

# **Assessment of Risks Associated with Activities in Filling Stations using Kinney Method: A case Study of Communal District 5 of Niamey (ACN5) Niger Republic**

**Zakari Mahamadou Mounir<sup>1,2\*</sup>, Paul Nguema Fabrice<sup>3</sup>, Keita Souleymane<sup>4</sup> and Esly Emmanuel<sup>5</sup>**

<sup>1</sup>Département Hygiène Sécurité Environnement, Institut Universitaire de Technologie, Université de Zinder, BP 656 Zinder, Niger.

<sup>2</sup>Laboratoire Ville et Développement Territorial au Sahel (VIDET-Sahel), Zinder, Niger.

<sup>3</sup>Faculty of Agronomy and Agricultural Science, University of Dschang School of Wood, Water and Natural Resources, P.O.Box 786, Ebolowa, Cameroon.

<sup>4</sup>Département Génie Civil, Ecole Nationale d'Ingénieurs Abderhamane Baba Touré, Mali.

<sup>5</sup>Adamawa State Rural Water Supply and Environmental Sanitation Agency, PMB 2251, Adamawa State, Nigeria.

## **Authors' contributions**

*This work was carried out in collaboration among all authors. The study is collaborative work – study design development, sample size selection, data acquisition, data interpretation and draft development by all authors. All authors reviewed and approved the final Manuscript.*

## **Article Information**

DOI: 10.9734/CJAST/2021/v40i2531509

### Editor(s):

(1) Dr. Elena Lanchares Sancho, University of Zaragoza, Spain.

### Reviewers:

(1) Gbaguidi Gouvidé Jean, University of Abomey-Calavi, Benin.

(2) Francisco Ureña Prieto, Universidad Nacional de Educación a Distancia (UNED), Spain.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/74103>

**Original Research Article**

**Received 10 July 2021  
Accepted 20 Septembre 2021  
Published 24 Septembre 2021**

## **ABSTRACT**

Filling Stations are Facilities developed for provision of Goods – Automobile Fuel, Other Petroleum Products and Services – Servicing of Automobiles, Filling Stations are vital and key to the Transport and Logistics Management Industry. Despite playing a vital developmental/Economic roles Filling Stations can unfortunately be Sources of Risks/Hazardous and Accidents to Human and the Environment.

In Niger Republic, Filling Stations is a "fashionable" Phenomenon, that is essential to have a

general establishment Master Plan, and Risk Prevention as well as Mitigation Plans. The objective of this Study is to assess the Risks associated with the presence and activities of Filling Station in Niamey Communal District 5 (ACN5). The Study considered compliance with Regulations on Location and Activities of Filling Stations and Risk associated with the Filling Station and their Activities using Kinney Method. The Result shows that there is no harmonious integration of these Companies into the Urban Development Plan due to lack of Compliance with certain Regulatory Provisions. The diagnosis highlights that the Risks of Explosion, Fire, Pollution (Water, Soil) are the most to be feared with high scores ( $\geq 300$ ) and 6% of the Filling Stations have must cases of non-Compliance to Regulations are supposed to be suspended/banned. Adoption of best practices in Operational Risk Management, namely Identification, Assessment, Mitigation and Monitoring of Risks is to be strictly adhered to by Filling Stations Studied.

*Keywords: Risk; filling station; kinney method; ACN5; Niger.*

## 1. INTRODUCTION

The Filling Stations (also called Service Stations, Gas Stations, Distribution Station, Petrol Stations) are an indispensable part of a Modern Society. In Africa, the Oil and Gas Industries are among the most lucrative and constitute important factors of Economic Growth thanks to the proliferation of Filling Stations. They are Infrastructures intended mainly to supply fuel to Motorists. Over time, they have experienced a real evolution in Cities with the grafting of new activities such as the Sale of Accessories and other Products in Stores, Washing, Troubleshooting, etc. which gives them the character of Urban and Economic Infrastructure. However, according [1], Filling Stations inside the Urban Environment are known as one of the existing and potential Dangers in Cities.

Law n ° 2007-01 of January 31, 2007 determining the Petroleum Code, established the Legal, Fiscal, Customs and Foreign exchange regime for the activities of Prospecting, Research, Exploitation and Transportation of Hydrocarbons in Republic of Niger. Thus, for the past Ten Years, the Oil Industry has experienced a boom due to Investments in the Hydrocarbon Sector by Private Actors and Multinational Companies, particularly in Filling Stations.

