IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 15, Issue 7 Ser. III (July 2021), PP 01-06
www.iosrjournals.org

Impact of the Distribution of Hydrocarbon Fuels on the Environment

Jamal KHAMIS[1], Sorin Mihai RADU[2], Ioan Petru SCUTELNICU[3], Ioan I. GÂF-DEAC[4/*1]

1- Dr., Ministry of Health, Damascus, Syria
2- Prof. Dr., University of Petrosani, Romania
3- PhD St., Geological Institute of Romania (IGR) Bucharest, Romania
4- Dr., INCE, Romanian Academy, Bucharest, Romania

Abstract
The presence of gas stations in residential areas is very dangerous for what can happen in case of accidents, fires, fuel leaks from tanks or even among vehicles when filling, refueling, in addition to the risk of toxic gases due to lead in gasoline. The article evaluates disaster management in the operational reality of gas stations in urban areas. It also analyzes the reality of occupational diseases and accidents at work of employees in those infrastructures. On this basis, appropriate recommendations and proposals are put forward to serve in the drafting of legislation regulating the distribution of hydrocarbon fuel and disaster management.

Keywords: *hydrocarbon fuels, oil distribution stations, anthropogenic impact, danger of explosion, damage to health*

Date of Submission: 13-07-2021 Date of Acceptance: 29-07-2021

I. Introduction

Although the intention to generalize electric car transport (2035-2050) is globally declared, the means of transport with the consumption of octane hydrocarbon fuels (diesel, petrol, LPG) remain predominant in the global economy.

In this paper we present some results and conclusions from research and systematization of field data in hydrocarbon oil distribution stations, as an exemplary case study from Damascus, Syria, but comparatively also technical, technological situations, of sanitation and sustainability in stations in Bucharest, Romania.

The presence of gas stations in residential areas is very dangerous for what can happen in case of accidents, fires, fuel leaks from tanks or even among vehicles when filling, refueling, in addition to the risk of toxic gases due to lead in gasoline.

As a result of these incidents, station workers have been and are exposed to a number of health risks.

Therefore, safety regulations and policies are needed to avoid such damage and risks to nearby employees or residents as a result of fires or explosions.

The spread of gas stations in large urban areas shows that most of them are scattered between or near residential neighborhoods, and this is naturally due to the density, increased mobility, movement, urban mobility, which brought neighborhoods near these stations.

Thus, it is suggested that a solution is to eliminate stations in residential neighborhoods or at least to force owners to increase safety and security standards.

One of the reasons for the risk of fire or explosion at gas stations is overcrowding, which occurs in oil stations and in populated areas nearby.

The high temperature emitted by motor vehicles during the summer causes the heat of the asphalt to increase, which in turn increases the temperature of the fuel tanks.

Feeding speed, high pressure in tanks and storage tanks lead to explosions.

The lack of commitment of citizens to the dangers and the non-observance of safety rules by motorists, in turn, lead to high, significant risks, including when filling open containers with fuel.

Smoking in the car, continuous acceleration, on the spot, under the clutch while refueling, all this must be combated through awareness, to generate safety for customers and staff at the station.

[1] Corresponding author: ro_affairs@yahoo.com

From here, from common deficiencies, even simple ones, the importance of this subject can be deduced generically, in order to study and evaluate the disaster management in the operational reality of the gas stations and to see the real situation of occupational diseases and injuries, work accidents of workers in those stations.

- **The purpose of the research**

- Assessment of disaster management in the operational reality of gas stations in urban areas.
- Analyzing the reality of occupational diseases and accidents at work of employees in those infrastructures.

- **The research involves:**

All refueling stations must benefit from recommendations that effectively meet the safe conditions for establishment / operation, and knowledge of the conclusions to contribute to disaster management at these stations.

