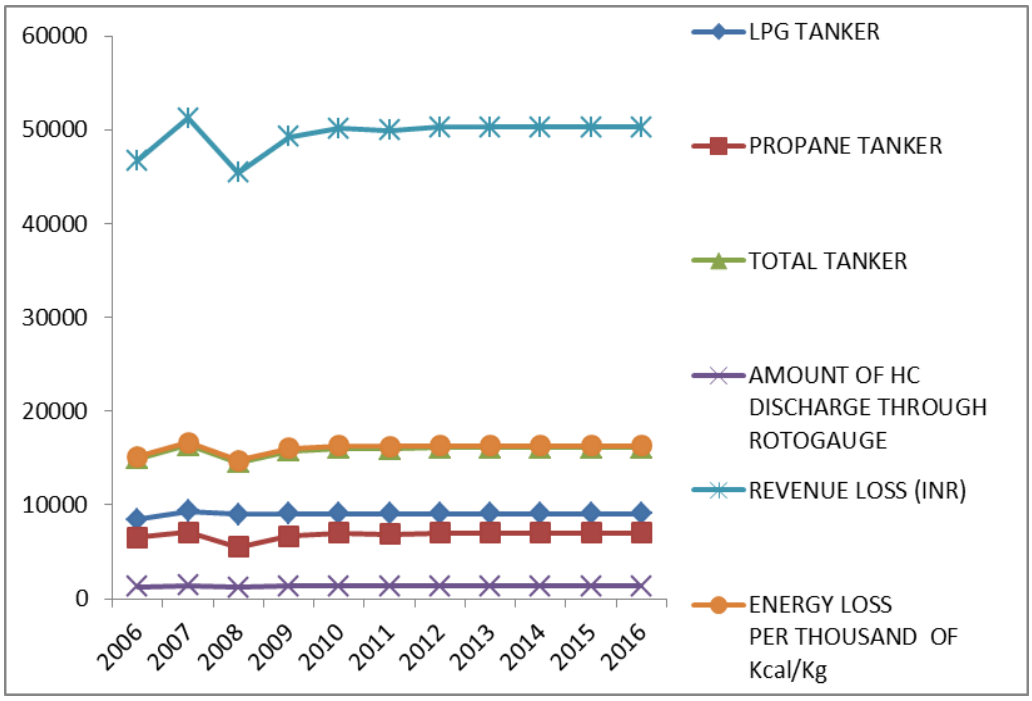


Figure 36 – Energy loss and Revenue loss to GAIL Vijaipur

3.1.5 Suggest the recommendations for overcoming the problem of release of LPG and Propane in atmosphere / application of technology

The Root Cause of all objectives is the discharge of hydro carbon (LPG and Propane) while loading activities in loading gantries. The prolonged exposure to these hydrocarbon leads to increase in blood Cholestrol level for the persons involved in loading and unloading activities of the road tankers. This was also established while studying the objective number 2 of this research work. Based on the results of objective no. 2 following recommendations are proposed to overcome the root cause of the problems

3.1.5.1 Loading crew needs to be shifted frequently, but this provides only temporary solution and every time special training to the crew for loading activities needs to be given.

3.1.5.2 Change the loading procedure ensuring zero leak during loading activity, but without changing the measuring mechanism, zero leak in tanker loading activity can not be achieved.

3.1.5.3 Use the zero leak mechanism for knowing the quantity of LPG / Propane inside the tanker thereby eliminating the risk of exposure of operators.

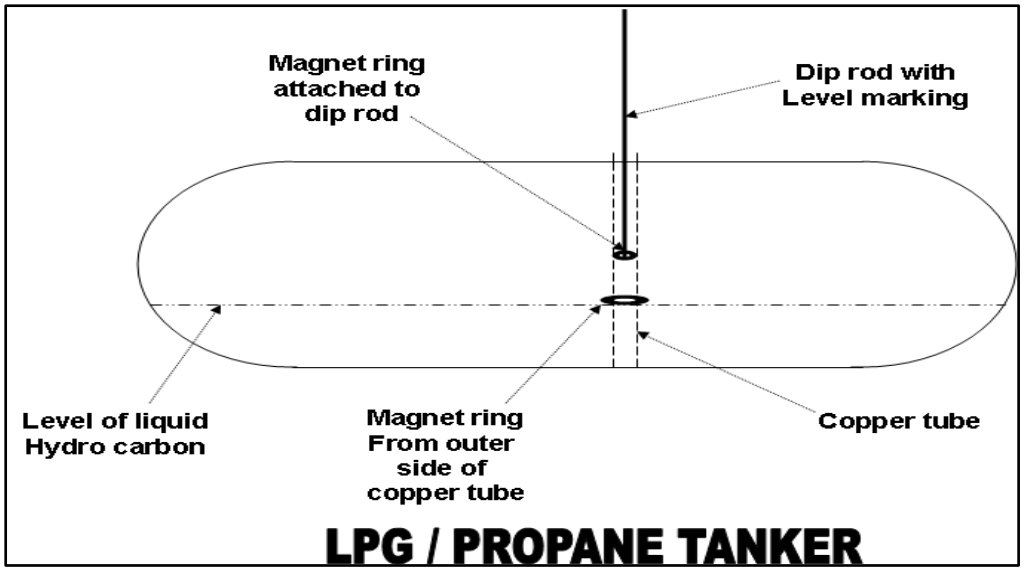
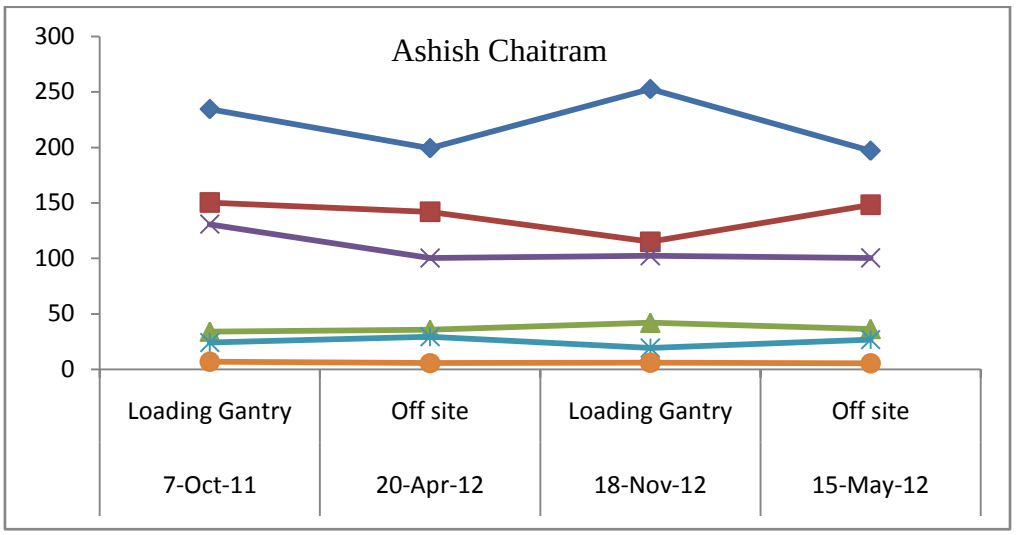


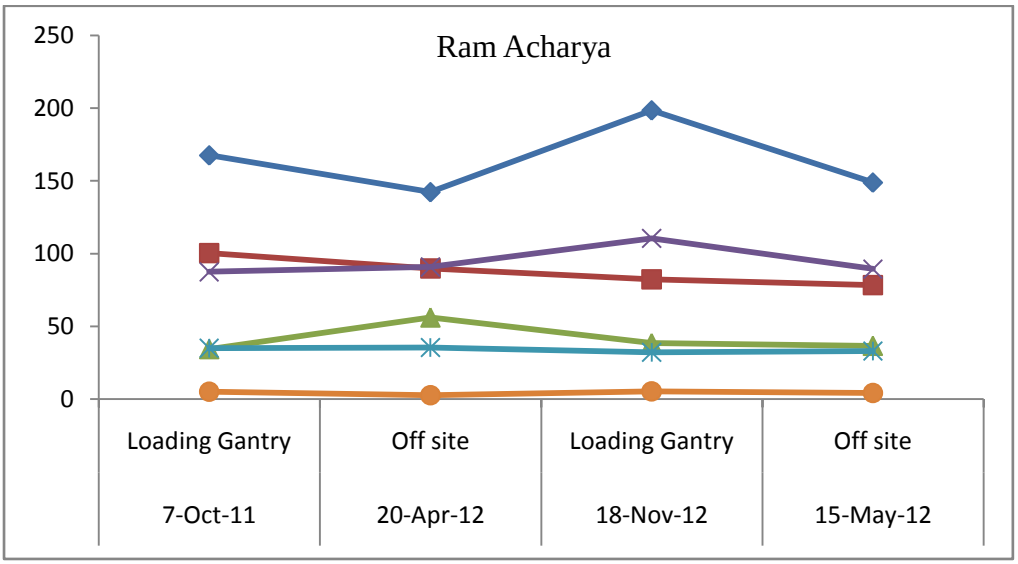
Figure 37 – Magnetic level gauge

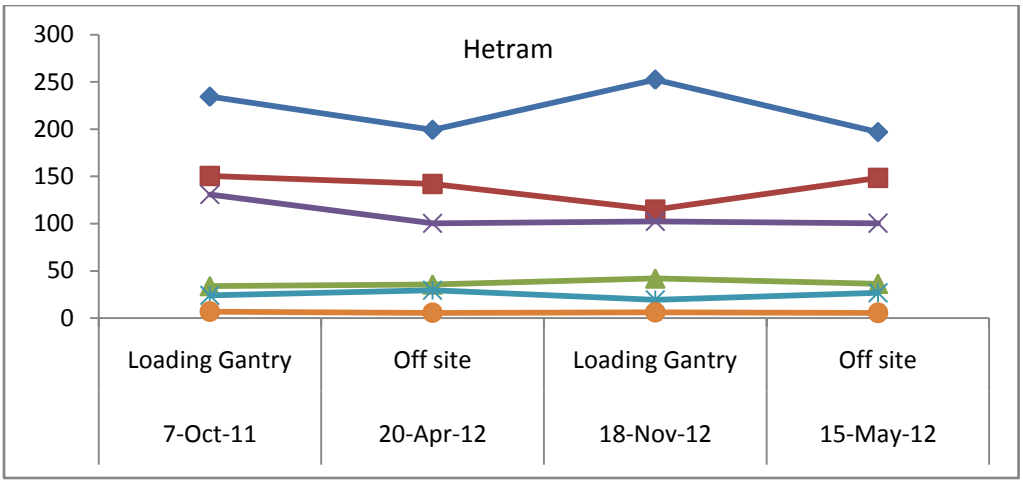
Working principle of Magnetic ring for measuring liquid level -

- Magnet floats on LPG and Propane.
- Hollow copper tube is placed inside the tank.
- Magnetic ring is place encircling from outer side the hollow copper tube.
- Circular magnet is attached at the bottom of the dip gauge.
- Calibrated Dip Gauge is inserted inside the hollow copper tube.
- Whenever LPG / Propane level increases inside the tank, outer side magnet which encircles the copper tube floats on the liquid level.
- Whenever the dip gauge is inserted inside the hollow copper tube, the magnet of the dip gauge attaches the floating magnet, thereby showing the liquid level inside the tank through calibrated scale.
- This helps to measure the liquid level without discharging any hydro carbon in atmosphere

By using this technique and deploying the operator in the loading gantry, it is found that cholesterol level of them is reduced. The same is shown in the appended graphs for the operators who have been deputed in these loading gantries where measurement of liquid inside the tanker is done with the help of magnetic level gauge–



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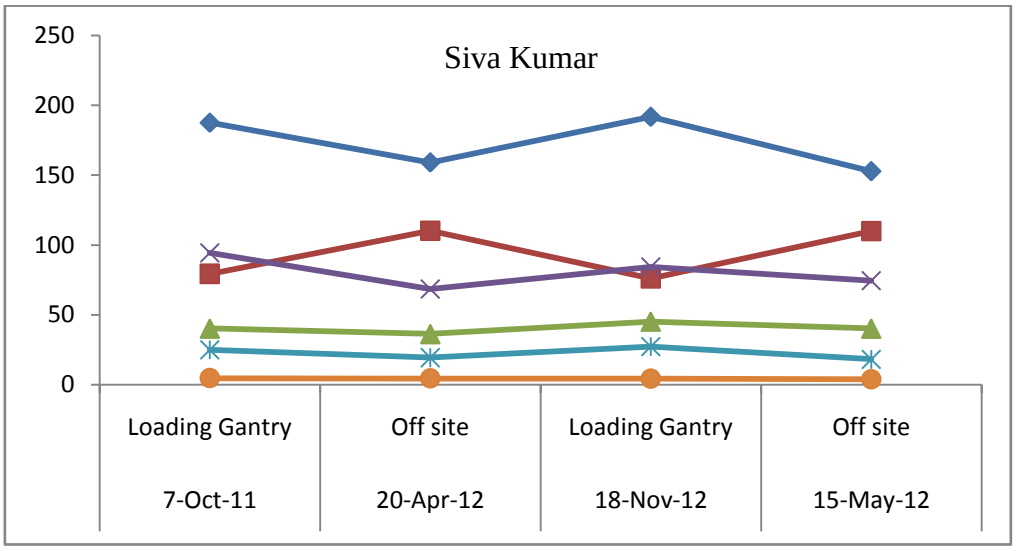
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Chapter 4.

Review of literature

The chapter discusses existing literature available in the similar and allied areas. Literature was reviewed under broad relevant heads and the inferences are recorded briefly under each category. It is evident from the literature that various studies are done without considering the effect on blood Cholesterol. The chapter ends highlighting gaps in existing standards systems and procedures.

4.1 General

Literature review carried out under the following broad categories. Summary of inferences from literature review is given under each category.

Category	Number of references
Hazards of hydrocarbon handling, their effects on living things and environment.	43
Incidents related to various hydrocarbon handling.	17
Design and fabrication requirement of hydrocarbon container.	4
Statutory requirement, guidelines and standards.	22

Various characteristics of Liquid hydrocarbon.	7
Other documents related to the field of the study.	39

Table 6 – Literature survey categories

4.2 Hazards of hydrocarbon handling

Following documents are reviewed under the category of Hazards of hydrocarbon handling, their effects on living things and environment.

- Burn Injuries Related to Liquefied Petroleum Gas and Fire and Explosion Hazards Associated with the Handling of LPG.[1, 2, 20]
- Domestic LPG hazards: a safety management perspective [3]
- Modeling the performance of coated LPG tanks engulfed in fires [8, 64]
- Boiling Liquid Expanding Vapour Explosions (BLEVE), the causes and consequences [13, 21]
- Risk reduction in road and rail LPG transportation by passive fire protection [16]
- Understanding the human health effects of chemical mixtures [47, 51]

From overall review of the literature it is understood that Liquefied petroleum gas (LPG), which is used as a type of fuel, is stored as a liquid under high pressure in tanks. Liquefied petroleum gas (LPG) has been in use as household fuel all over the world for several decades. Until the late 1980s, its use in the developing world was largely confined to the economically well-off strata of the society but it has since spread over a much larger catchment. Immediate and sudden explosion of these tanks can release a large amount of gas and

energy into the environment and can result in serious burns. There are various correlations for BLEVE and pool fire calculation for the size of the fireball, its duration and thermal flux and flame height at a distance for an isolated LPG tank, and the effect of thermal radiation on the population at various locations. It is found that the heat intensity at a distance has performed impact on the fatalities in the population. There are various techniques to reduce the risk while road and rail LPG transportation by doing the passive fire protection. Provision of PSV's, Excess flow check valves etc.

Most research on the effects of chemicals on biologic systems is conducted on one chemical at a time. However, in the real world people are exposed to mixtures, not single chemicals. Although various substances may have totally independent actions, in many cases two substances may act at the same site in ways that can be either additive or non-additive. Many even more complex interactions may occur if two chemicals act at different but related targets. In the extreme case there may be synergistic effects, in which case the effects of two substances together are greater than the sum of either effect alone. In reality, most persons are exposed to many chemicals, not just one or two, and therefore the effects of a chemical mixture are extremely complex and may differ for each mixture depending on the chemical composition.

4.3 Incidents related to various hydrocarbon handling

Following documents are reviewed under the category of incidents related to various hydrocarbon handling.

- Analytical investigation of thermal coating [9]
- Environmental Gas Displacement: Accidental Deaths in the Workplace [29, 31, 78, 80, 81, 83, 84]
- Assessment of an explosive LPG release accident [35, 126]
- Severe accidents in the energy sector: comparative perspective [37, 87]

Displacement of oxygen is caused due to leakage of hydro carbon (like LPG and Propane). The special characteristic of propane gas is that it is an asphyxiant agent. An accident occurred during a liquefied petroleum gas (LPG) tank filling activity. During the transfer of LPG from the source road tank car to the receiving fixed storage vessel, an accidental release of LPG gave rise to different final consequences ranging from a pool fire, to a fireball and to the catastrophic rupture of the tank with successive explosion of its contents.

Three cases of sudden death due to inhalation of portable cooking stove fuel (case 1), cigarette lighter fuel (case 2), and liquefied petroleum gas (LPG) (case 3) were studied. Specimens of blood, urine, stomach contents, brain, heart, lung, liver, kidney, and fat were collected and analyzed for propylene, propane, isobutane, and n-butane by headspace gas chromatography. n-Butane was the major substance among the volatiles found in the tissues of cases 1 and 2, and propane was the major substance in case 3. A combination of the autopsy findings and the gas analysis results revealed that the cause of death was ventricular fibrillation induced by hard muscle exercise after gas inhalation in cases 1 and 2, and that the cause of death in case 3 might be

hypoxia. It is possible that the victim in case 3 was under anesthetic toxicity of accumulated isobutane which is a minor component of liquefied petroleum gas. Most cases of acute poisoning by butane and other volatile compounds occur as a consequence of substance abuse by inhalation. Clinical symptoms are caused by asphyxia and mainly affect the cardiovascular, respiratory and central nervous system. There are also reported deaths from intoxication of butane inhalation.

4.4 Design and fabrication requirement of hydrocarbon container

Following documents are reviewed under the category of design and fabrication requirement of hydrocarbon container.

- LPG equipments and accessories [5]
- Design of tankers [96]
- Liquid propane gas (LPG) fuel cylinders (horizontal or vertical) mounting [101]

Review of the documents gave insight about Transportable refillable welded steel cylinders for LPG, its design and construction, design of bullets along with material specifications, fittings, mounting etc for transportation of LPG in bulk by road.

4.5 Statutory requirement, guidelines and standards

Following documents are reviewed under the category of statutory requirements, guidelines and standards.