Gasoline, Diesel stored and sold at Filling Stations are complex mixtures of Petroleum Hydrocarbons. The Hydrocarbon composition depends on factors such as the Origin of the Crude Oil subjected to refining and the refining conditions [2]. In addition, various additives are added in Small amounts (or even in traces) to improve the technical properties of fuels. Their

choices and concentrations also varies depending on the Oil Company. The work of [3] and [4] concluded that it is impossible to draw up an exhaustive list of additives. But, for example, to improve the Octane number, the additive Methyl-t-Buthylether (MTBE) is added to Gasoline to replace the previous Lead-based additives which is a poison with significant negative repercussions on Health. The research of [5] found that both Gasoline and Diesel are made up of four main Hydrocarbon structures: N-alkanes or n-Paraffins (octane and heptane play a particular role), Iso-alkanes or iso Paraffins, Cyclanes or Cycloparaffins, Aromatic compounds (BTEX and PAHs).

However, the problem of lack of or inadequate Risk Management is quite profound in Filling Stations across the World. According to [6], Globally, about half of Risk or Dangers at Filling Stations are attributed to carelessness by Workers and Owners of these Stations. The chance of an incident and its consequences vary between Stations, similarly, the action needed to prevent incidents will vary. Some of the Risks according to [7] include exposure to a mixture of toxic substances. Because of Gasoline's and Diesel's toxicity in fact, many Countries have introduced regulations aiming to reduce the content of Aromatics in vehicular fuels.

Globally, Risk is a combination of the interaction of a Hazard, Exposure and Vulnerability [8], which can be represented by the three sides of a triangle. [9] defines Technological Hazard (case of Gas station) as the interaction between Technology, Society and the Environment. He argues that Technological Hazards are a product of our Society and not acts of God or extreme Geophysical events. They are the Product of

failures in Technological Systems and shortcomings in the Political, Social, and Economic Systems that govern the use of Technology.

There has been no Research on Technological Hazard posed by Filling Stations in Niger Republic. Most of the Academic Literature in Niger Republic and Africa generally, has focused on issues relating to Fuel Prices, the Economic benefits of Filling Stations, Fuel Demand and Health impacts ([10], [11], [12]).

This Research deals with the issue of Risks linked to the Establishment and Operation of Filling Stations in the City of Niamey. The objective is to analyze the Safety and Environmental Risks through the Verification of Compliance with the Laws and Regulations and assess the Risks associated with Patrol Station using the Kinney method.

## 2. MATERIALS AND METHODS

### 2.1 Presentation of the Study Area

The City of Niamey, Capital of Niger Republic, is located in the South-Western Region of Country between Latitudes 13 ° 35 'and 13 ° 24' South and Longitudes 2 ° 15 'East. With altitude between 160m and 250m. The City is made up of two unit of Geographic Formation: on the left is Plateau and right Plain. The latter rests on Alluvial Terraces with an average altitude of 185m, which can be flooded in Many Places below 182 m [13]. It has an Area of 255 KM2 with a Population estimated in 2020 at 1,324,670 Inhabitants according to the National Institute of Statistics (INS). The City of is made up of Five Municipal Districts Headed by Mayors.

The Niamey Communal District 5 (ACN5) of the City of Niamey administratively has seven Main Districts in Urban Areas: Lamordé, Nogaré, Karadjé, Kirkissoye, Gawéye, Banga Bana and Gnalga and 12 Administrative Villages with an estimated population of 170,634 inhabitants. Map n ° 1 shows the ACN5.

### 2.2 Methodology

#### 2.2.1 Methodological Approach

Sampling Research Method was used in the study. Risk Analysis (Kinney Method), an Extensive Questionnaire with Respondent

Feedback and a Practical Field Investigation of each Filling Station was deployed and the study was conducted in Four Stages:

Step 1: Documentary Research based on the information available and accessible at the Filling

Stations, supplemented with a Field visit to Geo-locate the Sites and learn about their work and Environmental conditions. Survey Questionnaire serving as a framework for the Field Visit was administered to 25 Pump Attendants, 25 Managers and 200 Households (chosen at random).

Step 2: Examination of the Risks at Filling Stations by observing Risk behaviours and the availability of Protective/Prevention Gear/Equipment.

Step 3: Profiling of level of Compliance with the Laws and Regulations relating to Operation of a Filling Station.

Step 4: Risk estimates using Kinney Method, each type of Risk identified is assessed and rated on the Scale of the three variables in Table 1, 2 and 3. The result determine the Risk Score (Table 4).

#### 2.2.2 Kinney method

The method developed by G.F. Kinney and A.D. Wiruth (1976) known as Fine-Kinney's Method has been Popular thanks to the Paper Published by the Naval Weapons Center of California with the title "Practical Risk Analysis for Safety Management". The method developed "as an outgrowth of Safety considerations for a continuing Programme of Explosive blast effects" has been a resounding success, particularly in Europe. It is listed by Prevention Experts as a Method of Prioritizing and not of Screening Risks for both large and small Businesses [14].