- **The importance of research** comes from the following key points:

- Determining the degree to which workers comply with the procedures, occupational health rules and the impact on workers' health, of the factors affecting them, of impact through effects from risks related to operations in these units.
- Service facilities are examined and solutions are proposed for them, so that every day there is fluency and safety, and the work, operations with dangerous substances that can be ignited and are easily flammable, to be safe, reliable.
- Examining the reality of these stations in terms of disaster management leads to recommendations for the prevention of fires and explosions in the premises of fuel distribution units, as well as to the safety of workers, the public, property and the environment, in the general context of health.

II. Research Methodology

Theoretical section:

This includes standard knowledge of motor vehicle refueling stations and the effects of the effects on human health, resulting from the risks of exposure of workers to these stations, in relation to the legislation in force governing the activities of oil stations.

Practical section:

1- Contains data on fuel stations, their number, places of presence / location, number of employees, type of fuel, hydrocarbons sold in them, annual, periodic, phased consumption of petroleum products

2- Field study of gas stations.

This section includes the preparation of an extensive questionnaire on disaster management in stations and their analysis through a method of scientific research to determine the reality and degree of compliance with the legislation governing work in stations, to obtain the safety and security of workers, beneficiaries of the service , neighboring population, protection of property and the environment.

The questionnaire includes several basic axes for collecting research information and covers general information about stations, characteristics of residence area, station location, station property area, station buildings, vehicles entering and leaving the station, tanks, pumps, electricity.

A separate section for workers is also being researched, in particular with regard to work-related injuries and occupational diseases, and a special section on employers, focusing on action procedures in the event of emergencies in stations, such as fires. , explosions, etc.

On this basis, appropriate recommendations and proposals can be developed to serve in the drafting of legislation regulating the distribution of hydrocarbon fuel and disaster management.

III. Impact of fuels on the environment (case study)

In a workplace for the sale of fuels either in Bucharest (Romania) or in Damascus (Syria), there are conceptual technological, technical, safety and sustainability similarities regarding the distribution of hydrocarbon fuels through main activities such as:

1) supply of diesel fuels / fuels;
2) fuel storage;
3) fuel distribution / vehicle supply;
4) where applicable, the supply of LPG (liquefied petroleum gas) and its storage.

The supply of diesel and petrol in the Stations is made with car tanks, which are / must be equipped and approved based on some standards, specific norms in the field.

The atmosphere in the area of an oil station can be affected, and the sources of pollutants during the operation of the unit can be:

1) spillage losses when filling tanks in refueling vehicles,
2) the so-called "breathing" of storage tanks, storage of fuels, fuels,
3) stationary or mobile sources (traffic, movement of vehicles inside the station).
Some sources of soil / land pollution in the fuel distribution perimeter and in the vicinity of the station, during the operation of the unit, affect directly or indirectly on the surface in question, transforming its initial physical-bio-chemical properties, changing the regeneration rate. of the fertile land mass nearby.
Effects may occur when they occur:
1) the action of the remaining waters from the sanitation of the station premises;
2) the presence of toxic, flammable residual waste from fueling activities of vehicles in the station;
3) the presence of household waste spread inappropriately in the area;
4) accidental fuel leaks / losses / leaks (malfunctions of vehicle fuel systems);
5) air pollutants, air, with sediments / gravitational particles on the surface of the station, the enclosure.
During the intensive operational interval, losses / leaks of petroleum products / fuels during supply and delivery are associated / combined with dusts / sedimentable particles (dust from cleaning, handling, etc.).
Limiting pollution during refueling of motor vehicles means meeting specific technical requirements.
The main objective is to limit emissions of volatile organic compounds originating in:
1) storage of diesel, gasoline,
2) putting into operation their supply to pumps, terminals in oil stations, and
3) the expansion of birds in the atmosphere during the supply of vehicles.
In fact, virtually any oil station must have a system for recovering vapors from volatile organic compounds.
The obligation concerns the locations, the stations where the total annual quantity transited / handled, handled / distributed is higher than 500 m^3/ year.
To this is added an automatic system for monitoring / measuring the uptake of vapors of volatile organic compounds.
The loss of volatile organic compounds means their escape / elimination into the atmosphere in the gaseous phase, from point sources related to the overall infrastructure of an oil station (fuel distribution).
Supply pumps, terminals, storage tanks, tanks, car tanks, other containers are locations / sources of emission of volatile organic compounds.
In fact, the volatile organic compounds are hydrocarbons with 4-12 carbon atoms, respectively olefins, paraffin, aromatics, having a minimum vapor pressure of 0.01 KPa.
In a vapor recovery unit at the oil station, the average hourly concentration of discharged vapors / birds must be known by measurement.
On this basis, the instrumental and operational correction / adjustment for dilution takes place, because in the process complex in the oil station must not exceed 35 g / Nm^3 / hour of vapors emitted, escaped, lost, evacuated into the atmosphere.
As such, a continuous / discontinuous, quasi-periodic measurement program is considered during the day, at set time intervals.
Discontinuous non-determination removals require at least 4 measurements / determinations per hour.
The total measurement error is not allowed more than 10% of the quantified value.
The measuring equipment / instruments / apparatus must show concentrations of at least 3 g / Nm^3, with an accuracy of at least 95% of the measured value.
On the other hand, the meteoric waters reached on the concrete platform from the space / surface / inside the oil station, can infiltrate into the soil through cracks in the concrete and next to the washing waters in the vicinity of the pump, enriched with residues / fuel mixture pass uncontrolled and accumulates in pseudo-quasi-surface sheets, when there are no separate hydrocarbon separators.
I noticed that in the Petroleum Distribution Stations in the areas investigated by simulation, the disposal of household waste in the former destined area (in containers) falls into the category of auxiliary / complementary stimuli of the process and pollution sources.
If a fuel station is located in a natural risk area (in a geographically delimited perimeter where endogenously there are valences for the production of natural phenomena / dysfunctions / deviations), then the decision to revoke the categories of such units in the environment with natural hazards must be analyzed.
For example, earthquakes, climatic excesses (typhoons), geomorphological damage materialized by displacements, landslides, rock masses, erosion, etc., show that it is necessary to review the locations of stations, to deal with physical, geological, hydrological, floods or biological by avoiding the manifestations of epidemics, insect invasions, rodents, etc.
If a new Fuel Station is being built, it is important to consider inducing risks to the health of the neighborhood / people.
Lack or non-compliance with the rules, hygienic-sanitary requirements, losses, accidental spills of affecting, toxic substances infest the environment.

Often, clogging of wastewater or stormwater collection structures, inability to take over sewerage systems, if associated with storage, storage, handling, handling, inadequate hazardous chemicals, complete the picture of threats to the environment and human health.
The risk of fire must be taken into account, in particular by examining the fire and explosion hazards by means of a strongly accelerated volumetric extension within the perimeter of the refueling station. [8]
The coefficient of fire stability of the storage, fuel storage infrastructure is taken into account, which must be higher than the coefficients of stability of the elements, metal components with a bearing role in the structure of the station construction.
Various researches in the field show that, in fact, fuels and liquid propane in tanks have the property of absorbing the heat radiated by the metal structure of the containers and thus there is a delay in marking the point, the critical-limit situation to which the structures in question yield.
However, fuels must comply with the existing quality standards imposed in that country.
The unloading of fuel from tankers in the storage tank of the station takes place by gravity (at the unloading mouth and through the filling pipes). [9]
It is imperative that the unloading takes place on the basis of the provisions of a Regulation of operation of the station and in accordance with the operating instructions of the unit.
It is of particular importance that when unloading the tank, diesel and gasoline vapors are found circulating, in a closed circuit.
Therefore, any emission into the atmosphere, into the air of diesel, petrol vapors if it takes place, then we must ascertain and record if it is only accidental.
The distribution and delivery of fuel to the vehicles takes place with the help of distribution pumps.
Each pump has 2 supply heads, suction products, fuel from the tank, from the underground storage tank.
A pump has an automatic control and locking system. Its operation is monitored by computer, by process computer, with high safety in operation.
The technological flow of distribution is in a closed system, almost perfectly sealed, without losses.
However, the sulfur content of certain liquid fuels affects the environment.
Combating this critical aspect requires national legislation that empowers competent authorities to control and process the reduction of the harmful content in question, the formalization of a method, a sampling system and methods of analysis.
In frequent situations, fuel oil and heavy diesel with approved sulfur contents are stopped from burning.
Internationally, there is *the Global Fuel Economy Initiative* (GFEI), which aims to reduce greenhouse gas emissions from light vehicles. [3]
These targets provide for a 50% improvement in fuel efficiency (worldwide, by 2050).
We found, in a documentary, in the areas of Bucharest (Romania) and Damascus (Syria), that the wear and deficiencies caused by poor quality diesel come from its high viscosity (kinematic and dynamic viscosity).
At the same time, the insufficient fluidity of diesel affects, so it makes it difficult to start vehicles (turbidity temperature, clogged fuel filters, etc.). [6]
The existence of diesel water and solid particles disturbs the filtration and supply system.