- Gas Cylinder Rules 2004 [10, 12]

- Guidelines for good safety practices in the LPG gas industry [23, 25]
- Guide to the Harvard style of referencing [24]
- Field Guide to Fuel Handling, Transportation & Storage [22, 104]
- Fuels and combustion [57]
- LPG tank truck incidents which gives Guidelines for handling emergencies arising out of LPG Tank Truck (TT) incidents and layout of plants [61, 62, 67]

There are documents which provides guidance on acceptable industry practice for managing fuel handling, transportation and storage in rural and remote areas. Various requirements for design and fabrication of unfired pressure vessels were understood. Moreover there are guidelines which helps to identify the key stakeholders within the LP Gas industry and go on to describe their responsibilities to ensure a safe environment for LP Gas throughout the distribution chain; from the LP Gas producers at the refineries and gas fields, right through the distribution chain to the final application for the product. The importance of a sound regulatory framework for the LP Gas industry and the impact that has on a safe environment is understood. In-depth design criteria for bullets along with material specifications, fittings, mounting etc for transportation of LPG in bulk by road are discussed.

4.6 Characteristics of Liquid hydrocarbon

Following documents are reviewed under the category of characteristics of liquid hydrocarbon.

- Handbook of petroleum industry [7, 11, 60]

- Laminar burning velocity and explosion index of LPG–air and propane–air mixtures [41]
- Greenhouse gas emission 2020 [46]
- Fuels and combustion [93]

Various process in petroleum industries are discussed. The handbook has been compiled to give readers who are interested in the oil and gas production industry an overview of the main processes and equipment's used in the Oil and Gas Industry. It contains explanations of how oil and gas are discovered and extracted today. The determination of burning velocity is very important for the calculations used in hazardous waste explosion protection and fuel tank venting, which has a direct impact on environmental protection. The detail study is done regarding the projection of fugitive greenhouse gas emission to 2020.

4.7 Summary

It is evident from the literature that Liquefied petroleum gas (LPG) and Propane, which is used as a type of fuel, is stored as a liquid under high pressure in tanks. There are various hazards associated with these fuels. These fuels are stored in pressurized vessels and either transported through road tanker or rail wagons. There are various techniques to reduce the risk while road and rail LPG transportation by doing the passive fire protection. Provision of PSV's, excess flow check valves etc. The special characteristic of these gases is that it is an asphyxiant agent. Most cases of acute poisoning by these volatile compounds occur as a consequence of substance abuse by

inhalation. Clinical symptoms are caused by asphyxia and mainly affect the cardiovascular, respiratory and central nervous system. There are also reported deaths from intoxication of inhalation of these gases.

Chapter 5.

Conclusion and Contribution

The chapter concludes current research work and noticeable contributions are mentioned in this section. Recommendations of the research and the benefits in implementing research finding to all stakeholders of business are given in this section. Also, scope for future research was outlined at the end of this chapter.

5.1 Summary

Although the procedure for loading and unloading of road tankers for carrying LPG and Propane is well established and practiced in all LPG and Propane producing industries from decades but the method for measuring the volumetric quantity inside the road tankers with the help of rotogauge is not focusing towards the adverse impact on human health due to prolonged exposure to hydrocarbon vapour while loading and unloading operations of tankers. This is identified as a gap in this study and considered as basis for the current research to know the impact of exposure for prolonged period on occupational health. Detail study of loading and unloading procedure at

different locations of the Organisation is carried out. The theoretical outcome from mathematical modeling software (ALOHA) was correlated in the field with actual readings and found comparable. Economic loss to the Organisation due to release of un-burnt hydrocarbon was established including impact on occupational health of the persons involved in the activity. The effectiveness of the suggested measure was established.

5.2 Conclusion and Noticeable contributions

Research contributions are segmented in under the following board categories-

1. Study of LPG and Propane filling mechanism in road tankers.
2. Estimate the quantum of hydro carbon released in atmosphere through rotogauge.
3. Study the occupational health effect of VOC's over a period of different seasons.
4. Use of mathematical modeling to study the release of hydro carbons over the years with respect to occupational health effect as well as on Organisation economy.
5. Suggest the recommendations for overcoming the problem of release of LPG and Propane in atmosphere/application of technology.

5.3 In depth study of LPG and Propane filling in road tankers

From the procedure at different site, it is established that loading procedure at all the installation are similar. During the loading and unloading activity, rotogauge is being opened to check the liquid level inside the tanker at least 3

three times. While filling as well as emptying out these tankers, the general practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage. Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (hydrocarbon is being released in the atmosphere for 1 minutes through rotogauge). During opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as vapours)

5.4 Quantum of hydrocarbon (LPG & Propane) released in atmosphere

Discharge rate of hydrocarbon (i.e. LPG and Propane) through 2 mm diameter size hole of rotogauge is determined theoretically with the help of software available at following site - http://www.mechengcalculations.com/index.html as well as same is crosschecked practically by collecting the discharge through rotogauge in the sampling balloon. The discharge rate of the LPG / Propane from the 2mm hole is 5.1 Kg/Hr.

5.5 Occupational Health effect of VOC's

When operators were exposed to the hydro carbon (LPG as well as Propane) during the loading activity of road tankers, their Lipid profile changes viz Cholesterol level is increased. The increase in Cholesterol level was found more during the winter season. The effect of hydro carbon on lipid profile (cholesterol) of human being is found to be reversible when exposure duration and quantity is reduces or eliminated.

5.6 Use of mathematical modeling to study the release of hydro carbons

Mathematical modeling for the release of hydrocarbon (LPG and Propane) is done with the help of ALOHA Software. The same was also crosschecked in field by releasing the LPG / Propane form rotogauge for 1 minute in different weather condition and results are found comparable. The energy and economical loss based on quantity of un-burnt hydrocarbon released over the period of years were calculated.

5.7 Recommendations

1. The measuring device in the road tankers needs to be replaced with suggested measuring device (magnetic ring with calibrated measuring rod) to achieve the zero leak during volumetric measurement.

2. Frequent job rotation for the operators needs to be done to avoid the exposure to un-burnt hydrocarbon vapours for prolonged period.

3. Online weighment of road tankers while loading / unloading is in progress to be implemented with interlock for stoppage of operation on predetermined values.

5.8 Advantages

Following advantages are expected from the implementation of research recommendations.

5.8.1 Occupational health exposure to the loading operators can be eliminated during loading and unloading activities of LPG and Propane tankers.

5.8.2 Open cold venting of hydro carbon in the atmosphere can be eliminated.

5.8.3 Contribution in Greenhouse gas effect can be minimized due elimination of release of un-burnt hydrocarbon in the atmosphere.

5.8.4 Revenue loss of the organization due to release of un-burnt hydrocarbon can be minimized.

5.8.5 Surrounding area of the loading and unloading gantries can be made free from traces of un-burnt hydrocarbon thereby reduces the risk of fire and explosion.

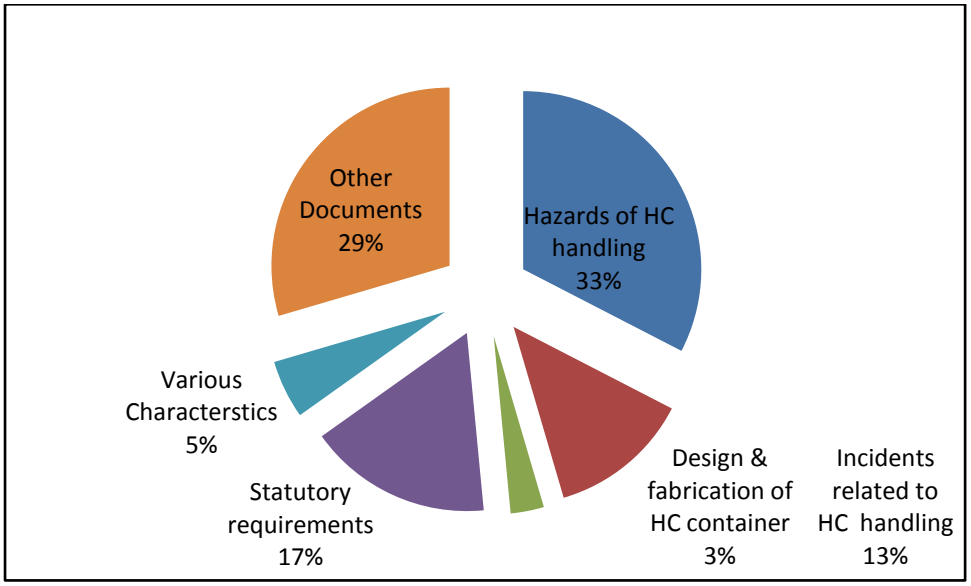
5.8.6 Countrywide during many of the road accident of the LPG and Propane tankers the most vulnerable portion rotogauge is easily gave away thereby increased the risk of leakage and fire / explosion. This risk can be eliminated in case rotogauge is replaced with another suggested measuring device.

Thus the research concludes with the solution to address the problem in existing hydro carbon level measuring device inside the road tanker with an aim to improve the occupational health issue to loading and unloading operators, to reduce the revenue loss to the organization and also ratifies the field outcome of the hydrocarbon presence zone against the software results.

Chapter 6.

References

The references are segmented in six different categories under hazards of hydrocarbon handling, incidents related to handling of hydrocarbon, design and fabrication, statutory requirements, characteristics of LPG and Propane and other related documents. Details references are given in this section.



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Appendix and Supporting Documents.

In this chapter, additional material that supports current research work is given for cross reference. Experimental data and primary data is also mentioned. Based on the research the author published research papers in 2 international journals.

Medical test report for loading operators for two seasons

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Kala Dharan
Investigation required:		Age / Sex:	29/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	14	13.5-18.5 gms %
Total Leucocyte Count	:	8650	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	O+ve	

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Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

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Referred by Dr		Name:	Kala Dharan
Investigation required:		Age / Sex:	29/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	250	110 - 200 mg%
Triglyceride	:	mg %	180	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	40	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	138	
V L D L Cholestrol	:		29	10 – 30 mg/dl
Risk Factor	:		6.25	3-6 Standard Risk (More than 6 : High Risk)
OTHERS				
COMMENTS				

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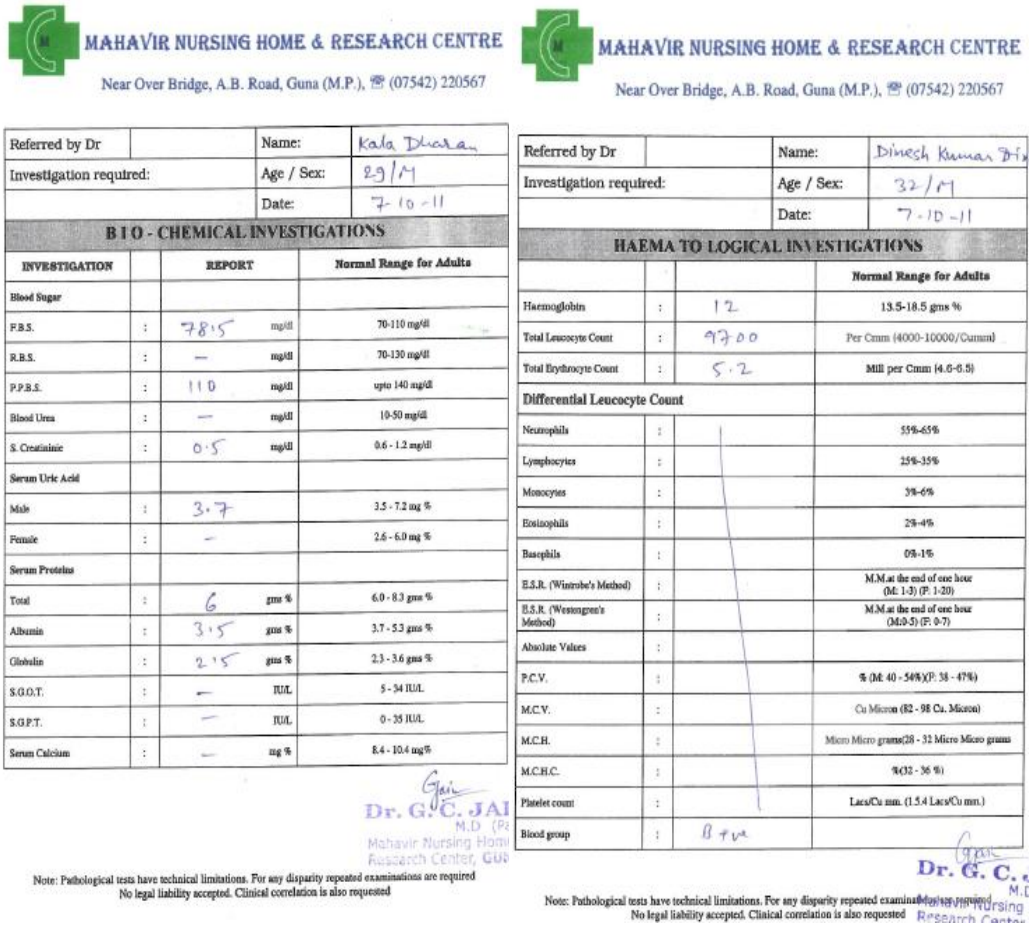

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Referred by Dr		Name:	Kala Dhaka
Investigation required:		Age / Sex:	29/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	78.5	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	110	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.5	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.7		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6	gms %	6.0 - 8.3 gms %
Albumin	:	3.5	gms %	3.7 - 5.3 gms %
Globulin	:	2.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Dinesh Kumar Dix
Investigation required:		Age / Sex:	32/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12	13.5-18.5 gms %
Total Leucocyte Count	:	9700	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	B +ve	

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Note: Pathological tests have technical limitations. For any disparity repeated examinations required
No legal liability accepted. Clinical correlation is also requested

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Referred by Dr		Name:	Dinesh Kumar Dixit
Investigation required:		Age / Sex:	32/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	98.3	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	122.6	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1.05	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.62		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	5.94	gms %	6.0 - 8.3 gms %
Albumin	:	3.82	gms %	3.7 - 5.3 gms %
Globulin	:	2.12	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Dinesh Kumar Dixit
Investigation required:		Age / Sex:	32/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	387.2	110 - 200 mg%
Triglyceride	:	mg %	196	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	57	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	150	
V L D L Cholestrol	:		30.2	10 – 30 mg/dl
Risk Factor	:		6.79	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

–

COMMENTS

–

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Research Center, GUNA.

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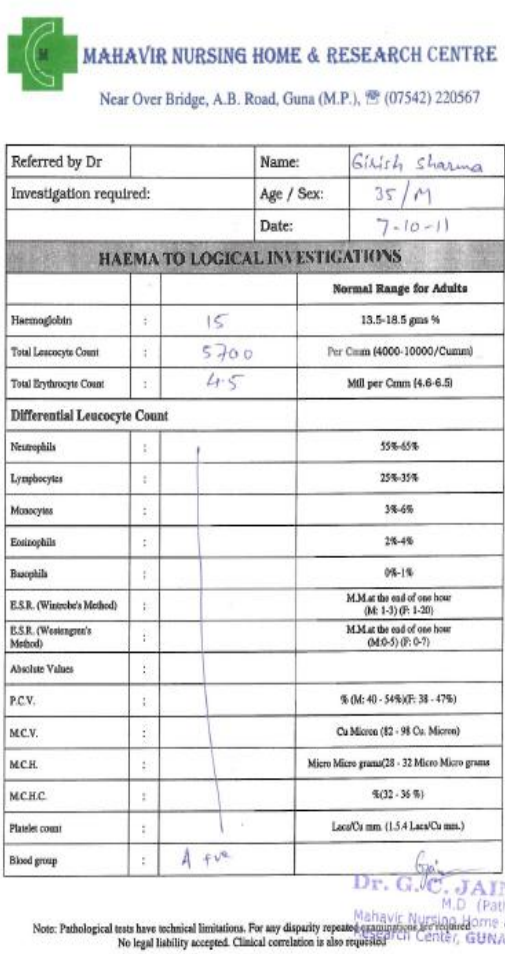

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	15	13.5-18.5 gms %
Total Leucocyte Count	:	5700	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4.5	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	A +ve	

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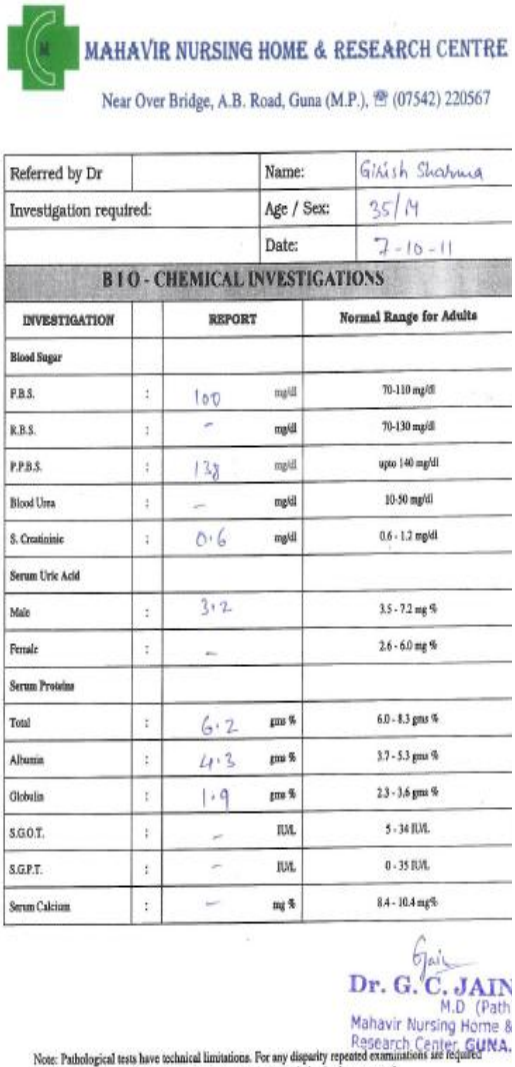


MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

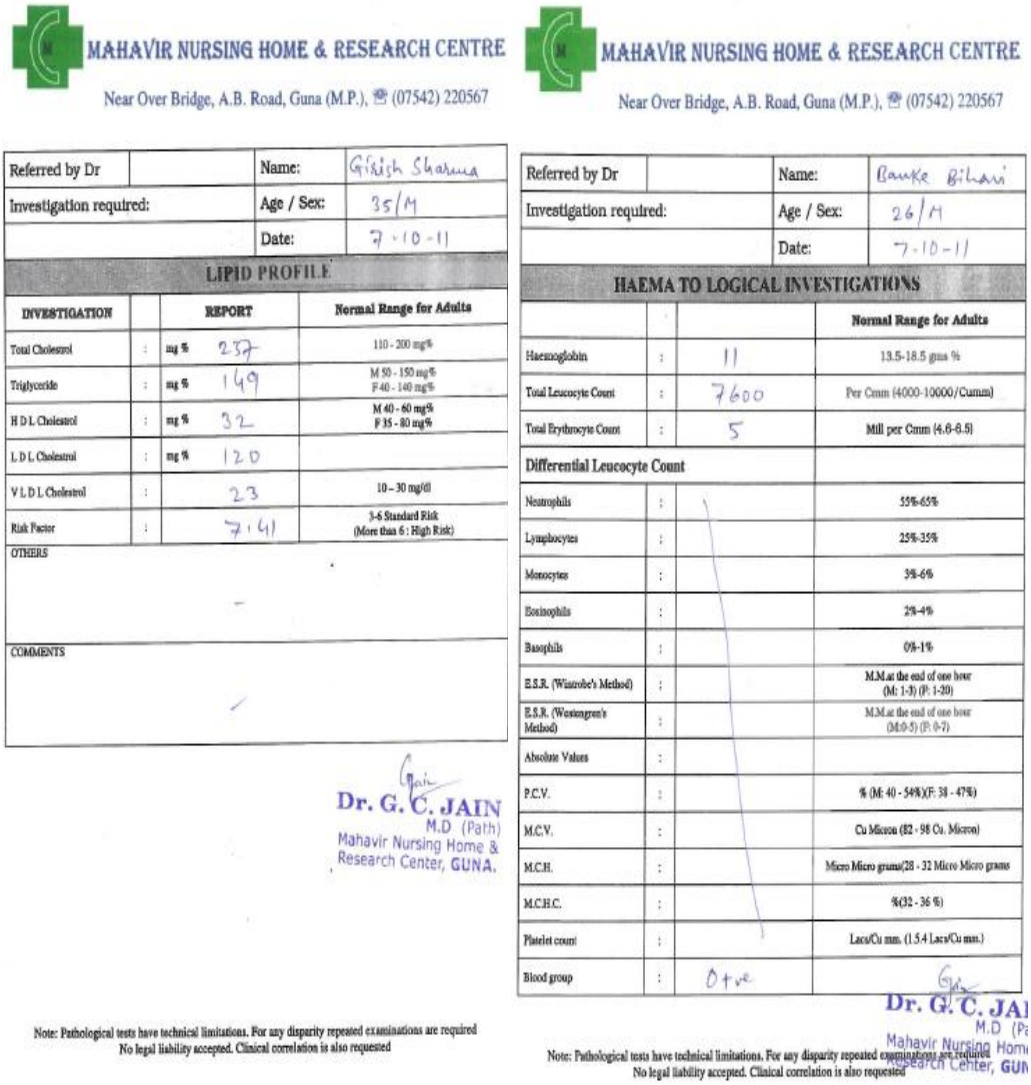
Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	100	mg/dl	70-110 mg/dl
R.B.S.	:	-	mg/dl	70-130 mg/dl
P.P.B.S.	:	138	mg/dl	upto 140 mg/dl
Blood Urea	:	-	mg/dl	10-50 mg/dl
S. Creatinine	:	0.6	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.2		3.5 - 7.2 mg %
Female	:	-		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.2	gms %	6.0 - 8.3 gms %
Albumin	:	4.3	gms %	3.7 - 5.3 gms %
Globulin	:	1.9	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	-	IU/L	5 - 34 IU/L
S.G.P.T.	:	-	IU/L	0 - 35 IU/L
Serum Calcium	:	-	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required.
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	257	110 - 200 mg%
Triglyceride	:	mg %	149	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholesterol	:	mg %	32	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholesterol	:	mg %	120	
V L D L Cholesterol	:		23	10 – 30 mg/dl
Risk Factor	:		7.41	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	11	13.5-18.5 gms %
Total Leucocyte Count	:	7600	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	O+ve	

Dr. G. C. JAI
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Research Center, GUN

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	87	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	125	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Protein				
Total	:	7.9	gms %	6.0 - 8.3 gms %
Albumin	:	5	gms %	3.7 - 5.3 gms %
Globulin	:	2.9	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	199.1	110 - 200 mg%
Triglyceride	:	mg %	123.2	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	47.9	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	126.5	
V L D L Cholestrol	:		24.64	10 – 30 mg/dl
Risk Factor	:		4.16	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar "T
Investigation required:		Age / Sex:	25/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	10	13.5-18.5 gms %
Total Leucocyte Count	:	6750	Per Cumm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.9	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	O+Ve	

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar "T
Investigation required:		Age / Sex:	25/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	93	mg/dl	70-110 mg/dl
R.B.S.	:	-	mg/dl	70-130 mg/dl
P.P.B.S.	:	132	mg/dl	upto 140 mg/dl
Blood Urea	:	-	mg/dl	10-50 mg/dl
S. Creatinine	:	1.2	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.9		3.5 - 7.2 mg %
Female	:	-		2.6 - 6.0 mg %
Serum Proteins				
Total	:	9.5	gms %	6.0 - 8.3 gms %
Albumin	:	5.5	gms %	3.7 - 5.3 gms %
Globulin	:	4	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	-	IU/L	5 - 34 IU/L
S.G.P.T.	:	-	IU/L	0 - 35 IU/L
Serum Calcium	:	-	mg %	8.4 - 10.4 mg %

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar Tiv
Investigation required:		Age / Sex:	25/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	204	110 - 200 mg%
Triglyceride	:	mg %	170	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	45	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	120	
V L D L Cholestrol	:		30	10 - 30 mg/dl
Risk Factor	:		4.53	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Virendra Kumar Tyo
Investigation required:		Age / Sex:	39/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	15	13.5-18.5 gms %
Total Leucocyte Count	:	8570	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	6.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	B +ve	

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Virendra Kumar Ty
Investigation required:		Age / Sex:	39/M
		Date:	7-10-11

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	110	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	157	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.7	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	6		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	7.9	gms %	6.0 - 8.3 gms %
Albumin	:	4	gms %	3.7 - 5.3 gms %
Globulin	:	3.9	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Virendra Kumar Ty
Investigation required:		Age / Sex:	39/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	300.52	110 - 200 mg%
Triglyceride	:	mg %	192	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholesterol	:	mg %	50.67	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholesterol	:	mg %	140	
V L D L Cholesterol	:		16	10 – 30 mg/dl
Risk Factor	:		5.93	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

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COMMENTS

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	13.4	13.5-18.5 gms %
Total Leucocyte Count	:	4500	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.3	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	B +ve	

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	7-10-11

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	79	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	110	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatininie	:	0.9	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.7		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	5.9	gms %	6.0 - 8.3 gms %
Albumin	:	3.9	gms %	3.7 - 5.3 gms %
Globulin	:	2	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	250	110 - 200 mg%
Triglyceride	:	mg %	157	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	43.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	190	
V L D L Cholestrol	:		31	10 - 30 mg\dl
Risk Factor	:		5.29	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

-

COMMENTS

-

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12	13.5-18.5 gms %
Total Leucocyte Count	:	9800	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	6	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	O+ve	

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	07-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	97.5	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	134.5	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1	mg/dl	0.6 - 1.3 mg/dl
Serum Uric Acid				
Male	:	5.6		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	9	gms %	6.0 - 8.3 gms %
Albumin	:	6	gms %	3.7 - 5.3 gms %
Globulin	:	3	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	234.45	110 - 200 mg%
Triglyceride	:	mg %	150.3	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	34	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	130.7	
V L D L Cholestrol	:		24	10 – 30 mg/dl
Risk Factor	:		6.90	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dhoki
Investigation required:		Age / Sex:	28/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12.6	13.5-18.5 gms %
Total Leucocyte Count	:	8950	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.6	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	AB +ve	

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dho
Investigation required:		Age / Sex:	28/M
		Date:	7-10-11

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	88.4	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	127.5	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1.1	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.8		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.6	gms %	6.0 - 8.3 gms %
Albumin	:	5.1	gms %	3.7 - 5.3 gms %
Globulin	:	1.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dhak
Investigation required:		Age / Sex:	28/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	190	110 - 200 mg%
Triglyceride	:	mg %	110.4	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	45	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	76.3	
V L D L Cholestrol	:		23	10 – 30 mg/dl
Risk Factor	:		4.22	3-6 Standard Risk (More than 6 : High Risk)
OTHERS				
COMMENTS				

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ashish Chaitram
Investigation required:		Age / Sex:	24/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	11.5	13.5-18.5 gms %
Total Leucocyte Count	:	9200	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	O -ve	

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ashish chaitram
Investigation required:		Age / Sex:	42/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	99	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	125	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.65	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	7.3		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.5	gms %	6.0 - 8.3 gms %
Albumin	:	3	gms %	3.7 - 5.3 gms %
Globulin	:	3.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ashish chaitram
Investigation required:		Age / Sex:	42/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	200.5	110 - 200 mg%
Triglyceride	:	mg %	98.5	M 50 - 150 mg % F 40 - 140 mg%
H D L Cholestrol	:	mg %	36	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	85.6	
V L D L Cholestrol	:		32	10 - 30 mg/dl
Risk Factor	:		5.57	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA

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No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12.6	13.5-18.5 gms %
Total Leucocyte Count	:	7830	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4.4	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	O+ve	

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Centre, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	76	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	118	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.7	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.6		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	5.5	gms %	6.0 - 8.3 gms %
Albumin	:	2.9	gms %	3.7 - 5.3 gms %
Globulin	:	2.6	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Centre, GUNA.

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No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39 / M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	187.47	110 - 200 mg%
Triglyceride	:	mg %	79.13	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	40.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	94.3	
V L D L Cholestrol	:		25	10 – 30 mg/dl
Risk Factor	:		4.66	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN M.D (Path) Mahavir Nursing Home & Research Center, GUNA.

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No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

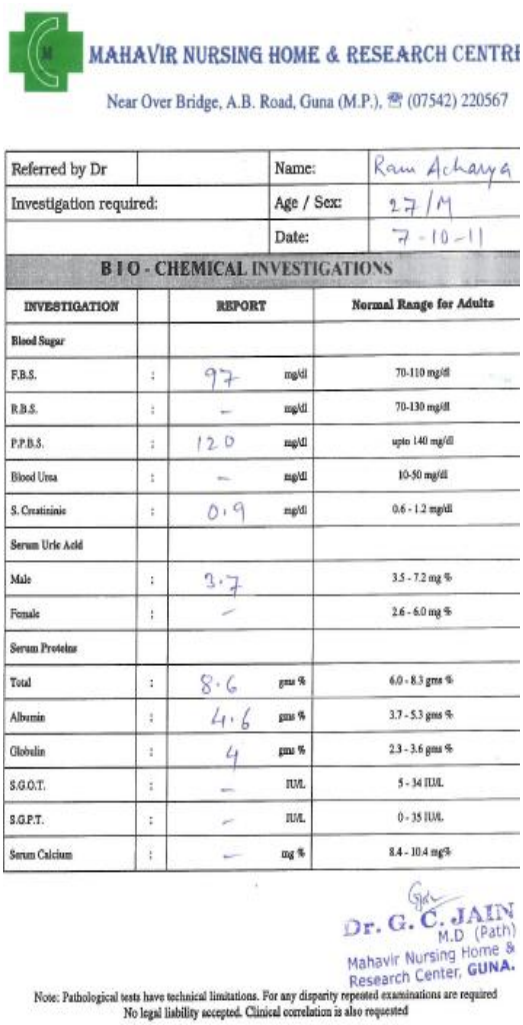
Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27 / M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	11	13.5-18.5 gms %
Total Leucocyte Count	:	10050	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4.9	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	A -ve	

Dr. G. C. JAIN M.D (Path) Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27 / M
		Date:	7-10-11

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	97	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	120	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.9	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.7		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	8.6	gms %	6.0 - 8.3 gms %
Albumin	:	4.6	gms %	3.7 - 5.3 gms %
Globulin	:	4	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
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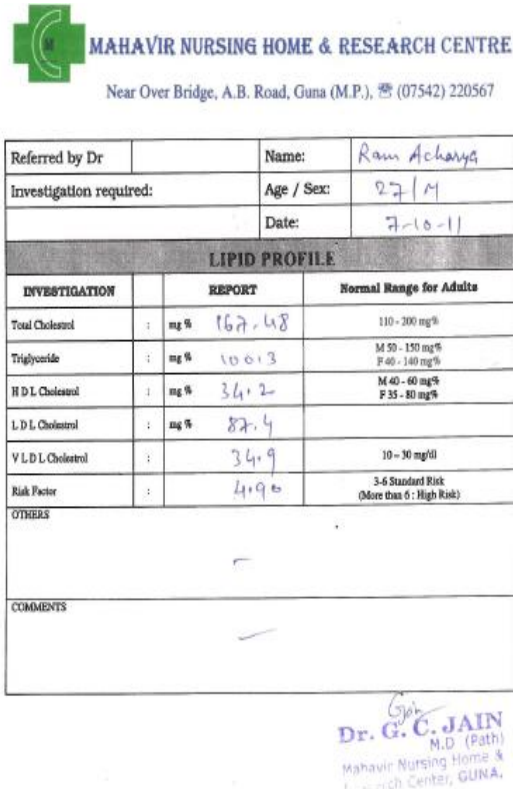

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27 / M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	167.48	110 - 200 mg%
Triglyceride	:	mg %	100.3	M 50 - 150 mg% F 60 - 140 mg%
H D L Cholesterol	:	mg %	34.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholesterol	:	mg %	87.4	
V L D L Cholesterol	:		34.9	10 – 30 mg/dl
Risk Factor	:		4.9	3-6 Standard Risk (More than 6 : High Risk)

OTHERS –

COMMENTS –

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M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	10.6	13.5-18.5 gms %
Total Leucocyte Count	:	6900	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.9	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:	B+ve	

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Centre GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examination are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	7-10-11

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	98	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	138	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.6	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.2		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Protein				
Total	:	7	gms %	6.0 - 8.3 gms %
Albumin	:	3.7	gms %	3.7 - 5.3 gms %
Globulin	:	3.3	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Centre GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION		REPORT	Normal Range for Adults
Total Cholestrol	:	mg % 298.3	110 - 200 mg%
Triglyceride	:	mg % 174.67	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg % 45.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg % 120.4	
V L D L Cholestrol	:	26.3	10 – 30 mg/dl
Risk Factor	:	6.60	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

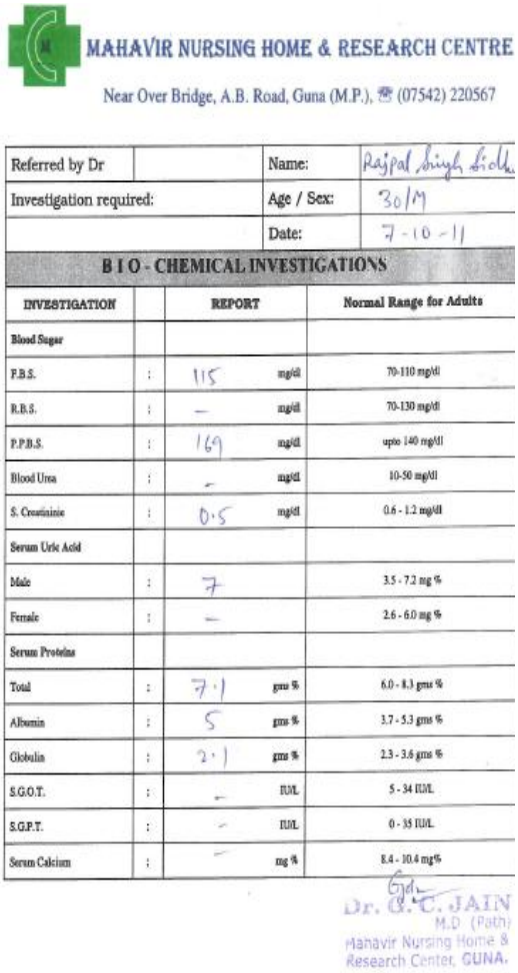
Referred by Dr		Name:	Rajpal Singh Sidh
Investigation required:		Age / Sex:	30/M
		Date:	7-10-11

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	13	13.5-18.5 gms %
Total Leucocyte Count	:	9700	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	6.3	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Microns (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:	B+ve	

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also required



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

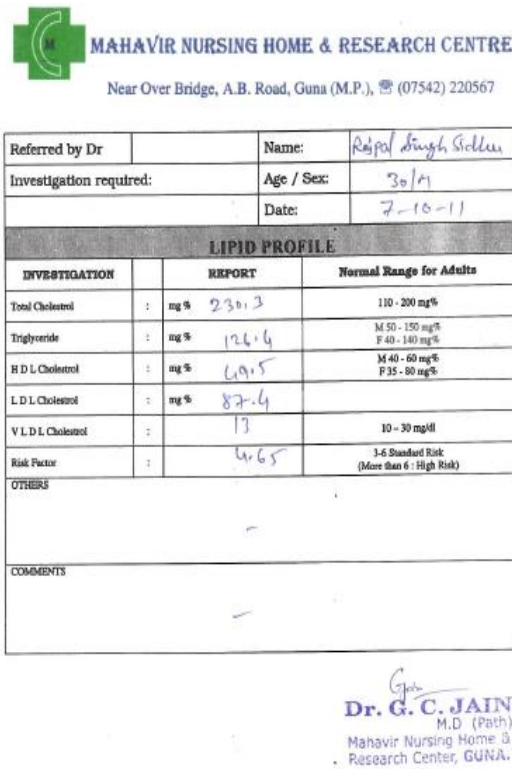
Referred by Dr		Name:	Rajpal Singh Sidhu
Investigation required:		Age / Sex:	30/M
		Date:	7-10-11

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	115	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	169	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.5	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	7		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	7.1	gms %	6.0 - 8.3 gms %
Albumin	:	5	gms %	3.7 - 5.3 gms %
Globulin	:	2.1	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Rajpal Singh Sidhu
Investigation required:		Age / Sex:	30/M
		Date:	7-10-11

LIPID PROFILE

INVESTIGATION			REPORT	Normal Range for Adults
Total Cholestrol	:	mg %	230.3	110 - 200 mg%
Triglyceride	:	mg %	126.4	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	69.5	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	87.4	
V L D L Cholestrol	:		13	10 – 30 mg/dl
Risk Factor	:		4.65	3-6 Standard Risk (More than 6 : High Risk)

OTHERS –

COMMENTS –

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Kala Dharan
Investigation required:		Age / Sex:	29/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	15.2	13.5-16.5 gms %
Total Leucocyte Count	:	7830	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.3	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Kala Dharan
Investigation required:		Age / Sex:	29/M
		Date:	20/4/12

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	80.3	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	112	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.6	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.1		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.4	gms %	6.0 - 8.3 gms %
Albumin	:	3.6	gms %	3.7 - 5.3 gms %
Globulin	:	2.8	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