With Fine-Kinney Risk Analysis Assessment Method, Probability, Frequency and Severity Parameters and Scale Tables of Each Parameter are included. In developing these Scale

Tables, Reference Points were determined in scoring and according to the Reference Points, other Scores were determined based on Experience.

Probability, Frequency and Severity Parameter Scales Recommended for use in Fine-Kinney Method are provided in Table 1, Table 2 and Table 3 respectively.

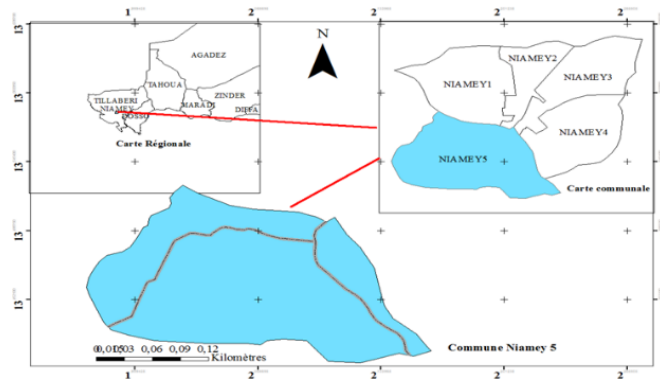


Fig. 1. Map of the Niamey Communal District 5

Table 1. Probability scale of Fine-Kinney Method

PROBABILITY	Value
Might well be expected	10
Quite possible	6
Unusual but possible	3
Only remotely possible	1
Conceivable but very unlikely	0.5
Practically impossible	0.2
Virtually impossible	0.1

Source: [15].

Table 2. Frequency scale of Fine-Kinney Method

Frequency	Value
Continuous	10
Frequent (Daily)	6
Occasional (Weekly)	3
Unusual (Monthly)	2
Rare (a few per Year)	1
Very rare (Yearly)	0.5

Source: [15].

Table 3. Severity Scale of Fine-Kinney Method

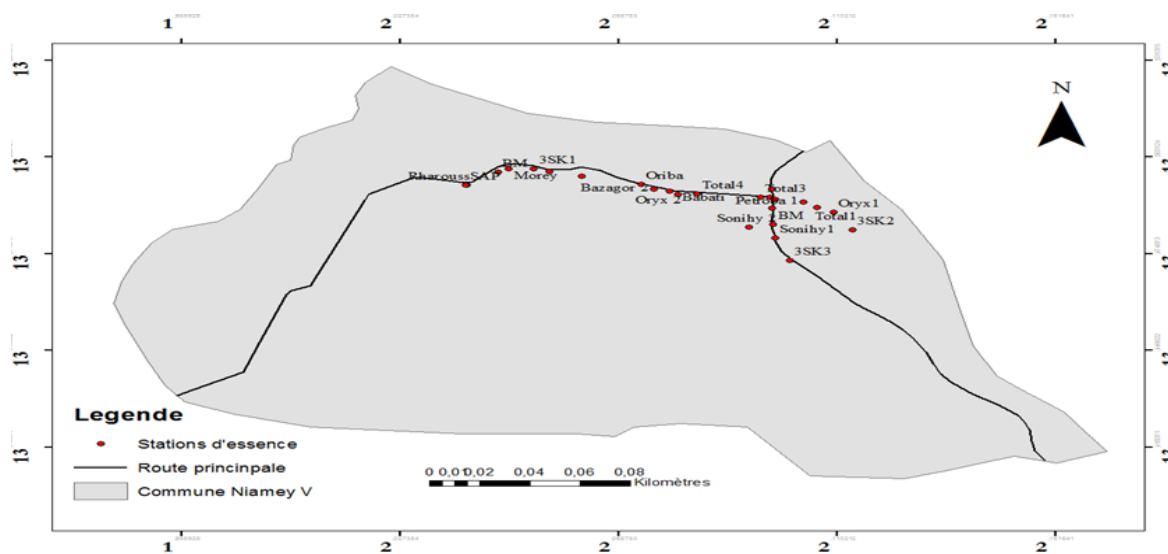
Severity	Value
Catastrophe (Many Fatalities, or >\$107 damage)	10
Disaster (Few Fatalities, or >\$106 damage)	6
Very Serious (Fatality, or >\$105 damage)	3
Serious (Serious Injury, or >\$104 damage)	2
Important (Disability, or >\$103 damage)	1
Noticeable (Minor First Aid accident, or >\$ 100 damage)	0,5

Source: [15].