IV. A block diagram of the material and expenditure parameters for the technical, medical-sanitary and safety maximization of the activities in the oil stations

We observe that in urban agglomerations the distribution stations of petroleum products with octane number, with refined products obtained from hydrocarbons, are found “in the network” $\{R_s\}$.
We state this assumption by the fact that no station is "alone" or "unique" in itself.
The stations generally have: 1) the same object of activity, 2) the same mission, 3) the same type of operationality.
Instead, they differ in:
1) quantitative, sustainable and qualitative supply differentiated with refined petroleum products from hydrocarbons, typologically numbered from 1 to 5-6 ΔQ_z (petrol, diesel / diesel, liquefied gas, etc.);
2) different levels of real global reference, ΔS_r;
3) different levels of sustainability / degree of sustainability / durability, (ΔS_d).

On this basis, it is important to design a model of "Optimal sustainable techno-medical-sanitary" {M(TMSD)}, which can be used to iterate / repeat parametric, aiming to achieve, value and quality required for a function general objective F(TMSD). (*fig.1*)

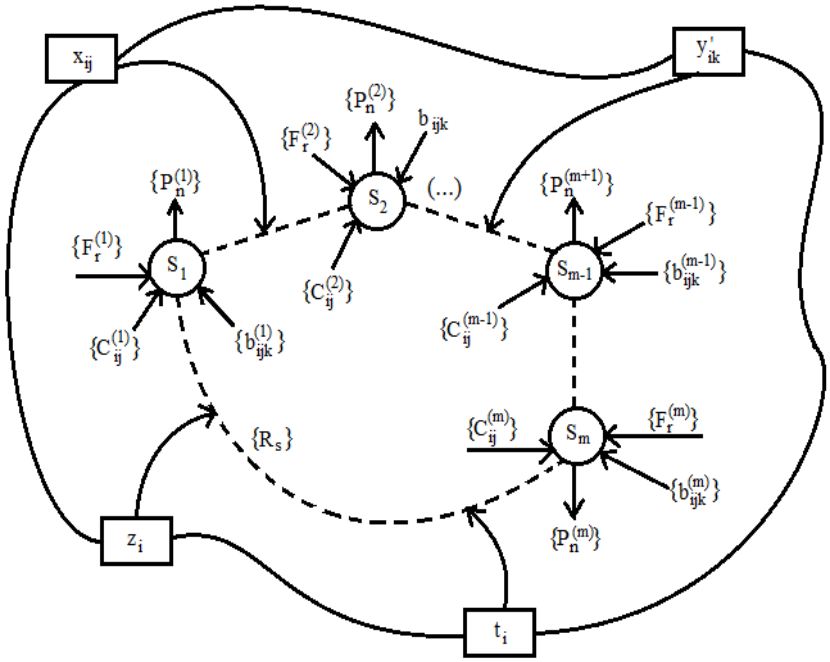

Fig. 1. Block diagram of material and expenditure parameters for technical, medical and safety maximization of activities
(Source: Author J.K., 2018-2021)