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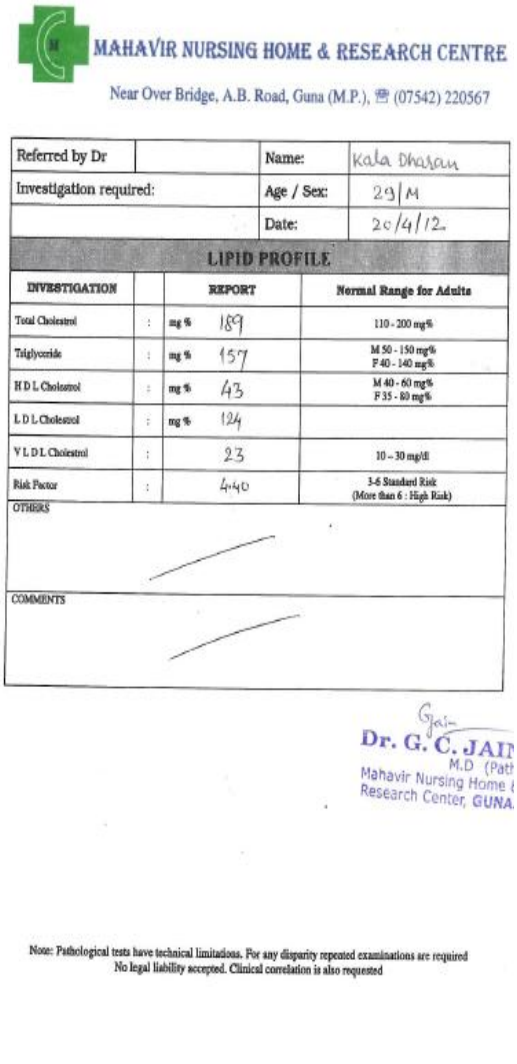

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Kala Dharan
Investigation required:		Age / Sex:	29/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT	Normal Range for Adults
Total Cholestrol	:	mg % 189	110 - 200 mg%
Triglyceride	:	mg % 157	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg % 43	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg % 124	
V L D L Cholestrol	:	23	10 – 30 mg/dl
Risk Factor	:	4.40	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Patt
Mahavir Nursing Home &
Research Center, GUNA

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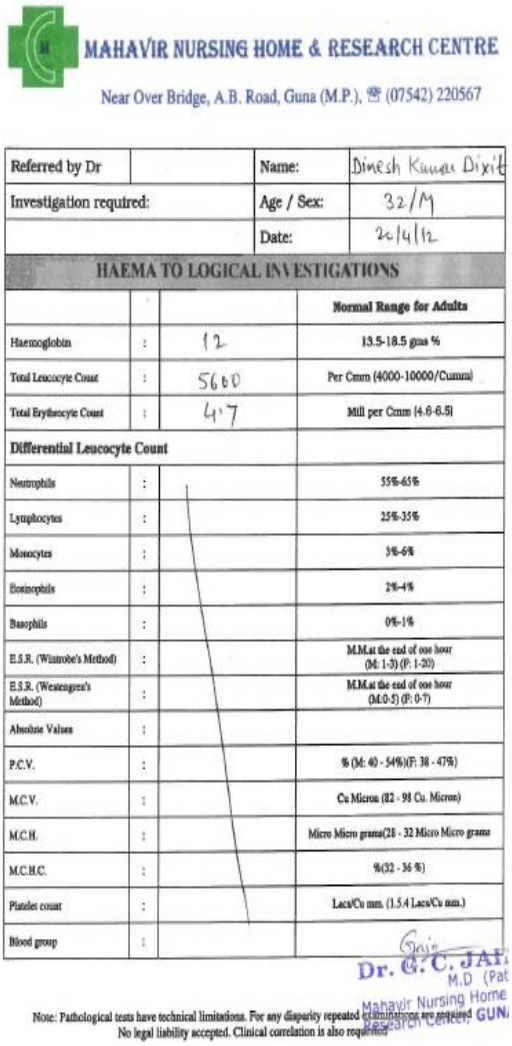

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Dinesh Kumar Dixit
Investigation required:		Age / Sex:	32/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12	13.5-18.5 gms %
Total Leucocyte Count	:	5600	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4.7	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAI
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Mahavir Nursing Home
Research Center, GUN

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Dinesh Kumar Dixit
Investigation required:		Age / Sex:	32/M
		Date:	20/4/12

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	92.3	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	125	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1.02	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.52		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	7.7	gms %	6.0 - 8.3 gms %
Albumin	:	4.2	gms %	3.7 - 5.3 gms %
Globulin	:	3.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Dinesh Kumar Dixit
Investigation required:		Age / Sex:	32/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	256.4	110 - 200 mg%
Triglyceride	:	mg %	125.4	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholesterol	:	mg %	65	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholesterol	:	mg %	78	
V L D L Cholesterol	:		27.6	10 - 30 mg/dl
Risk Factor	:		3.94	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	14.3	13.5-18.5 gms %
Total Leucocyte Count	:	4570	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

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No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	103.2	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	148.3	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.7	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.1		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	7.4	gms %	6.0 - 8.3 gms %
Albumin	:	5.1	gms %	3.7 - 5.3 gms %
Globulin	:	2.3	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

Dr. G. C. JAIN
M.D (Path)
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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Girish Sharma
Investigation required:		Age / Sex:	35/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT	Normal Range for Adults
Total Cholestrol	:	mg % 142	110 - 200 mg%
Triglyceride	:	mg % 150·2	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg % 35	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg % 112·3	
V L D L Cholestrol	:	20·3	10 – 30 mg/dl
Risk Factor	:	4.06	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path
Mahavir Nursing Home &
Research Center, GUNA

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12·8	13.5-18.5 gms %
Total Leucocyte Count	:	8037	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4·9	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengreen's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAIN
M.D (Pat
Mahavir Nursing Home
Research Center, GUN

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
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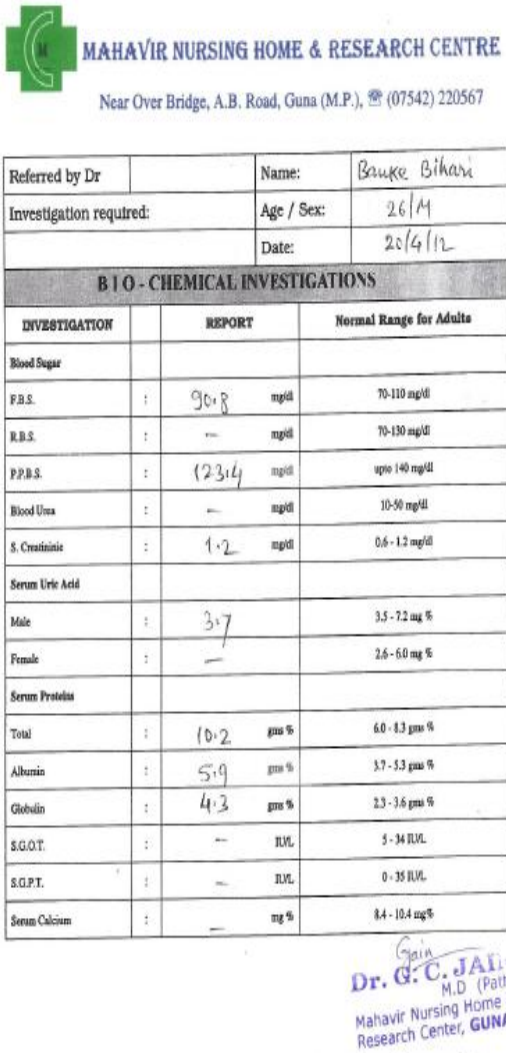

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	90.8	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	123.4	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	1.2	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.7		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	10.2	gms %	6.0 - 8.3 gms %
Albumin	:	5.9	gms %	3.7 - 5.3 gms %
Globulin	:	4.3	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

Dr. G. C. JAI
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Research Center, GUNA

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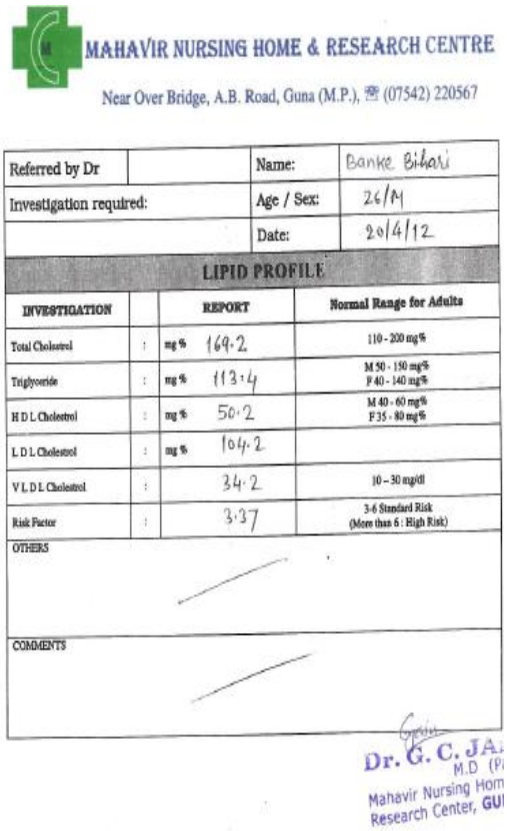

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Banke Bihari
Investigation required:		Age / Sex:	26/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	169.2	110 - 200 mg %
Triglyceride	:	mg %	113.4	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	50.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	104.2	
V L D L Cholestrol	:		34.2	10 – 30 mg/dl
Risk Factor	:		3.37	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JA
M.D (P
Mahavir Nursing Hom
Research Center, GU

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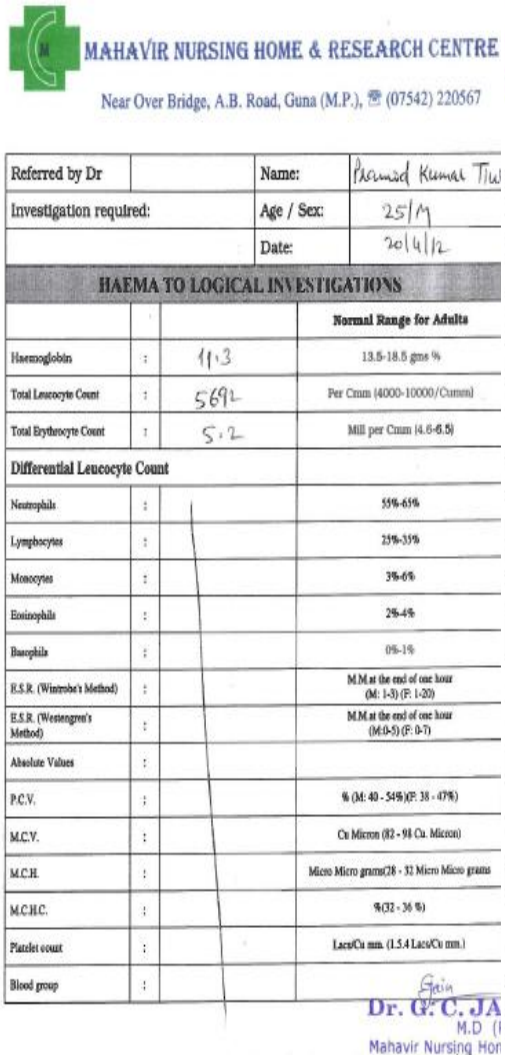

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar Tiw
Investigation required:		Age / Sex:	25/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	11.3	13.5-18.5 gms %
Total Leucocyte Count	:	5692	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JA
M.D (
Mahavir Nursing Hor
Research Center, GU

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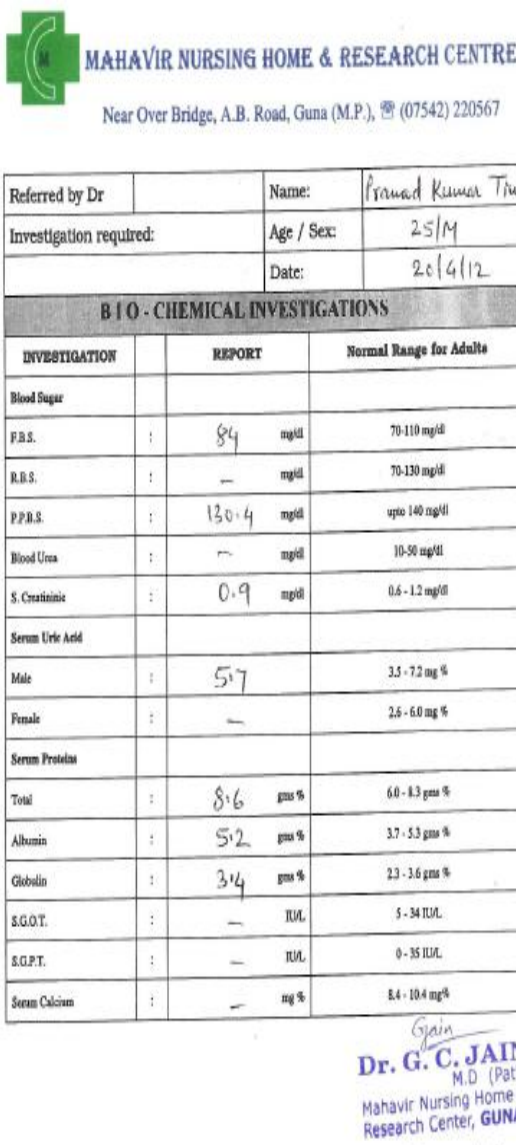

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar Tiw
Investigation required:		Age / Sex:	25/M
		Date:	20/4/12

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	84	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	130.4	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatininie	:	0.9	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	5.7		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Protein				
Total	:	8.6	gms %	6.0 - 8.3 gms %
Albumin	:	5.2	gms %	3.7 - 5.3 gms %
Globulin	:	3.4	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAI
M.D (Pat
Mahavir Nursing Home
Research Center, GUNA

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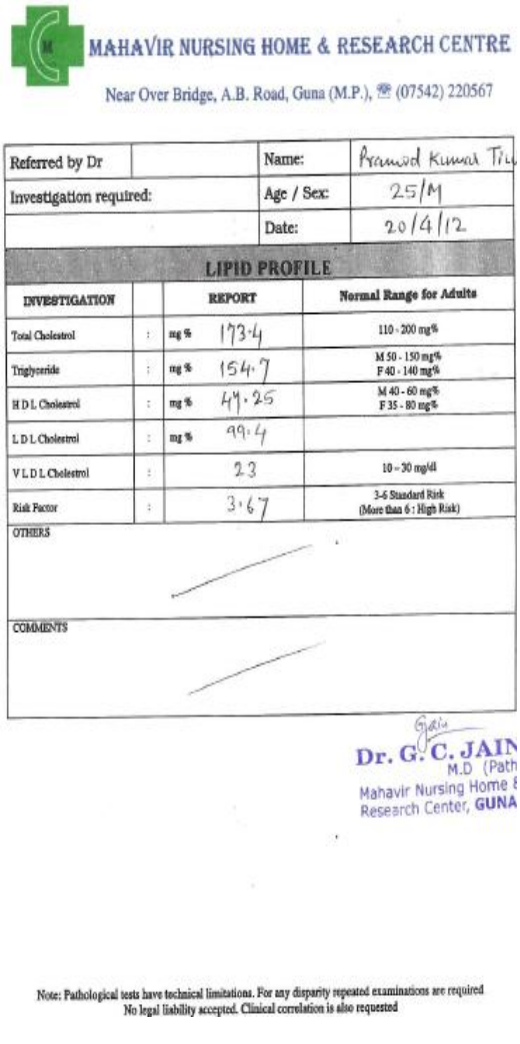

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Pramod Kumar Tiw
Investigation required:		Age / Sex:	25/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	173.4	110 - 200 mg%
Triglyceride	:	mg %	154.7	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	49.25	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	99.4	
V L D L Cholestrol	:		23	10 - 30 mg/dl
Risk Factor	:		3.67	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

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M.D (Path
Mahavir Nursing Home &
Research Center, GUNA

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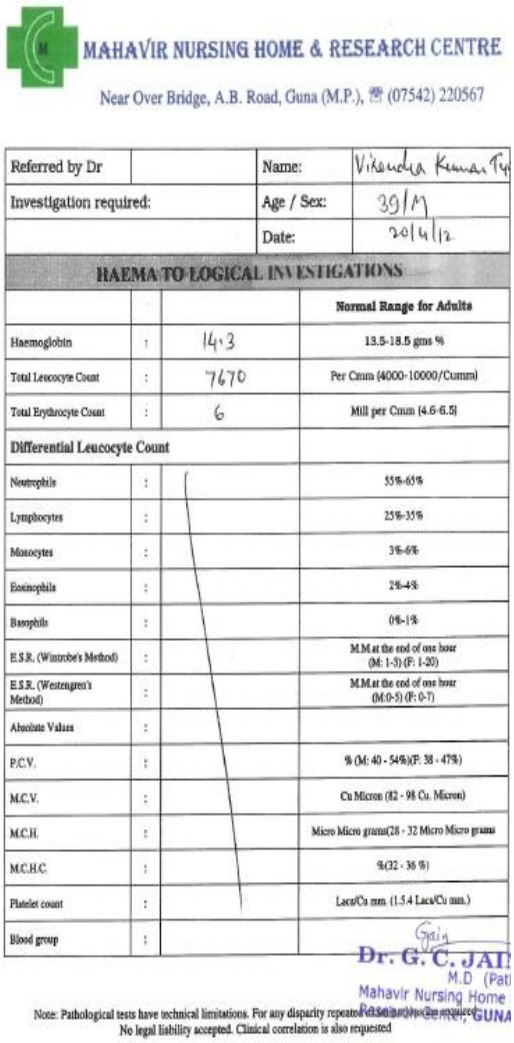
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

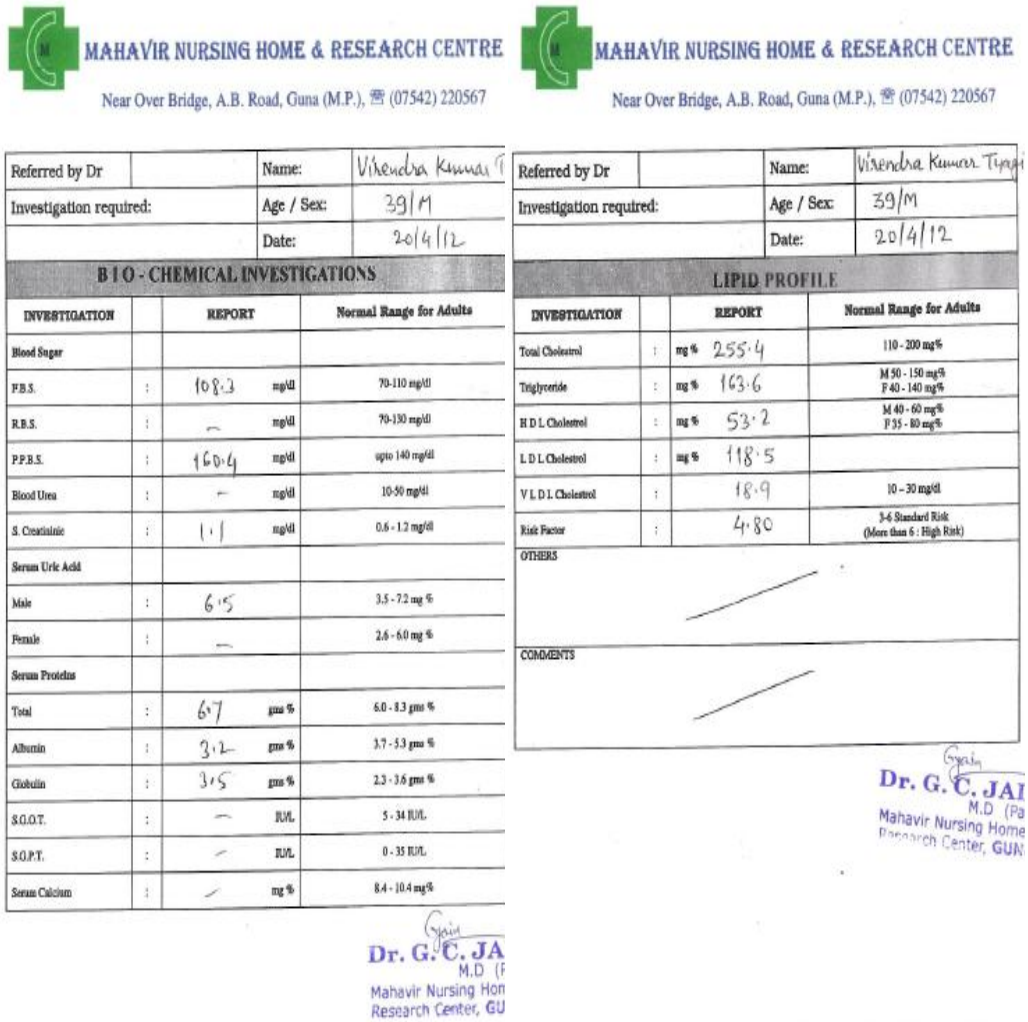
Referred by Dr		Name:	Virendra Kumar Ty
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

HAEMATOLOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	14.3	13.5-18.5 gms %
Total Leucocyte Count	:	7670	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	6	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(26 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5 4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAI
M.D (Pat
Mahavir Nursing Home
Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Virendra Kumar T
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	108.3	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	160.4	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	1.1	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	6.5		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.7	gms %	6.0 - 8.3 gms %
Albumin	:	3.2	gms %	3.7 - 5.3 gms %
Globulin	:	3.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

Dr. G. C. JA
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Research Center, GU

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Virendra Kumar Tiyagi
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

LIPID PROFILE

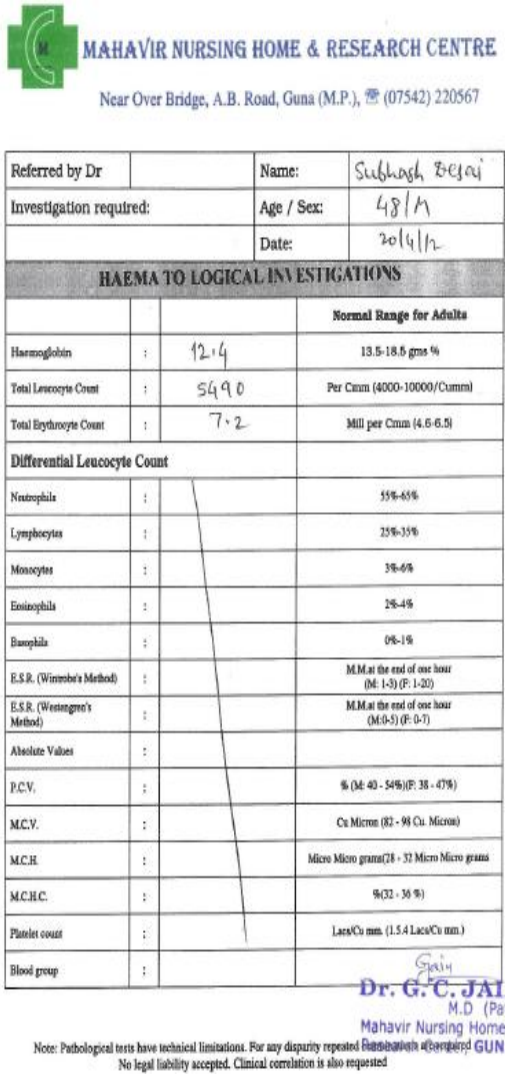
INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	255.4	110 - 200 mg%
Triglyceride	:	mg %	163.6	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	53.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	118.5	
V L D L Cholestrol	:		18.9	10 - 30 mg/dl
Risk Factor	:		4.80	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAI
M.D (Pa
Mahavir Nursing Home
Research Center, GUN

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

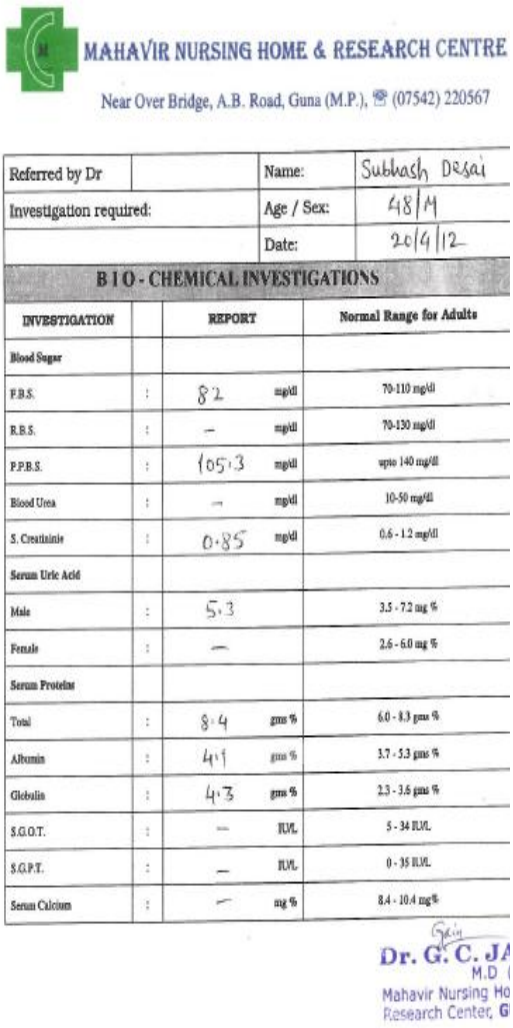
Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12.4	13.5-18.5 gms %
Total Leucocyte Count	:	5490	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	7.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAI
M.D (Pa
Mahavir Nursing Home

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required GUN
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

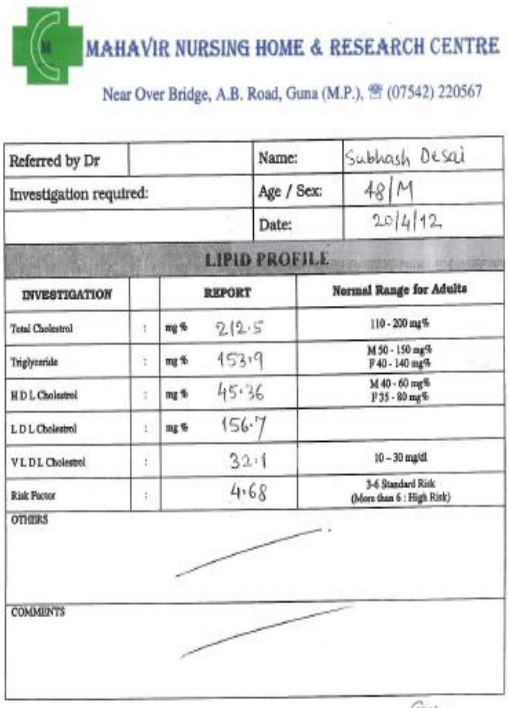
Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	82	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	105.3	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.85	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	5.3		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Protein				
Total	:	8.4	gms %	6.0 - 8.3 gms %
Albumin	:	4.1	gms %	3.7 - 5.3 gms %
Globulin	:	4.3	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JA
M.D
Mahavir Nursing Ho
Research Center, G

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Subhash Desai
Investigation required:		Age / Sex:	48/M
		Date:	20/4/12

LIPID PROFILE

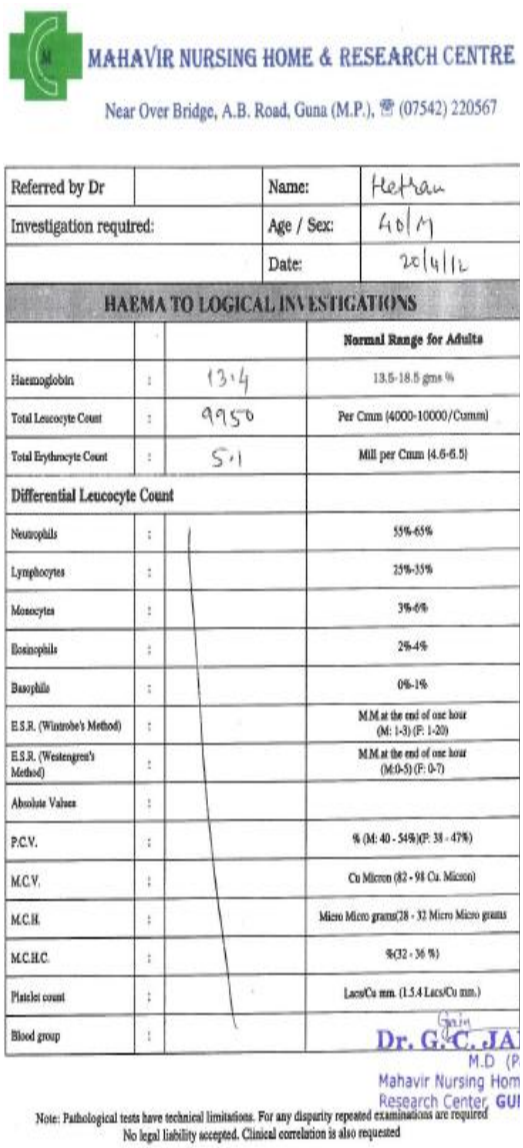
INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	212.5	110 - 200 mg%
Triglyceride	:	mg %	153.9	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	45.36	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	156.7	
V L D L Cholestrol	:		32.1	10 - 30 mg/dl
Risk Factor	:		4.68	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path
Mahavir Nursing Home &
Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	13.4	13.5-18.5 gms %
Total Leucocyte Count	:	9950	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.1	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JA
M.D (P
Mahavir Nursing Hom
Research Center, GU

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	95.3	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	129.4	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.5	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	6.9		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	9.1	gms %	6.0 - 8.3 gms %
Albumin	:	5.6	gms %	3.7 - 5.3 gms %
Globulin	:	3.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAI
M.D (P
Mahavir Nursing Hom
Research Center, GU

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Hetram
Investigation required:		Age / Sex:	40/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	199.2	110 - 200 mg%
Triglyceride	:	mg %	142	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	35.7	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	100.3	
V L D L Cholestrol	:		29.3	10 – 30 mg/dl
Risk Factor	:		5.58	3-6 Standard Risk (More than 6 : High Risk)
OTHERS				
COMMENTS				

Dr. G. C. JAI
M.D (Pa
Mahavir Nursing Home
Research Center, GUN

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dhe
Investigation required:		Age / Sex:	28/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12.5	13.5-18.5 gms %
Total Leucocyte Count	:	8650	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JA
M.D (Pa
Mahavir Nursing Home
Research Center, GUN

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dhe
Investigation required:		Age / Sex:	28/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	88.4	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	125.2	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.78	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	5.2		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	7.3	gms %	6.0 - 8.3 gms %
Albumin	:	4.9	gms %	3.7 - 5.3 gms %
Globulin	:	2.4	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

Dr. G. C. JA
M.D (
Mahavir Nursing Ho
Research Center, G

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Vinod Kumar Dhoki
Investigation required:		Age / Sex:	28/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	161.2	110 - 200 mg%
Triglyceride	:	mg %	103.2	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	44.2	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	80.6	
V L D L Cholestrol	:		11.3	10 – 30 mg/dl
Risk Factor	:		3.65	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

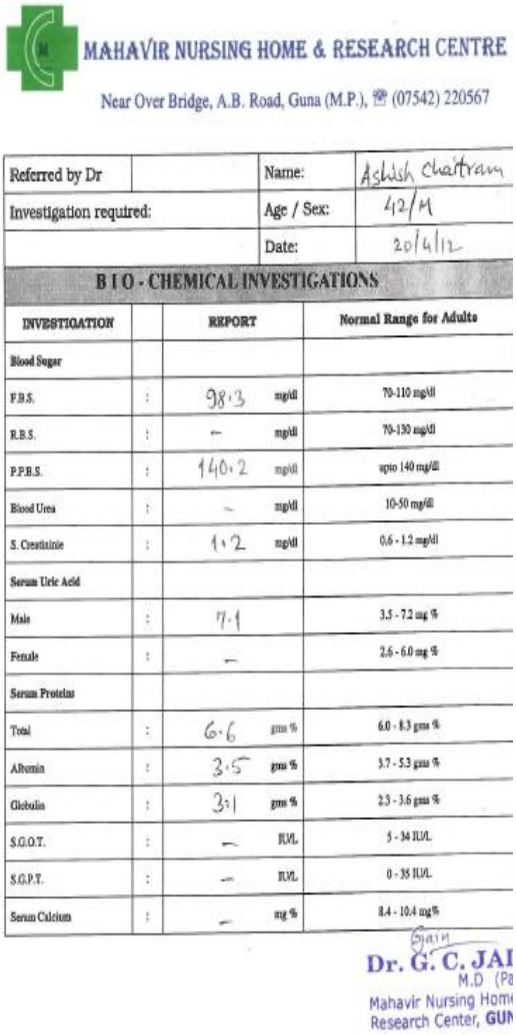
Referred by Dr		Name:	Ashish Chaitram
Investigation required:		Age / Sex:	42/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	14.3	13.5-18.5 gms %
Total Leucocyte Count	:	8930	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.7	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAI
M.D (Pat
Mahavir Nursing Home
Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

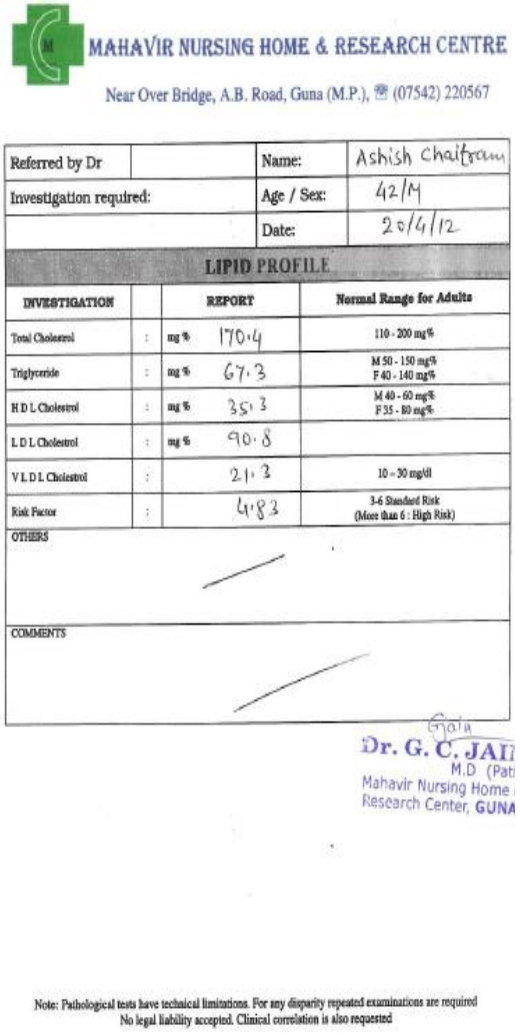
Referred by Dr		Name:	Ashish Chaitram
Investigation required:		Age / Sex:	42/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	98.3	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	140.2	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	1.2	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	7.1		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.6	gms %	6.0 - 8.3 gms %
Albumin	:	3.5	gms %	3.7 - 5.3 gms %
Globulin	:	3.1	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

Dr. G. C. JAI
M.D (Pa
Mahavir Nursing Hom
Research Center, GU

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ashish Chaitram
Investigation required:		Age / Sex:	42/M
		Date:	20/4/12

LIPID PROFILE

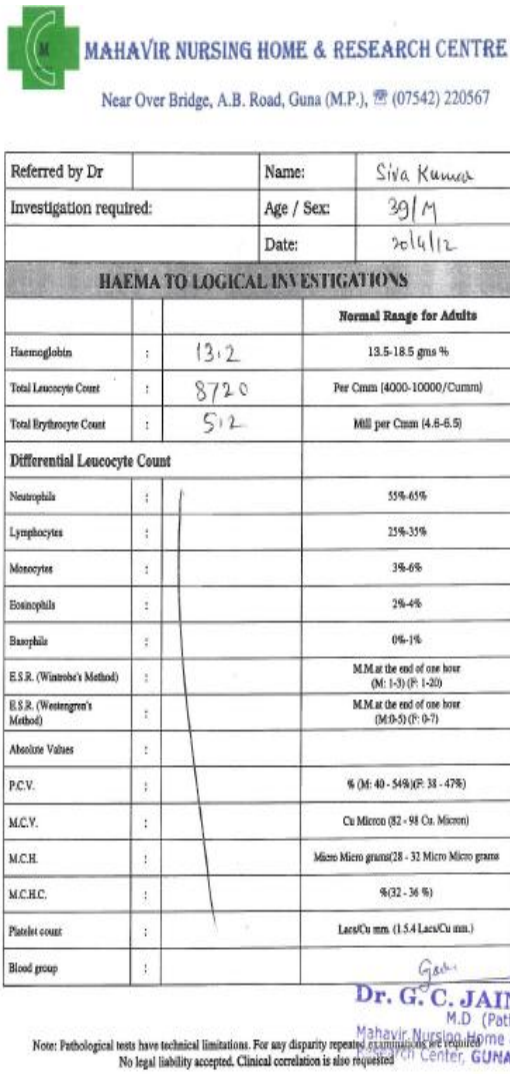
INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	170.4	110 - 200 mg %
Triglyceride	:	mg %	67.3	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	35.3	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	90.8	
V L D L Cholestrol	:		21.3	10 - 30 mg/dl
Risk Factor	:		4.83	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAI
M.D (Pat
Mahavir Nursing Home
Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	13.2	13.5-18.5 gms %
Total Leucocyte Count	:	8720	Per Cmm [4000-10000/Cumm)
Total Erythrocyte Count	:	5.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAI
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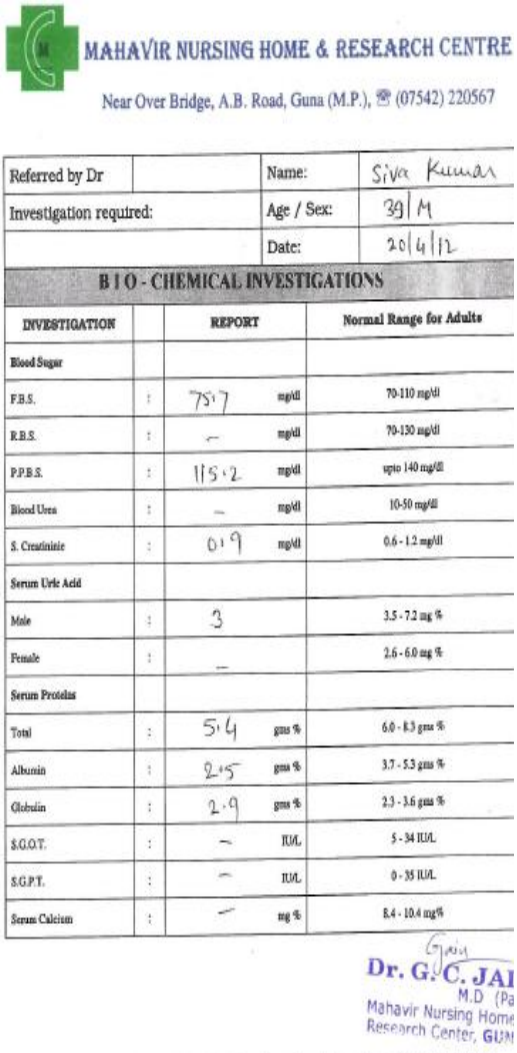
Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested



MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	75.7	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	115.2	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.9	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	5.4	gms %	6.0 - 8.3 gms %
Albumin	:	2.5	gms %	3.7 - 5.3 gms %
Globulin	:	2.9	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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Research Center, GUN

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Siva Kumar
Investigation required:		Age / Sex:	39/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	159	110 - 200 mg%
Triglyceride	:	mg %	110.2	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg %	36.3	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	68.4	
V L D L Cholestrol	:		19.4	10 - 30 mg/dl
Risk Factor	:		4.38	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path
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Research Center, GUNA.