**Table 4. Risk Scale of Fine-Kinney Method**

Value	Probability Risk
R<20	Risk; Perhaps Acceptable
20<R<70	Possible Risk; Attention indicated
70<R<200	Substantial Risk; Correction needed
200<R<400	High Risk; Immediate correction required
R>400	Very high Risk; Consider discontinuing operation

Source: [15].



**Fig. 2. Map of Geo-location of ACN5 Filling Stations**

Depending on the determined Risk, Probability, Frequency and Severity values are obtained from the Table and these three Factors are multiplied, and the Risk Score is calculated. The obtained Risk Scores are classified according to Table 4.

**2.3. Data collection**

Twenty-nine (29) Filling Stations are identified in ACN5, of which twenty-five (25) are Operational. Map 2 shows the Geo-referencing of the Filling Stations in the Study Area.

This geo-referencing made it possible to highlight that there is a concentration of Filling Stations on the Main Road crossing ACN5.

Fieldwork revealed that all Filling Stations are located in an open Environment within the Urban Area with two things in common: Distribution Area and Unloading Area, which are generally separate. Data collection also revealed that 84% of Filling Stations are privately owned and / or independent and 16% are owned by Oil Conglomerates. In terms of equipment, while the former operate with limited means, the latter are often equipped with sophisticated means. The table below provides information on the activities of Filling Stations and their surface types.

**Table 5. Information on Filling Stations in the study area**

N°	Filling Stations Name	Surface type	Activities
1	Oriba	cemented surface	Corner Shops, Vehicle Servicing Shop/Workshop
2	Sonihy 1	No cemented surface	Vehicle Servicing Shop/Workshop, sell Gas
3	Sonihy 2	cemented surface	Vehicle Servicing Shop/Workshop, sell Gas

N°	Filling Stations Name	Surface type	Activities
4	3SK 1	cemented surface	Vehicle Servicing Shop/Workshop, Trades in Electronic-Money Transfer transactions.
5	3Sk 2	cemented surface	Vehicle Servicing Shop/Workshop
6	3Sk 3	cemented surface	Car Washing Services and/or Vehicle Servicing Shop/Workshop
7	IB petroleum	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
8	Escadrille	cemented surface	Vehicle Servicing Shop/Workshop
9	Morey	cemented surface	Car Washing Services and/or Vehicle Servicing Shop/Workshop, Corner Shops
10	BM trading 1	cemented surface	Trades in Electronic-Money Transfer transactions. sell Gas, Vehicle Servicing Shop/Workshop
11	BM trading 2	cemented surface	Vehicle Servicing Shop/Workshop
12	Rharouss	cemented surface	Vehicle Servicing Shop/Workshop, Car Washing Services and/or Vehicle Servicing Shop/Workshop
13	Sonihy 3	cemented surface	sell Gas, Vehicle Servicing Shop/Workshop
14	Oryx	No cemented surface	Vehicle Servicing Shop/Workshop
15	Total 1	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
16	Total 2	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
17	Total 3	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
18	Total 4	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops, sell Gas, Trades in Electronic-Money Transfer transactions
19	Petroba	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
20	Sap	cemented surface	Vehicle Servicing Shop/Workshop
21	Bazagor 1	cemented surface	Vehicle Servicing Shop/Workshop, Trades in Electronic-Money Transfer transactions
22	Bazagor 2	cemented surface	Vehicle Servicing Shop/Workshop
23	Oilibya 1	cemented surface	Vehicle Servicing Shop/Workshop, Trades in Electronic-Money Transfer transactions , Corner Shops , sell Gas,
24	Oilibya 2	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops
25	Babati	cemented surface	Vehicle Servicing Shop/Workshop, Corner Shops

Source: Field Survey Data, 2021

The information in this table can be summarised as follows:

- 44% of Filling Stations have Corner Shops
- 36% do runs Car Washing Services and/or Vehicle Servicing Shop/Workshop
- 20% sell Gas and trades in Electronic-Money Transfer transactions.

Additional information, the Study observed:

- 92% of Filling Stations have a cement concrete surface and Perimeter Fence,
- 100% of Filling Stations received their supply from the Nigerien Petroleum Products

Company (SONIDEP)

80% of Managers are illiterate and / or do not have Secondary School Certificate.