In mathematical symbolic expression, the original model in question, launched by this paper, is:

$$\begin{cases} Max\ Min\ F(\text{TMSD}) = Optim\ \{M(TMSD)\} \\ [(\Delta Q_q) * (\Delta S_r) * (\Delta S_d) \rightarrow Max\ (TMSD) \\ \propto_{ijk}^{01} * \propto_{ijk}^{10} * \propto_{ijk}^{11} \xrightarrow{\text{Min } (C_H)} Max\ [E_f] \end{cases} \quad (1)$$

where Min (C_H) is the total expenditure, and Max $[E_f]$ represents the maximum total efficiency (on the whole area configured in the block-scheme formula for the refined petroleum products distribution stations from hydrocarbons).

Usually, the original model (mathematical / symbolic) (1) will continue to be processed in information programming mode ("soft"), and later, there will be the probability of its use as a computing tool have:

a) non-controllable values (those *inputs*),

b) processing, and obtaining controllable values (*outputs*), imposed for minimum costs and maximum efficiency, safety, sustainability.

From a scientific perspective, of networked mathematical analysis, the recorded situations represent cases of the "techno-medical-sanitary" mathematical model.

We consider that a model {M(TMSD)} must have the potential or the set of iterative / repetitive valences for all situations / cases in a limited range [0,1], in which:

"0" = total lack of petroleum products in stocks for distribution to consumers, respectively

"1" = the maximum / projected assortment presence of all fuel assortments in complete controllable quantities (established / predetermined).

V. Conclusions

• The oil station is an entity, an organization responsible for passing fuels through a control point of petroleum products when distribution to consumers, customers, so it is a *supplier of refined hydrocarbon fuels.*

• In this context, *the characterization of the risk in the distribution stations of petroleum* products is treated starting from the qualitative and quantitative determination, from complementary uncertainties, based on probabilities of occurrence of negative effects on the organism, population in well defined exposure conditions.

• It is shown that prolonged occupational exposure to gasoline, as found among employees of oil stations, is a health hazard with *negative effects from benzene constituents* that enter the body.

• *Benzene is said to have a carcinogenic effect* and toluene, ethylene and xylene, although relatively non-carcinogenic, are not good for health.

There are no known or available data in contemporary knowledge that show a level of benzene from which the deterioration of the immune system begins and the state of carcinogenicity appears.

• It is specified that long-term exposure to benzene, occasioned by the operational distribution of fuels in stations, *causes DNA degradation, reaching acute myeloid leukemia or myelodysplastic syndrome.*

• It is concluded that *the cumulative exposure and the higher risk* of inhaling petrol vapors during refueling occurs when permanent staff at petrol stations have a continuous work schedule.

Benzene is responsible for 10-50% of total leukemia mortality, being classified as a carcinogen.

• In this context, recommendations are advanced such as:

- gas station owners to use health risk assessments at service stations,
- comply with specific health regulations, instructions and rules,
- employees to benefit from medical analysis programs, control and techno-socio-medical-sanitary monitoring,
- there are strict control plans for equipment and personal protection.

• Improper maintenance or upkeep, lack of professional interest among employees, lack of control and guidance, mechanical and electrical failures in stations, are those that cause deficiencies in fuel distribution, with effects on human health.

Bibliographical References

[1]. Abd Alrauf Rahban, - Geographical Evaluation of Oil and Gas Resources in Syria, Damascus University Journal, 25: 259–90, 2009

[2]. Adami G., Larese F., Venier M., Barbieri P., Lo Coco F., et al., - Penetration of benzene, toluene and xylenes contained in gasoline through human abdominal skin in vitro. Toxicol. Vitro., 20(8):1321-1330, 2006

[3]. Băbuț G., Moraru R., - New trends in environmental risk assessment and management. Annals of the University of Petroşani – Mining Engineering, vol. 5 (XXVI), Universitas Publishing House, Petroşani, 2004