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	12.2	13.5-18.5 gms %
Total Leucocyte Count	:	9020	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	7	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westeragren's Method)	:		M.M at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5-4 Lacs/Cu mm.)
Blood group	:		

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Research Center, GUN

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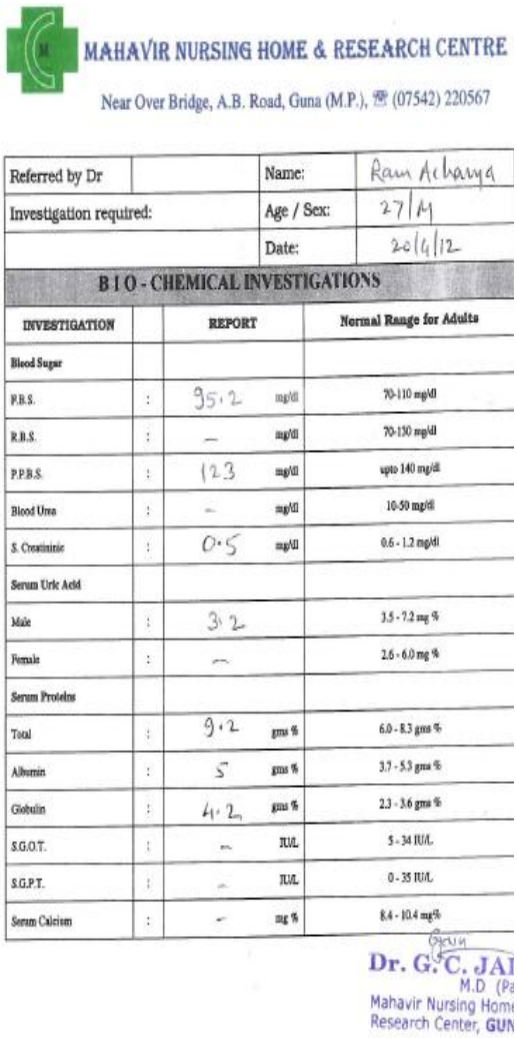

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27/M
		Date:	20/4/12

B I O - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	95.2	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-150 mg/dl
P.P.B.S.	:	123	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.5	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	3.2		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	9.2	gms %	6.0 - 8.3 gms %
Albumin	:	5	gms %	3.7 - 5.3 gms %
Globulin	:	4.2	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

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Research Center, GUN

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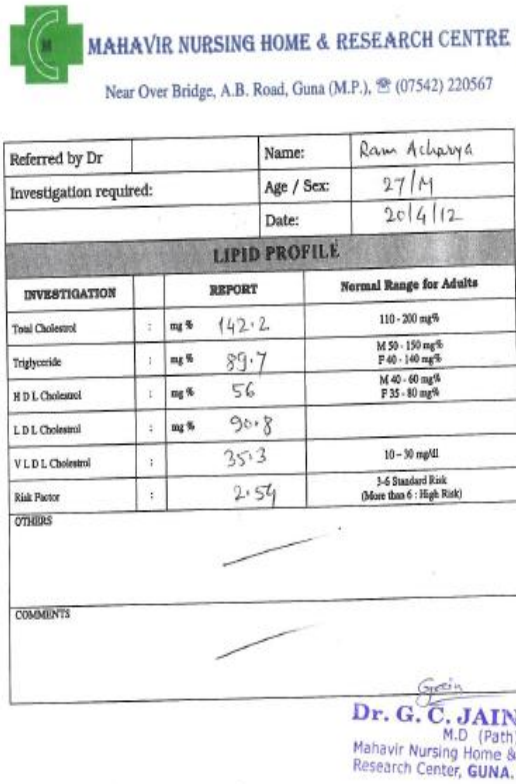

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Ram Acharya
Investigation required:		Age / Sex:	27/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholestrol	:	mg %	142.2	110 - 200 mg%
Triglyceride	:	mg %	89.7	M 50 - 150 mg% F 60 - 140 mg%
H D L Cholestrol	:	mg %	56	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg %	90.8	
V L D L Cholestrol	:		35.3	10 – 30 mg/dl
Risk Factor	:		2.54	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home &
Research Center, GUNA.

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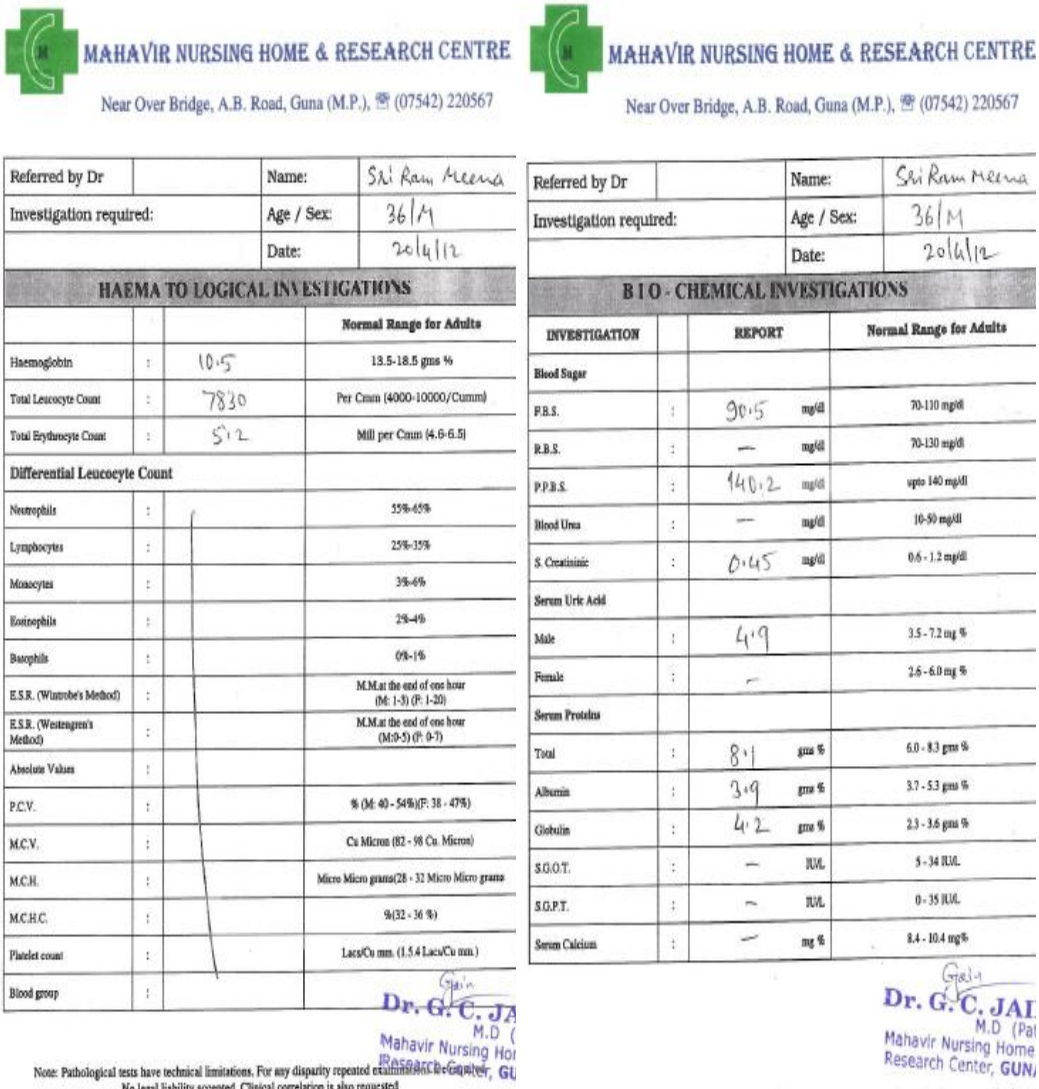

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	10.5	13.5-18.5 gms %
Total Leucocyte Count	:	7830	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	5.2	Mill per Cmm (4.6-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M.at the end of one hour (M: 1-5) (F: 1-20)
E.S.R. (Westengren's Method)	:		M.M.at the end of one hour (M:0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5 4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JA
M.D (
Mahavir Nursing Ho
Research Center, GU

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	90.5	mg/dl	70-110 mg/dl
R.B.S.	:	—	mg/dl	70-130 mg/dl
P.P.B.S.	:	140.2	mg/dl	upto 140 mg/dl
Blood Urea	:	—	mg/dl	10-50 mg/dl
S. Creatinine	:	0.45	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	4.9		3.5 - 7.2 mg %
Female	:	—		2.6 - 6.0 mg %
Serum Proteins				
Total	:	8.1	gms %	6.0 - 8.3 gms %
Albumin	:	3.9	gms %	3.7 - 5.3 gms %
Globulin	:	4.2	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	—	IU/L	5 - 34 IU/L
S.G.P.T.	:	—	IU/L	0 - 35 IU/L
Serum Calcium	:	—	mg %	8.4 - 10.4 mg%

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Research Center, GUNA

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Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Sri Ram Meena
Investigation required:		Age / Sex:	36/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT	Normal Range for Adults
Total Cholestrol	:	mg % 150·2	110 - 200 mg%
Triglyceride	:	mg % 138·2	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholestrol	:	mg % 42·5	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholestrol	:	mg % 134·2	
V L D L Cholestrol	:	33·8	10 – 30 mg/dl
Risk Factor	:	3·53	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path)
Mahavir Nursing Home & Research Center, GUNA.

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Rajpal Singh Sidhu
Investigation required:		Age / Sex:	36/M
		Date:	20/4/12

HAEMA TO LOGICAL INVESTIGATIONS

			Normal Range for Adults
Haemoglobin	:	14·5	13.5-18.5 gms %
Total Leucocyte Count	:	8910	Per Cmm (4000-10000/Cumm)
Total Erythrocyte Count	:	4·7	Mill per Cmm (4.0-6.5)
Differential Leucocyte Count			
Neutrophils	:		55%-65%
Lymphocytes	:		25%-35%
Monocytes	:		3%-6%
Eosinophils	:		2%-4%
Basophils	:		0%-1%
E.S.R. (Wintrobe's Method)	:		M.M at the end of one hour (M: 1-3) (F: 1-20)
E.S.R. (Westergren's Method)	:		M.M at the end of one hour (M.0-5) (F: 0-7)
Absolute Values	:		
P.C.V.	:		% (M: 40 - 54%)(F: 38 - 47%)
M.C.V.	:		Cu Micron (82 - 98 Cu. Micron)
M.C.H.	:		Micro Micro grams(28 - 32 Micro Micro grams
M.C.H.C.	:		%(32 - 36 %)
Platelet count	:		Lacs/Cu mm. (1.5.4 Lacs/Cu mm.)
Blood group	:		

Dr. G. C. JAIN
M.D (Path
Mahavir Nursing Home &

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required GUNA
No legal liability accepted. Clinical correlation is also requested

MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Rajpal Singh Sidhu
Investigation required:		Age / Sex:	30/M
		Date:	20/4/12

BIO - CHEMICAL INVESTIGATIONS

INVESTIGATION		REPORT		Normal Range for Adults
Blood Sugar				
F.B.S.	:	118.4	mg/dl	70-110 mg/dl
R.B.S.	:	–	mg/dl	70-130 mg/dl
P.P.B.S.	:	158.4	mg/dl	upto 140 mg/dl
Blood Urea	:	–	mg/dl	10-50 mg/dl
S. Creatinine	:	0.67	mg/dl	0.6 - 1.2 mg/dl
Serum Uric Acid				
Male	:	7.5		3.5 - 7.2 mg %
Female	:	–		2.6 - 6.0 mg %
Serum Proteins				
Total	:	6.8	gms %	6.0 - 8.3 gms %
Albumin	:	4.3	gms %	3.7 - 5.3 gms %
Globulin	:	2.5	gms %	2.3 - 3.6 gms %
S.G.O.T.	:	–	IU/L	5 - 34 IU/L
S.G.P.T.	:	–	IU/L	0 - 35 IU/L
Serum Calcium	:	–	mg %	8.4 - 10.4 mg%

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M.D (Pa
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Research Center, GUN

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MAHAVIR NURSING HOME & RESEARCH CENTRE

Near Over Bridge, A.B. Road, Guna (M.P.), ☎ (07542) 220567

Referred by Dr		Name:	Rajpal Singh Sidhu
Investigation required:		Age / Sex:	30/M
		Date:	20/4/12

LIPID PROFILE

INVESTIGATION		REPORT		Normal Range for Adults
Total Cholesterol	:	mg %	195.7	110 - 200 mg%
Triglyceride	:	mg %	129.1	M 50 - 150 mg% F 40 - 140 mg%
H D L Cholesterol	:	mg %	39.3	M 40 - 60 mg% F 35 - 80 mg%
L D L Cholesterol	:	mg %	109.2	
V L D L Cholesterol	:		14.2	10 - 30 mg/dl
Risk Factor	:		4.98	3-6 Standard Risk (More than 6 : High Risk)

OTHERS

COMMENTS

Dr. G. C. JAIN
M.D (Path
Mahavir Nursing Home &
Research Center, GUNA

Note: Pathological tests have technical limitations. For any disparity repeated examinations are required
No legal liability accepted. Clinical correlation is also requested

Research Papers published in International Journals

Study of Release of Hydrocarbon In The Atmosphere While LPG And Propane Tankers Loading

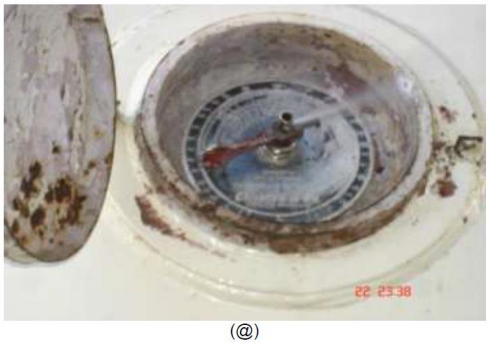
Dr Nehal Anwar Siddiqui, UPES Dehradoon; Dr Ashutosh Gautam, India Glycols Limited; Anant Tandale

Abstract:- Hydro carbon is released in the atmosphere through rotogauge (Ref photo @) while loading of LPG and Propane in the tankers contributes occupational health problems to the workers, greenhouse gas effect (Ref $) as well as revenue loss though it is insignificant in case of one tanker but it is significant if we consider loading and unloading of tanker at National level per day and Organizational level per year. In order to overcome the problem of releasing of hydrocarbon through rotogauge (for measuring liquid level inside the tanker) it is necessary to study this topic in detail along with the effect of these hydrocarbons on the workers working in that area. To know the effect of released hydrocarbon on the loading operators their medical checkups were done in three different seasons. The result of the study will tell the effects of these hydrocarbons on operators, extent of energy loss and revenue loss as well as the method to minimize the loss of hydrocarbon in atmosphere during loading and unloading of tankers thereby limiting the exposure of the operators to hydrocarbon vapours.

Index Terms:- Rotogauge, Occupational health, Hydrocarbon, Different seasons, Operators, Tankers

1 INTRODUCTION

Rotogauge is a device which is used to measure the volumetric quantity of liquid level inside the pressurized container. The release of hydrocarbon from the rotogauge cannot be contained and is allowed to disperse in the atmosphere. (Ref #). In India Loading and unloading operation of the Liquefied Petroleum Gas (LPG) and Propane tanker is done with manual intervention to know the liquid level content inside the tank of the tanker lorry. Loading and unloading operation of Liquefied Petroleum Gas (LPG) and Propane tanker is carried out with intermittent checking of liquid level inside the tank with the help of rotogauge (Ref #). Rotogauge is a devise fitted in the tanker which is useful in measuring the liquid level inside the tanker in terms of percentage. In the present scenario the rotogauge helps to determine the liquid level inside the tank and liquid level inside the tank is ensured. (Maximum allowable liquid level is 95% and Vapour space of 5% is left) (Ref *). Hydro carbon is released in the atmosphere through rotogauge (Ref photo @) while loading of LPG and Propane in the tankers contributes occupational health problems to the workers, greenhouse gas effect (Ref $) as well as revenue loss though it is insignificant in case of one tanker but it is significant if we consider loading and unloading of tanker at National level per day and Organizational level per year. In order to overcome the problem of releasing of hydrocarbon through rotogauge (for measuring liquid level inside the tanker) it is necessary to study this topic in detail along with the effect of these hydrocarbons on the workers working in that area. The photograph of releasing of LPG / Propane from rotogauge is given below –



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2 MATERIALS AND METHODS

Photograph of Road tanker which is used for loading, unloading and transportation of LPG & Propane is given below

HYDRO CARBON TANKER WITH ROTOGAUGE

INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 1, ISSUE 11, DECEMBER 2012 ISSN 2277-8616

ROTOGAUGE

The study is designed at every stage keeping in view of the following objective

2.1 To study the filling mechanism of LPG as well as Propane tankers - Detail study is carried out regarding loading and unloading operation of LPG and Propane in the tankers at various locations of GAIL (India) Limited as well as other petroleum installations. Standard operating procedures are collected.

2.2 To estimate the quantum of hydro carbon released in atmosphere through rotogauge while checking the liquid level of hydrocarbon inside the tankers – Discharge rate of hydrocarbon (i.e. LPG and Propane) through 2 mm diameter size hole of rotogauge is determined theoretically with the help of software available (Ref ©) as well as same is crosschecked practically by collecting the discharge through rotogauge in the sampling balloon. The exact quantity of hydro carbon released through rotogauge is established for one tanker with the help of differential weight of sampling balloon. Data for number of LPG and Propane tankers loaded (at GAIL Vijaipur) during last three years is collected for calculating the quantity of unburnt LPG and Propane released in atmosphere.