### 3. RESULTS

#### 3.1 Control of Compliance with Regulatory Provisions and Other Standards

For the safety of People, Property and the Environment, Republic of Niger has legislated laws and other Regulations in the Oil (Hydrocarbon) Sector. Among which is the Ordinances No. 007 / MMH of February 21, 1980 that defines the Technical and Safety Standards to which Filling Stations in Niger Republic must be subject to. These are in particular the rules of Siting, Construction, Operation and Safety.

According to the General Directorate of Hydrocarbons, all Filling Stations are to be subjected to Hazard Study. And Technicians of the Directorate to conduct follow-up-control visits twice a year, to check the conformity of the installations, the quality of the products and the calibration.

In line with the foregoing the following were observed during the Study:

- Availability of Sandboxes and Fire Extinguishers at all Filling Stations surveyed.
- Filling Station Staff wears Personal Protective Equipment (PPE) and have formal training on Fire safety.
- 32% of the surveyed Filling Stations have smoke detector Alarms and/or Surveillance Cameras installed at appropriate locations,
- Only 16% of the surveyed Filling Station have Waste Management Procedure and Sanitation facilities. In some, non-separation of Waste (Common and Contaminated), Poor Disposal, the absence and / or Poor Design of Sanitation Structures, etc. were observed, this is noncompliance to Ordinances No. 007 / MMH of February 21, 1980, that requires Filling Stations to properly Manage their Waste (Solid as well as Liquid).
- Only 16% of Filling Stations have a poster showing Safety Instructions during unloading. Provisions of the joint Decree n ° 000010 MM / DI / MEP of February 4, 2013 sets the minimum distances to be observed when setting up

Hydrocarbon Depots (Service Stations, Depots-Packages, Gas Depots) classified in the 3rd class of Dangerous, Unhealthy or Inconvenient Establishments (EDII in French), subjecting the Surveyed Filling Station to above provision the following were deduced:

- 40% of the Filling Stations surveyed are in the vicinity of either Schools, Markets, or a Health Center and do not respect the Regulatory distance of at least 100m;
- 12% of the Filling Stations surveyed are within a radius of less than 1000m with strategic Areas (Company of Fire Fighters, Police Station, Customs Camp/Post), that constitutes non-Compliance with Regulation;
- 24% of the Filling Stations surveyed do not respect the minimum distance of 200m between two Stations as contained in the 3rd class of EDII;
- 40% of the Filling Stations surveyed are adjacent to Homes and/or Public Buildings (Banks, Town Halls, etc.) and do not have separation walls of at least 2m.

#### 3.2 Risk Estimates Using Kinney's Method

The diagnostic elements of the first two steps provide information on the potential Risks at the level of ACN5 Filling Stations. Thus, the criteria on which the diagnosis is based are among others:

- Types of related activities: sale of Gas and Storage conditions, Car Washing Services, Servicing Shop, Shop, etc.
- Location and respect for Regulatory Distances
- Risky activities on Site: Cigarettes, Tea Stove (Heater/Flames), Use of the Mobile Phone, Non-Stopping of Customers' Engines, Fuel (Petrol, Diesel etc.) spillage, electrical installation, etc.
- Activities at Risk in the neighborhood in particular anything involving fire: Grilling, Incineration of Waste and other uses of Fire such as during demonstrations;
- Unloading conditions: Compliance with measures and other Instructions;
- Waste Management (Solid and Liquid),
- Safety Devices put in place: Wearing PPE, presence of Fire Extinguishers and their handling, Alarms, Smoke Detectors, Staff Training, etc.
- Site Characteristics: Waterproofing, Access routes, Attendance, etc. The results of the Study identified Seven Potential Risks:  
1-Risk of fire,

- 2-Risk of explosion,
- 3-Risk of air pollution,
- 4-Risk of soil pollution,
- 5-Risk of water pollution,
- 6-Risk of environmental noise; and
- 7- Health and safety risk.

To evaluate these Risks, the Fine-Kinney Method was used to calculate the scores which are recorded in table n ° 3.

It can be seen from Table 6 that a Risk is characterized by a number of factors and parameters of vulnerability. Thus, the Risk in the Filling Stations evaluated in this study, are Risks of Fire, Explosion and Pollution (Soil and Water) are the most to be feared with scores greater than 300. On the other hand, Air and Noise Pollution have the lowest scores, but are still high.