[4]. Chan C., Özkaynak H., Spengler J.D., Sheldon L., -Driver exposure to volatile organic compounds, CO, ozone and NO_2 under different driving conditions. Environ. Sci. Technol., 25(5): 964-972, 1991

[5]. Duarte-Davidson R., Courage C., Rushton L., et al., - Benzene in the Environment: an Assessment of the Potential Risks to the Health of the Population. Occupational and Environmental Medicine, 58(1):2–13, 2010

[6]. Edokpolo B, Yu Q, Connell D., - Health Risk Assessment of Ambient Air Concentrations of Benzene, Toluene and Xylene (BTX) in Service Station Environments. International Journal of Environmental Research and Public Health, 11(6): 6354–6374., Risk Assessment of Environmental Exposures to Petrol, 60, 2014

[7]. Khamis Jamal, - Case study in petroleum products distribution stations in Damascus, / Dampress Media Association / Dampress Media, 2020

[8]. Khamis Jamal, - Economy and management of critical cases at the stations of distribution of petroleum products in Damasc, Syria, Workshop 3: Knowledge, Innovation, Smart Development And Human Capital, The Romanian Academy House, Calea 13 Septembrie no. 13, East Wing, Groundfloor, P-231, Romanian Academy, National Institute for Economic Research NIER, The 6 th International Conference, Economic Scientific Research–Theoretical, Empirical and Practical Approaches, ESPERA 2019, Bucharest, October 10 th -11 th, 2019

[9]. Khamis Jamal, - Managing critical industrial and medical cases in petroleum products distribution stations in Damascus, Syria during 2016-2019/ 2016-2019, Al- Wehdeh Association for publishing/, Tishreen newspaper 2017

[10]. Khamis Jamal,- Eco-network characterization of the distribution of petroleum products in Damascus, Syria 3/ Knowledge, Innovation, Smart Development and Human Capital / The 7 International Conference the Economic Scientific Research – Theoretical, Empirical and Practical Approaches, Romanian Academy National Institute of Economic Research, National Bank of Romania, Centre for Economic Information and Documentation, 30 Years of Inspiring Academic Economic Research – From the Transition to Market Economy to the Interlinked Crises of 21 Century, Bucharest, Romania, November 26-27, 2020

[11]. Khamis Jamal, et al., - Super-compact structures of quality standards for health and security in the sustainable development of a Mining Basin in Romania, International Journal of Research in Engineering & Technology, ISSN(P): 2347–4599; © Impact Journal**,** ISSN(E): 2321–8843, Vol. 8, Issue 2, 11–22

[12]. Makwela M.H., - Occupational exposure and genotoxicity among Ethekwini municipality petrol attendants, School of Nursing and Public Health, College of Health Sciences, University of KwaZulu-Natal, 2013

[13]. Morales Terrés, Isabel M., et al., - Assessing the impact of petrol stations on their immediate surroundings, Journal of Environmental Management, 91, pp. 2754-2762, 2010

[14]. Mshelia A.M, John Abdullahi, Emmanuel Daniel Dawha, - Environmental Effects of Petrol Stations at Close Proximities to Residential Buildings in Maiduguri and Jere, Borno State, Nigeria, IOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 20, Issue 4, Ver. IV, pp. 01-08, Apr. 2015

[15]. Schnatter A.R., Armstrong T.W., Nicolich M.J., et al., - Lymphohaematopoietic Malignancies and Quantitative Estimates of Exposure to Benzene in Canadian Petroleum Distribution Workers. Occupational and Environmental Medicine 53(11): 773–781, 1996

[16]. Tunsaringkarn T., Siriwong W., Rungsiyothin A., Nopparatbundit S., - Occupational exposure of gasoline station workers to BTEX compounds in Bangkok, Thailand. Int. J. Occ. Environ. Med.;3(3):117-125, 2010

Jamal KHAMIS, et. al. "Impact of the Distribution of Hydrocarbon Fuels on the Environment." *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*, 14(7), (2021): pp 01-06.