2.3 To study the occupational health effect of VOC's (volatile organic compounds) on the loading operators who are involved in loading operations of these tankers over a period of different seasons.

2.4 Use of mathematical modeling to study the of the release of hydro carbon over a years with respect to occupational health effect due to exposure to the operator as well as on the organization economy.

2.5 To suggest the recommendations for overcoming the problem of release of LPG and Propane in atmosphere/application of technology

3 RESEARCH METHODOLOGY

3.1 THEORETICAL FRAMEWORK –

At present in India there are about 10,400 tankers (LPG + Propane) having valid license to carry / transport compressed hydrocarbon from Petroleum and Safety Organisation (formerly Chief Controller of Explosive). These tankers are being filled and emptied out regularly at different locations in India. All these tankers are having the liquid level measuring device called ROTOGAUGE. While filling as well as emptying out these tankers, the standard practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage (Please see photographs of procedure displayed at loading gantry is enclosed). Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (approximately hydrocarbon is being released in the atmosphere for total 1 minute through rotogauge). During opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as vapours). While loading of these tankers, operator has to ensure that the liquid level of LPG / Propane inside the tanker should not exceed 95% (Ref *). For ensuring the same, operator fixed the rotogauge indicator at 95% mark, so that whenever liquid level reaches that mark, LPG / Propane in the liquid form starts coming out from the 2 mm diameter size orifice of rotogauge. Moreover while doing this measurement the operator is standing very near to the rotogauge device for operating it. The proposed study is undertaken to see the occupational health effects on the loading workers due to inhalation of hydrocarbon mixed air, estimate the impact on greenhouse gas emission and revenue loss due to release of hydrocarbon in the atmosphere.

3.1 Source of Data

Data for study will be collected from various sources like –

3.1.1 Data collection for standard operating procedure for loading of tankers is taken from ISO manual of GAIL (India) Limited Vijaipur.

3.1.2 Visual inspection with photographs in support of confirming the loading procedure is taken from loading gantry of GAIL (India) Limited Vijaipur.

3.1.3 Quantity of hydrocarbon tankers (i.e. LPG and Propane only) is derived from the official web site of Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

3.1.4 Material Safety Data sheets and contribution of unburnt hydrocarbon in greenhouse gas emission through various web sites.

3.1.5 Average price of industrial LPG and Propane is collected from GAIL's data bank.(through ERP-SAP)

3.1.6 Medical records of the sample loading operators having different years of experience and different age group.

4.0 Sampling

4.1 The data for the study is collected from existing standard operating procedures of loading activities.

4.2 Data pertaining to number of tankers state wise is taken from the official web site of the Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

4.3 Crosschecking of the amount of LPG and Propane release in the atmosphere through 2 mm diameter rotogauge hole is done with the help of collecting the content in the sampling balloon and its differential weighment.

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4.4 Survey is carried out for standard tanker loading practices in the other installation so as to determine the impact on health of workers as well as revenue loss at Organizational level on yearly basis.

4.5 Blood sample checking and clinical examination of the fixed workers of different age and different years of exposure.

5.0 Statistical Tool

The result of the study with respect to contribution of unburnt LPG and Propane (due to release from rotogauge) in occupational health effects on the workers, in greenhouse gas emission as well as revenue loss over a period of time will be presented.

6.0 Review of Literature

As far now with the best of information research in the same / similar field is not undertaken. Same is confirmed from NFSC, NCDC, DIFR, DGFASLI (Directorate General, Factory Advice Service and Labour Institutes) etc. However following literature is reviewed which is tabulated below with brief summary.

Sr No.	Themes	Author	Context	Inference
1	Green house gas emission	Dr Lawrence Leung	International	Projection of fugitive greenhouse gas emission to 2020
2	Fuels and combustion	Bureau of energy efficiency	Indian	Introduction to Fuels, Properties of Fuel oil, Coal and Gas, Storage, handling and preparation of fuels, Principles of Combustion, Combustion of Oil, Coal, and Gas
3	Meteorological data	Meteorological department	Indian	Data with respect to temperature, humidity, wind speed and wind direction in different seasons.
4	Energy sector overview	The international energy outlook 2005	Indian	Reserve of hydrocarbon and its consumption pattern.
5	LPG tank truck incident	OISD GDN 161	Indian	Guidelines for handling emergencies arising out of LPG Tank Truck (TT) incidents
6	Composition of LPG		Indian	Energy need for India
7	Design of tankers	Functional committee (OISD + PESO + Consultants)	Indian	Design of bullets along with material specifications, fittings, mounting etc for transportation of LPG in bulk by road
8	National energy map of India Technology vision 2030	TERI the energy resource institute and Office of Principal Scientific Advisor Government Of India.	Indian	Estimated energy demand. Production of primary sources of conventional energy in India.
9	Likely consequences of events on release of LPG	S S Gautam P K Saxena	Indian	Survey of criticality of risk from LPG storage tanks at user sites
10	Loading procedure of LPG road tankers	ISO manual	Indian	Detail procedure and operation of rotogauge

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11	Loading procedure of LPG rail wagons	GAIL (India) Limited	Indian	Detail procedure for measuring the inside content.
12	Design layout of plants.	OISD GDN 144	Indian	Safety requirements on design, layout, storage, loading / unloading, operation, inspection & maintenance, fire protection, emergency planning and safety audit systems of LPG Installations.
13	Design aspects of tank lorries.	OISD GDN 151	Indian	Safety in design, fabrication and fittings of propane tank trucks
14	Handling of bulk petroleum gas	OISD GDN 158	Indian	Operation of equipment and facilities connected with storage and handling of LPG at Gas Processing Plants, Refineries and other Bulk Handling installations. Some basic concepts for design and construction of such facilities
15	Effect of VOC's	Klaus Abraham, Hans Mielke, Wilhelm Huisinga & Ursula Gundert-Remy	International	Elevated internal exposure of children in simulated acute inhalation of VOC's
16	LUNG FUNCTION AND BRONCHIAL REACTIVITY IN ASTHMATICS DURING EXPOSURE TO VOLATILE ORGANIC COMPOUNDS	Institute of Environment and Occupational Medicine, University of Aarhus, Aarhus, Denmark.	International	Study was to investigate whether vapors of organic solvents at low concentrations could exert an adverse effect in the lower airways. Under controlled conditions in a climate chamber
17	EFFECT OF LPG ON HUMAN BEING	US Department of health and human services	International	MSDS, monitoring and measurement procedures
18	EFFECT OF LPG ON HUMAN BEING	US Department of health and human services	International	MSDS, monitoring and measurement procedures
19	HAZARDS OF LPG	Major Hazard control by ILO	International	Fire, explosion and BLEVE conditions during release of LPG
20	CHEMICAL SAFETY	International program on chemical safety	International	Effect of LPG on environment and animals
21	CHEMICAL PROCESS SAFETY	Roy E Sanders	International	Various case studies are discussed
22	CHEMICAL PROCESS SAFETY	Danial A, Crowl, Joseph F, Louvar	International	Discussion on different source models

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7.1 @ - Photographs taken during loading operation of LPG and Propane Tanker.

7.2 $ - http://en.wikipedia.org/wiki/Propane

7.3 * - OISD standard 159- LPG tank truck design / fabrication and fitting.

7.4 +- http://www.worldofmolecules.com/fuels/propane.htm

7.5 (¥) – http://www.cypenv.org/world/Files/methane.htm

7.6 (©) – http://www.mechengcalculations.com/index.html

7.7 # - Standard Loading procedure of LPG and Propane Tankers given in ISO:9001 Manual as well as displayed in the loading gantry at GAIL Vijaipur.

8. ABBREVIATIONS

LPG	Liquefied Petroleum Gas
ISO	International Standardization organization
GAIL	Gas Authority of India Limited
OISD	Oil Industry Safety Directorate
PESO	Petroleum Explosive and Safety Organisation
CCOE	Chief Controller of Explosives
PSV	Pressure Safety Valve
VOC	Volatile Organic compound

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OCCUPATIONAL HEALTH EFFECTS OF EXPOSURE OF LPG AND PROPANE ON HUMAN

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ABSTRACT

To know the effect of released hydrocarbon on the loading operators their medical checkups were done in three different seasons. The result shows that the workers exposed to the LPG and Propane vapours during tanker loading activity for prolonged period (six months) are having higher cholesterol level and it is reversible when they are shifted to the area where there are no vapours of hydro carbon available in working atmosphere. The study also helped to know the extent of energy loss and revenue loss as well as the method to minimize the loss of hydrocarbon in atmosphere during loading and unloading of tankers thereby limiting the exposure of the operators to hydrocarbon vapours.

INDEX TERMS: Rotogauge, Occupational health, Hydrocarbon, Different seasons, Operators, Tankers

1. INTRODUCTION

Rotogauge is a device which is used to measure the volumetric quantity of liquid level inside the pressurized container. The release of hydrocarbon from the rotogauge cannot be contained and is allowed to disperse in the atmosphere. (Ref #). In India Loading and unloading operation of the Liquefied Petroleum Gas (LPG) and Propane tanker is done with manual intervention to know the liquid level content inside the tank of the tanker lorry. Loading and unloading operation of Liquefied Petroleum Gas (LPG) and Propane tanker is carried out with intermittent checking of liquid level inside the tank with the help of rotogauge (Ref #). Rotogauge is a devise fitted in the tanker which is useful in measuring the liquid level inside the tanker in terms of percentage. In the present scenario the rotogauge helps to determine the liquid level inside the tank and liquid level inside the tank is

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ensured. (Maximum allowable liquid level is 95% and Vapour space of 5% is left) (Ref *).

Hydro carbon is released in the atmosphere through rotogauge (Ref photo @) while loading of LPG and Propane in the tankers contributes occupational health problems to the workers, greenhouse gas effect (Ref $) as well as revenue loss though it is insignificant in case of one tanker but it is significant if we consider loading and unloading of tanker at National level per day and Organizational level per year. In order to overcome the problem of releasing of hydrocarbon through rotogauge (for measuring liquid level inside the tanker) it is necessary to study this topic in detail along with the effect of these hydrocarbons on the workers working in that area. The photograph of releasing of LPG / Propane from rotogauge is given below –

2 Steps used in the research

Photograph of Road tanker which is used for loading, unloading and transportation of LPG & Propane is given below

(@) HYDRO CARBON TANKER WITH ROTOGAUGE

ROTOGAUGE

The study is designed at every stage keeping in view of the following objective

To study the filling mechanism of LPG as well as Propane tankers - Detail study is carried out regarding loading and unloading operation of LPG and Propane in the tankers at various locations of GAIL (India) Limited as well as other petroleum installations. Standard operating procedures are collected.

To estimate the quantum of hydro carbon released in atmosphere through rotogauge while checking the liquid level of hydrocarbon inside the tankers – Discharge rate of hydrocarbon (i.e. LPG and Propane) through 2 mm diameter size hole of rotogauge is determined theoretically with the help of software available (Ref ©) as well as same is crosschecked practically by collecting the discharge through rotogauge in the sampling balloon. The exact quantity of hydro carbon released through rotogauge is established for one tanker with the help of differential weight of sampling balloon. Data for number of LPG and Propane tankers loaded (at GAIL Vijaipur) during last three years is collected for calculating the quantity of unburnt LPG and Propane released in atmosphere.

To study the occupational health effect of VOC's (volatile organic compounds) on the loading operators who are involved in loading operations of these tankers over a period of different seasons.

Use of mathematical modeling to study the of the release of hydro carbon over a years with respect

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to occupational health effect due to exposure to the operator as well as on the organization economy.
To suggest the recommendations for overcoming the problem of release of LPG and Propane in atmosphere/application of technology

2. RESEARCH METHODOLOGY ADOPTED

2.1 Theoretical Framework

At present in India there are about 10,400 tankers (LPG + Propane) having valid license to carry / transport compressed hydrocarbon from Petroleum and Safety Organisation (formerly Chief Controller of Explosive). These tankers are being filled and emptied out regularly at different locations in India. All these tankers are having the liquid level measuring device called ROTOGAUGE. While filling as well as emptying out these tankers, the standard practice is to open the Rotogauge screw to check the level of tank in terms of volumetric percentage (Please see photographs of procedure displayed at loading gantry is enclosed). Particularly while filling the tankers, the liquid level content is being monitored at least three times by opening the Rotogauge (approximately hydrocarbon is being released in the atmosphere for total 1 minute through rotogauge). During opening the Rotogauge liquid hydrocarbon is coming out in the form of mist (containing liquid as well as vapours). While loading of these tankers, operator has to ensure that the liquid level of LPG / Propane inside the tanker should not exceed 95% (Ref *). For ensuring the same, operator fixed the rotogauge indicator at 95% mark, so that whenever liquid level reaches that mark, LPG / Propane in the liquid form starts coming out from the 2 mm diameter size orifice of rotogauge. Moreover while doing this measurement the operator is standing very near to the rotogauge device for operating it.

The proposed study is undertaken to see the occupational health effects on the loading workers due to inhalation of hydrocarbon mixed air, estimate the impact on greenhouse gas emission and revenue loss due to release of hydrocarbon in the atmosphere.

3.1 Source of Data

Data for study will be collected from various sources like –

3.1.1 Data collection for standard operating procedure for loading of tankers is taken from ISO manual of GAIL (India) Limited Vijaipur.

3.1.2 Visual inspection with photographs in support of confirming the loading procedure is taken from loading gantry of GAIL (India) Limited Vijaipur.

3.1.3 Quantity of hydrocarbon tankers (i.e. LPG and Propane only) is derived from the official web site of Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

3.1.4 Material Safety Data sheets and contribution of unburnt hydrocarbon in greenhouse gas emission through various web sites.

3.1.5 Average price of industrial LPG and Propane is collected from GAIL's data bank.(through ERP-SAP)

3.1.6 Medical records of the sample loading operators having different years of experience and different age group.

3.1.7 Use of ALOHA software for carrying out the mathematical modeling.

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4. SAMPLING

4.1 The data for the study is collected from existing standard operating procedures of loading activities.

4.2 Data pertaining to number of tankers state wise is taken from the official web site of the Petroleum and Safety Organisation (formerly Chief Controller of Explosives).

4.3 Crosschecking of the amount of LPG and Propane release in the atmosphere through 2 mm diameter rotogauge hole is done with the help of collecting the content in the sampling balloon and its differential weighment.

4.4 Survey is carried out for standard tanker loading practices in the other installation so as to determine the impact on health of workers as well as revenue loss at Organizational level on yearly basis.

4.5 Blood sample checking and clinical examination of the fixed workers of different age and different years of exposure.

5. FINDINGS AND CONCLUSION

(A) The occupational health effect after prolonged exposure to Hydro carbons were studied and results are as under -

5.1 Loading operators of different age groups were selected.

5.2 Clinical examination of the operators conducted.

5.3 Total 7 operators each deployed for loading operations in LPG and Propane tanker loading gantry.

5.4 After a period of six months, pathological tests conducted for certain parameters.

5.5 Following precautions taken during study period for the operators –

5.6 Living conditions were monitored.

5.7 Regular food intake of operators.

5.8 Proper scheduling of duties and rest

5.9 Pathological tests were conducted at the end of first six months.

5.10 Duty locations of all the operators were changed where there is no release of hydro carbon during normal operational activity for next six months.

5.11 Again pathological tests were conducted after the completion of six month at new work location.

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Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was decreased thereby decreased the risk factor.

5.12 In order to verify the outcome again all the operators were sent back to the loading gantries for next six months and at the end medical tests were conducted.

Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was increased thereby increased the risk factor.

5.13 Again duty locations of all the operators were changed where there is no release of hydro carbon during normal operational activity for next six months.

Result – The change in lipid profile of almost all the operators were noticed. The total cholesterol level was decreased thereby decreased the risk factor.

5.14 When operators were exposed to the hydro carbon during the winter season, then there is more effect on lipid profile.

5.15 The effect of hydro carbon on lipid profile (cholesterol) of human being is found to be reversible when exposure duration and quantity is reduces.

The data for exposure of loading operators during three different seasons were measured. Area monitoring were done in three different seasons to know the level of various environment polluting parameters like SPM and Presence of Hydrocarbon traces and for the study total 15 loading operators (three groups of different age range i.e. 21 yrs – 30 yrs; 31 yrs – 40 yrs and 41 yrs – 50 yrs) were monitored for the following parameters –

- Blood cholesterol level.
- Ergonomic postures while doing loading operations.
- Various symptoms like cold, cough, headache, dizziness etc.
- Habits while working.
- Alertness of the operators.

Based on the collected data it is concluded that –

1. **For Age group 21 yrs – 30 yrs**
   - Cholesterol level was found increased.
   - They were complaining regarding intermittent pain in the right side potion of their body particularly right groin and shoulder.
   - Teeth colour found change from White / off white to Reddish spots due to continuous chewing of tobacco or tobacco product.
   - Mild headache at the end of shift.

2. **For Age group 31 yrs – 40 yrs**
   - Cholesterol level was found increased including triglycerides.
   - They were complaining regarding pain in the right side potion of their body particularly right groin and shoulder during morning.
   - Teeth colour found change from White / off white to Reddish spots due to continuous chewing of tobacco or tobacco product.
   - Mild headache at the end of shift.
   - No sensation for ethyl mercaptan smell.

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3. For Age group 41 yrs – 50 yrs

- Cholesterol level was found increased including triglycerides.
- They were complaining regarding pain in the back and thigh muscles.
- Teeth colour found change from White / off white to Reddish cum blackish spots due to continuous chewing of tobacco or tobacco product.
- Cold during morning.
- These age group operators suffered from fever 4 to 6 times during study may be due to deteriorating immune system.
- No sensation for ethyl mercaptan smell.