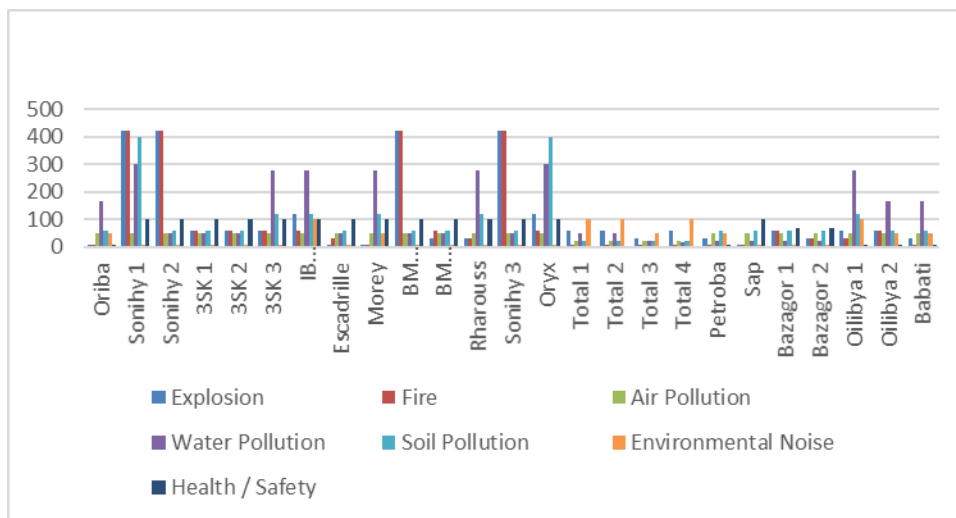
Fig. 3 clarifies the Risk scores by Filling station. A great disparity emerges. For example, for some the amplitude of the scores is [5-100] while for others the amplitude is between [50-420].

For a better understanding of the results of this work, figure 4 allows a reading by type of risk and an easy count. This is how the range [20-70] is the majority for all Risks (except Health / Safety Risk). Also, there is no a single type of Risk that combines all five ranges of Risk scores. Nevertheless, it is easy to observe that the Risk of Explosion and Water Pollution each abounds in four beaches while the Risk of Air Pollution only abounds in one. The Filling Stations with the highest risk scores are Sonihy 1, 2, 3; BM Trading 1 and Oryx.

**Table 6. Risk scores related to the activities of ACN5 Filling Stations by the Kinney Method**

Risk	Probability	Frequency	Gravity	Score
Air pollution	10	10	1	100
Soil pollution	10	7	5	350
Water pollution	10	7	5	350
Explosion	10	7	6	420
Fire	10	7	6	420
Environmental noise	10	10	1	100
Health / Safety	10	10	3	300

Source: Field Survey Data, 2021



**Fig. 3. Risk scores by Filling Station**



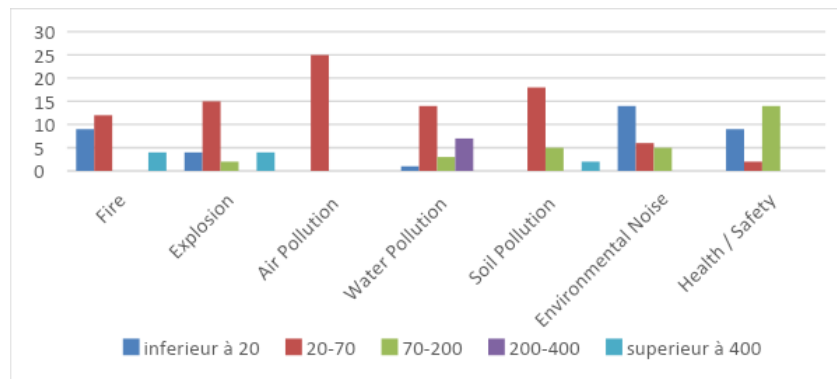


Fig. 4. Range of Risk Scores

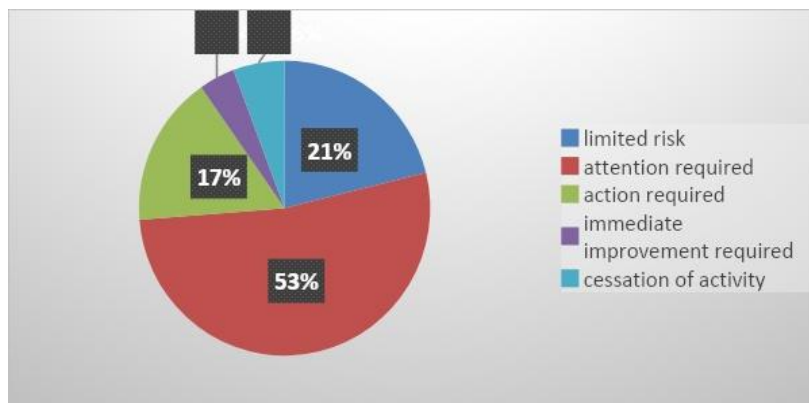


Fig. 5. Statistics on the categorization of ACN5 Filling Stations

By reading the score ranges as defined by Kinney (see Table 2), Figure 5 makes it possible to categorize the ACN5 Filling Stations. It appears that 21% do not have any particular problem regarding Installation, while, 6% of Filling Stations are recommended for immediately stoppage of operation due to unsafe Installation. But overall 73% of the Surveyed Filling Stations requires immediate improvements to continue operating safely.

#### 4. DISCUSSION

The assessment of the results of this study reveals discrepancies in compliance with certain legislative and regulatory provisions, despite the fact that the Regulatory Bodies are expected to subject/subjected the Filling Stations to Hazard Study using the following Laws and Ordinances:

Law n ° 2014-11 of April 16, 2014 regulating the Refining, Import, Export, Storage, Massive Transport, Distribution and Marketing of

Hydrocarbons and By-products, especially the dimension of setting up measures minimizing the transfer of possible Pollution into the Environment;

Law No. 2012-45 of September 25, 2012 on the Labor Code of the Republic of Niger, in particular the provisions of Chapter II on issues of Hygiene, Safety and Health at Work, which obliges the Employer to Guarantee the Safety of People and Property;

Law No. 98-56 on the Framework Law on Environmental Management of December 29, 1998 specifically these Fundamental Principles: Prevention, Precaution, Polluter-Pays, responsibility and Participation;

Law No. 66-33 of May 24, 1966 relating to Dangerous, Unhealthy or particularly inconvenient establishments, the aspect of Regular Monitoring of Stations by the competent Authority.

Ordinance No. 93-13 of March 2, 1993 establishing a public hygiene code, namely the

management of solid and liquid waste in a hygienic and sustainable manner. All of these shortcomings may justify the high risk scores for some aspects of Table 3 like Fire and Explosion. Studies conducted at Teheran by [1] reached similar conclusions with 89% of Service Stations in critical conditions, urgently requiring rapid reconstructions in Residential Areas where the Risk of irreversible damage in the event of an Explosion or Fire is very High.

The possible source of contamination of Water and Soil Pollution at ACN5 Filling Stations is Oil spillage, when filling Storage and especially when dispensing Fuel (with non-waterproof floors). Also, due to the irregular and/or inappropriate nature of the maintenance of the installations, the phenomenon of corrosion as a source of Pollution cannot be ruled out as well. The work of [16] indeed confirms the threat of Groundwater Pollution by Service Stations and that of [17] clearly describes the phenomena of the transport of hydrocarbons in a saturated porous medium such as Groundwater through displacement and the "sink / source" mechanism.

In terms of Air Pollution, the study in France of [18] highlighted that the activity of Service Stations may be at the forefront origin of the local rise in the concentrations of certain Pollutants (Benzene and Toluene) in the outside ambient Air, especially under unfavorable dispersion conditions, which corroborates the results of this Work.

A study commissioned by [19] has developed a methodology for Risk assessment on Facilities such as active, out of Service and /or abandoned Gas Stations using rating Tools. These made it possible to assess and highlight the vulnerability of the Sites and their Environment to Pollution, for the various Environments concerned (Water, Air, Soil) and for the possible targets (Humans and possibly Fauna, Flora and Natural Resources).

Regards Health and Safety, the Risks that may be linked to the activities of ACN5 Filling Stations are justified above all by the absence of a systematic approach to prevention and Risk reduction. Failure to comply with Safety Instructions such as the absence and / or wearing of PPE and basic Hygiene Rules expose Workers to certain serious Health Problems. By referring to the classification of

[20], the Health Risks of Filling and Diesel Fuel are above all the risk of Cancer (R45) and Lung damage if swallowed. (R65).

The National Institute for Industrial Environment and Risks (INERIS) conduct Study on Service Stations and an Accident analysis in 2002 in France. From this work, INERIS defined five Accident Scenarios from the lowest to the highest involving Fire and Explosion phenomena [21]. The tendency is to extrapolate the results of these Scenarios in the case of ACN5 Filling Stations for arguments such as: the permanent creation of conditions of an explosive atmosphere, the absence of clear intervention procedures and / or their non-compliance, the carelessness of the Agents or Residents, the failure of Equipment or means of Protection and also and above all the cramped nature of certain Filling Stations. [22] work in 2018 on the Assessment of Occupational Hazards, Health Problems and Safety Practices of Filling Station Attendants in Uyo, Nigeria revealed that Filling Station attendants are exposed to various Dangers and Health Problems. They also came to the conclusion that the knowledge and use of PPE was very low, hence the questioning of the owners of Filling Stations for the Safety of their Agents.