SR NO	PARAMETERS	Dinesh Kumar Dixit (32 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholesterol	387.2	256.4	340.7	255.5
2	Triglyceride	196	135.4	178.3	125.3
3	H D L (High Density Lipoprotein) Cholesterol	57	65	52	56
4	L D L (Low Density Lipoprotein) Cholesterol	150	73	98.3	87.5
5	V L D L Cholestrol	30.2	27.6	25.3	28.5
6	Risk Factor	6.79	3.94	6.55	4.56

SR NO	PARAMETERS	Virendra Kumar Tyagi (39 Yrs)			
		7-Oct-11	20-Apr-12	18-Nov-12	15-May-12
		Loading Gantry	Off site	Loading Gantry	Off site
1	Total Cholestrol	300.52	255.4	293.5	237.1
2	Triglyceride	192	163.6	189.2	158.9
3	H D L (High Density Lipoprotein) Cholestrol	50.67	53.2	48.5	37.5
4	L D L (Low Density Lipoprotein) Cholesterol	140	118.5	120.4	120.4
5	V L D L Cholestrol	16	18.9	22.1	20.6
6	Risk Factor	5.93	4.80	6.05	6.32

(B) Use of mathematical modeling to study the of the release of hydro carbon over a years with respect to occupational health effect due to exposure to the operator as well as on the organization economy

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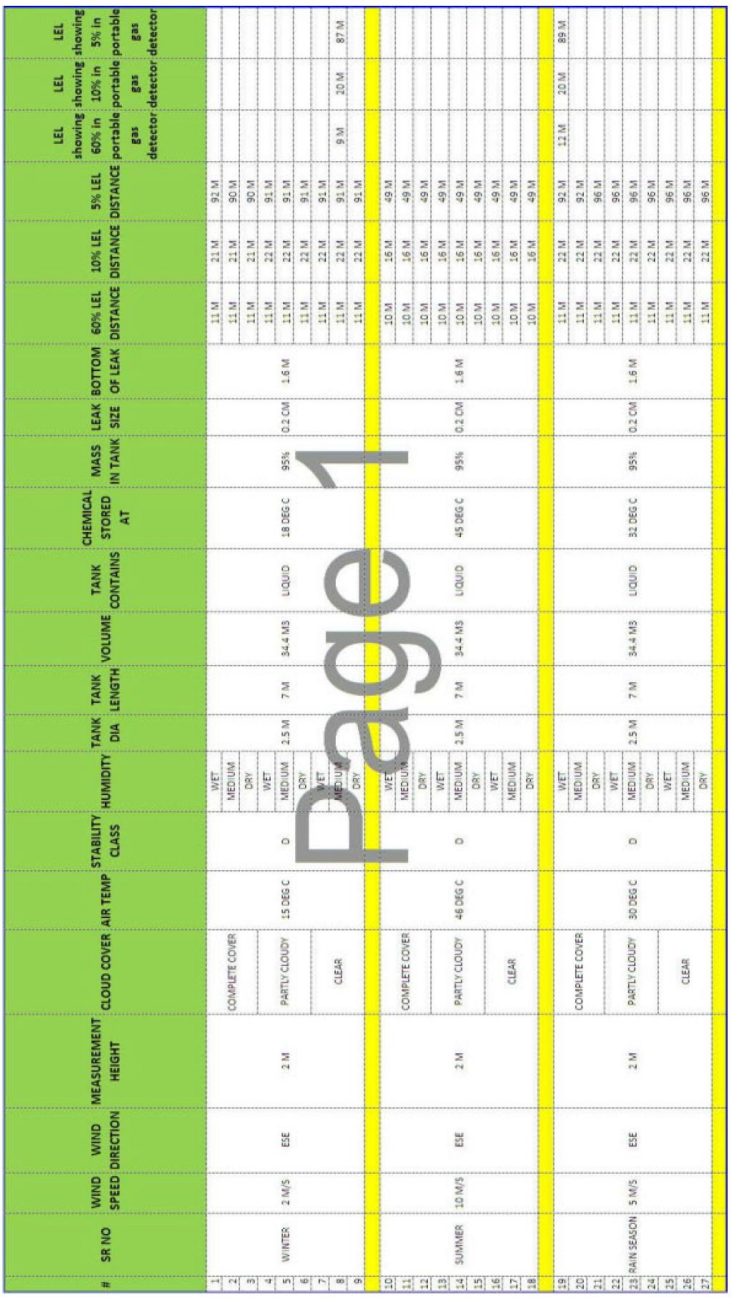
Mathematical modeling for the release of hydrocarbon (LPG and Propane) is done with the help of ALOHA Software for the following parameters.



#	SR NO	WIND SPEED	WIND DIRECTION	MEASUREMENT HEIGHT	CLOUD COVER	AIR TEMP	STABILITY CLASS	HUMIDITY	TANK DIA	TANK LENGTH	VOLUME	TANK CONTAINS	CHEMICAL STORED AT	MASS IN TANK	LEAK SIZE	BOTTOM OF LEAK	60% LEL DISTANCE	10% LEL DISTANCE	5% LEL DISTANCE	LEL showing 60% in portable gas detector	LEL showing 10% in portable gas detector	LEL showing 5% in portable gas detector
1								WET									11 M	21 M	92 M			
2					COMPLETE COVER			MEDIUM									11 M	21 M	90 M			
3								DRY									11 M	21 M	90 M			
4					PARTLY CLOUDY			WET									11 M	22 M	91 M			
5	WINTER	2 M/S	ESE	2 M		15 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	18 DEG C	95%	0.2 CM	1.6 M	11 M	22 M	91 M			
6								DRY									11 M	22 M	91 M			
7					CLEAR			WET									11 M	22 M	91 M			
8								MEDIUM									11 M	22 M	91 M	9 M	20 M	87 M
9								DRY									11 M	22 M	91 M			
10								WET									10 M	16 M	49 M			
11					COMPLETE COVER			MEDIUM									10 M	16 M	49 M			
12								DRY									10 M	16 M	49 M			
13					PARTLY CLOUDY			WET									10 M	16 M	49 M			
14	SUMMER	10 M/S	ESE	2 M		46 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	45 DEG C	95%	0.2 CM	1.6 M	10 M	16 M	49 M			
15								DRY									10 M	16 M	49 M			
16					CLEAR			WET									10 M	16 M	49 M			
17								MEDIUM									10 M	16 M	49 M			
18								DRY									10 M	16 M	49 M			
19								WET									11 M	22 M	92 M	12 M	20 M	89 M
20					COMPLETE COVER			MEDIUM									11 M	22 M	92 M			
21								DRY									11 M	22 M	96 M			
22					PARTLY CLOUDY			WET									11 M	22 M	96 M			
23	RAIN SEASON	5 M/S	ESE	2 M		30 DEG C	D	MEDIUM	2.5 M	7 M	34.4 M3	LIQUID	32 DEG C	95%	0.2 CM	1.6 M	11 M	22 M	96 M			
24								DRY									11 M	22 M	96 M			
25					CLEAR			WET									11 M	22 M	96 M			
26								MEDIUM									11 M	22 M	96 M			
27								DRY									11 M	22 M	96 M			

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The result of the study with respect to contribution of unburnt LPG and Propane (due to release from rotogauge) in occupational health effects on the workers, in greenhouse gas emission as well as revenue loss over a period of time is calculated and found that –

Sample calculation for the revenue loss & energy loss due to discharge of LPG and Propane in the atmosphere during loading activity at GAIL Vijaipur is summarized below –

- Discharge rate of LPG & Propane from 2 mm diameter hole of rotogauge = 0.085 Kg / Min.
- No of LPG + Propane tankers loaded at GAIL Vijaipur in the year 2012 = 16089.
- Total amount of Hydro carbon discharged through rotogauge in the year 2012 at GAIL Vijaipur = 0.085 x 16089 = 1367.56Kg.
- Average cost of LPG in the year 2012 = Rs. 36,766.9 per MT.
- Revenue loss for GAIL Vijaipur only for LPG for the year 2012 = 1.36x 36,766.9 = Rs. 50281.12
- Calorific Value of LPG / Propane = 11950 KCal/Kg (50032.26 KJ/kg).
- Total amount of Hydro carbon discharged through rotogauge in the year 2012 at GAIL Vijaipur = 1367.56Kg.
- Energy loss for GAIL Vijaipur only for LPG & Propane for the year 2012 = 11950 x 1367.56 = 16342342 Kcal = 68422117 KJ.

6. STUDY OF LITERATURE

As far now with the best of information research in the same / similar field is not undertaken. Same is confirmed from NFSC, NCDC, DIFR, DGFASLI (Directorate General, Factory Advice Service and Labour Institutes) etc. However following literature is reviewed which is tabulated below with brief summary.

6.1 Greenhouse gas emission by Dr Lawrence Leung. The detail study is done regarding the projection of fugitive greenhouse gas emission to 2020.

6.2 Fuels and combustion by Bureau of energy efficiency. Introduction to fuels, properties of fuel oil, coal and gas, storage handling and preparation of fuels, preparation of fuels, principles of combustion, combustion of oil, coal and gas.

6.3 BSI (2009). BSEN 12807:2009. LPG equipment and accessories - transportable refillable brazed Steel cylinders for liquefied petroleum gas (LPG) - design and construction. England: British Standards institute.

6.4 Meteorological data from meteorological department for temperature, humidity, wind speed and wind direction in different seasons.

6.5 Energy sector overview by the international energy outlook 2005 gave insight about Reserve of hydrocarbon and its consumption pattern.

6.6 OISD GDN 161 regarding LPG tank truck incidents which gives Guidelines for handling emergencies arising out of LPG Tank Truck (TT) incidents.

6.7 Composition of LPG by Indian author gave insight regarding detail properties of LPG and energy need for India.

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6.8 Design of LPG and propane tankers by Functional Committee of Oil Industry Safety Directorate gave in-depth design criteria for bullets along with material specifications, fittings, mounting etc for transportation of LPG in bulk by road.

6.9 National Energy Map for India by TERI for estimated energy demand Production of primary sources of conventional energy in India.

6.10 Likely consequences of events on release of LPG by Dr S S Gautam and P K Saxena for Survey of criticality of risk from LPG storage tanks at user sites.

6.11 Loading procedure of LPG road tankers from ISO manuals of GAIL India Limited for studying Detail procedure and operation of rotogauge.

6.12 Loading procedure of LPG rail wagons from ISO manuals of GAIL India Limited for studying detail procedure for measuring the inside content.

6.13 OISD Guideline 144 for design layout of plants wherein details regarding Safety requirements on design, layout, storage, loading / unloading, operation, inspection & maintenance, fire protection, emergency planning and safety audit systems of LPG Installations.

6.14 OISD Guideline 151 for design aspects of tank lorries for Safety in design, fabrication and fittings of propane tank trucks.

6.15 OISD GDN 158 for Handling of bulk petroleum gas gives insight about Operation of equipment and facilities connected with storage and handling of LPG at Gas Processing Plants, Refineries and other Bulk Handling installations. Some basic concepts for design and construction of such facilities.

6.16 Effect of VOC's by Klaus Abraham, Hans Mielke, Wilhelm Huisinga & Ursula Gundert – Remy regarding elevated internal exposure of children in simulated acute inhalation of VOC's.

6.17 Lung Function and Bronchial Reactivity in Asthmatics during Exposure to Volatile Organic Compounds by Institute of Environment and Occupational Medicine, University of Aarhus, Aarhus, Denmark. In this book study was done to investigate whether vapors of organic solvents at low concentrations could exert an adverse effect in the lower airways. Under controlled conditions in a climate chamber.

6.18 Effect of LPG on human being by US Department of health and human services. The details regarding MSDS, monitoring and measurement procedures are studied.

6.19 Hazards of LPG by Major Hazard control by ILO wherein Fire, explosion and BLEVE conditions during release of LPG are studied.

6.20 Chemical process safety by Roy E Sanders. Various case studies are discussed.

6.21 Chemical process safety by Danial A, Crowl, Joseph F, Louvar. Different source models are studied.

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6.22 CNG Europe 2013 through http:// cngeurope.com for Calorific value of LPG and Propane.

6.23 Alternate Energy Systems, Inc for Calorific value of LPG and Propane.

6.24 Three cases of sudden death due to butane or propane gas inhalation: analysis of tissues for gas components by Hideaki Sugie, Chizuko Sasaki, Chikako Hashimoto, Hiroshi Takeshita, Tomonori Nagai, Shigeki Nakamura, Masataka Furukawa, Takashi Nishikawa, Katsuyoshi Kurihara.

6.25 ATYPICAL COMBINATION-ZOPICLONE AND LPG IN A CASE OF PLANNED COMPLEX SUICIDE by I.C.Prodan, I. Fulga, C.L. Chitescu, N. Dobrovici-Bacalbasa, C. Georgescu, V. Ardeleanu, D.Perju-Dumbrava. The autopsy findings together with zopiclone and the gas analysis results revealed that the cause of death was anoxic asphyxia following liquefied petroleum gas (LPG) inhaling.

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Occupational health is closely linked to public health and health systems development, and WHO is addressing all determinants of workers 'health, including risks for disease and injury in the occupational environment, social and individual factors, and access to health services. WHO is implementing a Global Plan of Action on Workers' health 2008-2017 endorsed by the World Health Assembly in 2007 with the following objectives:

- devising and implementing policy instruments on workers' health;
- protecting and promoting health at the workplace;
- improving the performance of and access to occupational health services;
- providing and communicating evidence for action and practice; and
- incorporating workers' health into other policies.

Further information about the work of WHO in the area of occupational health is available at: http://www.who.int/occupational_health/about/en/ index.html.

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7.7 # - Standard Loading procedure of LPG and Propane Tankers given in ISO:9001 Manual as well as displayed in the loading gantry at GAIL Vijaipur.

8. ABBREVIATIONS

LPG	Liquefied Petroleum Gas
ISO	International Standardization organization
GAIL	Gas Authority of India Limited
OISD	Oil Industry Safety Directorate
PESO	Petroleum Explosive and Safety Organisation
CCOE	Chief Controller of Explosives
PSV	Pressure Safety Valve
VOC	Volatile Organic compound

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Profile

Motivated, friendly, working professional with multiple degrees, various certifications and a successful 14 years career as a HSE & Fire professional possessing excellent communication skills in English, Hindi & Marathi with a knowledge of computer combined with proven organizational and administrative abilities. Strength in setting up the HSE and Fire Department and formulating and designing HSE Training courses, Safety reports, Safety audits, Inspections, JSA's, Emergency plans, Fire prevention & protection, HAZOP, Incident investigations and "fire & Safety" associated jobs,

formulating expert opinions and conclusions within framework of detailed technical reports, liaisoning with Factory Inspectorate and statutory bodies etc.

Personal Information

Nationality:- Indian

Date Of Birth :- 30th July 1975

Languages Known:- English, Hindi, Marathi, Gujarati

Education

Nagpur University, Nagpur.

B.Sc – Physics, Mathematics & Chemistry with 67%

Nagpur University, Nagpur, India

BE - Fire Engineering with 75% from National Fire Service College

Gujarat Technical Education Board, Govt. of Gujarat

Post Diploma in Industrial Safety with 68%

University of Petroleum and Energy Studies, Dehradoon

M Tech (HSE) with 84.2%

Ancillary Safety & Health Training & Education

- Trained in Oil Spill Response Level – 2 from OSRL Singapore
- Trained in Management Development Programme by Indian Institute of Management, Kolkata.
- Lead Auditor of " OHSAS-18001", and auditor of "ISO-9001 and ISO 14001"
- Participated in "HAZOP & HAZID" study for gas processing plant and cross country pipelines.
- Trained First Aider by St. John Ambulance Association, New Delhi
- Participated in "Fire Risk Management conducted by Gujarat Safety Council, Baroda
- Safety Management System in Process Plants
- Certified safety auditor from National Safety Council, Mumbai.
- Member of Red Cross Society of India.

Skills Summary

- Process Safety Management (OSHA) & OISD.
- Accident / Incident / Near Miss Investigation.
- Fire Safety – Prevention and Protection (OISD,NFPA)
- Safety & Fire Training Requirements.
- Carried out Safety Audits of various units of Gas processing plants and Cross country Natural gas, LPG pipelines and heated crude oil pipeline.

- Carried out Emergency /Disaster mitigation Planning.
- Certified inspector for Scaffolding.
- Conversant with ISO/EMS/OHSAS management systems
- Auditor of ISO-9001, 14001/ OHSAS-18001.
- Knowledge of SAP/ERP on HSE and MM module.
- Knowledge in Applicable Indian Legislations & OISD Codes
- Trained in "Radiological Safety Aspects", from BARC, Mumbai.
- Task based Risk Assessments, Job Safety Analysis, Hazard identification.
- Liaisoning with Factory inspectorate and statutory authorities.
- Liaisoning for consents and approvals form Pollution control board.

Employment History

1999 – 2009 : GAIL (India) Limited – New Delhi

Manager (Safety & Fire)

2009 –Present: Cairn India Limited

Manager (HSE)

Qualifications and experience gained through significant HSE work done for more than Fourteen Years, have produced a HSE and fire professional capable of coordinating and participating in HAZOP / HAZID studies, safety audits and reports, training sessions, investigating incidents and advising on HSE

matters in one of the India's premier Navratna company, operating world's longest LPG Pipeline, primarily deals with Natural Gas distribution, LPG Recovery and production of Petrochemicals.

- Coordinated HSE aspects for Safe and Successful commissioning of Crude, Gas pipelines and NTGG plant
- Monitors the F&S aspects including Pollution control board requirement, first aid centres and occupational health aspects of employees and contract workers.
- Developed HSE systems for contractors
- Conducted pre commissioning safety audits of pipelines and plants.
- Involved in engineering aspects of fire water network during upgradation of the existing system.
- Participated in HAZOP and HAZID studies for Cross country pipeline and gas processing plants.
- Designed and implemented the PLC based fire control systems.
- Provides regulatory compliance and on-site inspection services to industry on HSE matters.
- Responsible for planning and technical support for safety and fire equipments for cross country pipeline and gas processing plants.
- Provides regulatory compliance with respect to statutory requirements such as Factory Act, Petroleum Rules, OISD, MSIHC Rules, Pollution control boards etc.
- Developed and conducted HSE and fire fighting training courses.

- Significant Support has been provided to the HSE and fire fighting systems for LPG Plant and Natural Gas Compressor Station which includes:

❖ Implementing HSE Management System

❖ Total Fire Prevention and Protection of the installation, includes handling of diverse types of emergency calls

❖ Conducting, Coordinating of HSE Audits to determine the conformance of the SMS and monitoring of their recommendations & their compliance.

❖ Coordinating for smoother & safe plant shutdown activities and for new projects

❖ Developing Emergency Plans with complete line responsibility

❖ Conducting & Evaluating – Emergency Drills, Safety Awareness Surveys, training lectures to plant personnel on HSE

❖ Coordinating and organizing Safety Committees.

❖ Rendered efficient services to get " Five Star" Certification for two different units in GAIL

❖ Instrumental in getting " Sword of Honour" from BSC, UK at GAIL, Vijaipur for the fourth time.

- Implementation and supervising plant safety (includes Personnel and Process)
- HSE audit, liasioning with all statutory bodies.
- Responsible for coordination of Mutual aid with other PSU's.
- Preparation of Budgets, Inventory controls and other MIS reporting

- Conducting & Evaluation of Safety Committees, Emergency Drills, Safety Surveys
- Attending Road Side accidents of LPG, Naphtha, Hydrocarbon tankers, including leakage as well as fire.
- Responsible for Designing and implementation of various HSE campaigns and ensuring Schemes for promotion of HSE
- Preparation and issuing of Safety Manuals, Pocket hand books, safety literature, etc
- Ensuring Safe practices, occupational health safety and Industrial Hygiene
- Scripting Site's HSE Policy, Safety Plan & steps to meet the goals of HSE Policy
- Developed "Fire Training Centre" with various world class simulation models like BLEVE

Papers Submitted

- "Safety Management System" of GAIL at GSC, Vadodara.
- "Major Hazard Control"
- Effect of hydro carbon on occupational health of workers in International Journal of scientific and research publication.
- Occupational health effect of exposure of LPG and Propane on human.
- Study of release of hydro carbon in atmosphere

Professional Affiliations

- National Safety Council
- International Institute of Safety & Risk Management, London
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