The analysis of a sample of 270 Accidents that occurred in Gasoline Plants in France between 1958 and 2007 by [23] builds the INERIS study. The main precautions and recommendations recommended by the work of INRS can serve as practical solutions for Risk Management at ACN5 Filling Stations.

## 5. CONCLUSION

This study underlines that prevention in terms of Safety in Filling Stations undoubtedly requires strict compliance with all rules, procedures and working methods. Niger Republic certainly has tangible legislative and regulatory provisions which, if applied, would create conditions to ensure the safety of people, property and the environment.

The diagnosis and the methodology of the Kinney scores made it possible to highlight that the Risks of Explosion, Fire, Hygiene and Safety, Pollution (Water-Soil) are the potential dangers for the Filling Stations of this Study. They also show that the Safety Culture is not effective at the level of most of the Actors. Finally, it is essential that Risk prevention

devices taking into account interactions and interference with the immediate Environment of Filling Stations are in force to carry out activities in complete Safety.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

- Nouri J, Omidvari M, and Tehrani, SM. Risk Assessment and Crisis Management in Gas Stations. *Int. J. Environ. Res.* 2010;4(1):143-152, Winter.
- IFP. Biofuels in Europe, Synthesis Note, Panorama. [Online] Available:[https://inis.iaea.org/collection/NCLCollectionStore/\\_Public/42/050/42050200.pdf?r=1&r=1French](https://inis.iaea.org/collection/NCLCollectionStore/_Public/42/050/42050200.pdf?r=1&r=1French)
- INERIS. Toxicological and environmental data sheets for chemical substances. 2005-2006. France. French.
- Muck JC. Les Carburants. [Online] Available:<http://muck.jeanclau.free.fr>
- Marchal R, Penet S, Solano-Serena F, Vande Castele, JP. Gasoline and Diesel Oil Biodegradation, *Oil & Gas Science and Technology. Rev. IFP.* Vol 58, n°4, pp. 441- 448, editions Technip 2003.
- Munir M. Filling Station Safety and Risk Assessment Framework. University of Petronas, Malaysia 2013.
- Raad R, Marganeand A, & Saade E. Environmental risk assessment of fuel stations in the Jeita Spring Catchment, German-Lebanese Technical Cooperation Project Protection of Jeita Spring 2012.
- United Nations Office for Disaster Risk Reduction (UNISDR). The 2009 UNISDR Terminology on Disaster Risk Reduction. (Online). Available:[https://www.unisdr.org/files/7817\\_UNISDRTerminologyEnglish.pdf](https://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf). [Accessed 19 January 2018].
- Cutter S. Living with risk: the geography of technological hazard. Rutgers University, Great Britain 1993.
- Bennett KF. Matching Filling and diesel fuel demand in South Africa. Department of Mechanical Engineering, University of Cape Town. Available:[www.sciencedirect.com.ez.sun.ac.za/science/article/pii/030142159090217R](http://www.sciencedirect.com.ez.sun.ac.za/science/article/pii/030142159090217R)
- Hadland A. In Terror and in Silence: An Investigation into Safety Levels and Standards December 2002. Social cohesion and integration research programme. Human sciences research Council HSRC, Cape Town, South Africa.
- Moolla R & Curtis CJ. Health Risk Assessment of BTEX Emissions from Gas Stations in Johannesburg, South Africa. Paper presented at: XVth International Medical Geography Symposium on Health and Medical Geography: Highlights of Research, Training and Practice. Michigan, United States 2013.
- Motcho HK. Living environment and health systems in Niamey (Niger). Bordeaux: Michel de Montaigne University of Bordeaux III, Geography Thesis. Year 1991. French.
- Malchaire J, Koob JP. Reliability of the Kinney Method of Risk Analysis ". *Occupational Medicine and Ergonomics.* Flight. 43 no.1, 2006, pp3-8. French.
- Kinney GF, Wiruth AD. Practical Risk Analysis for Safety Management. NWC Technical publication 5865, Naval Weapons Center, China Lake, CA 1976.
- European Environment Agency (EEA). Early Signals and Late Lessons: The Precautionary Principle 1896-2000. Copenhagen.
- Marly X. Soils polluted, supported by the Ministry of Industry as part of the program for collective use of the Internet by SMEs (UCIP), e-training. France 2007. [Online] Available: <http://www.gessta.net>
- OQAI, National Housing Campaign, State of air quality in French housing. Final report, November 2006.
- BRGM. Management of potentially polluted sites in the oil industry - Technical guide for reading the national methodological guide "Management of potentially polluted sites". Report BRGM R 39641, 1997 62 p., 4 fig., 8 tabl., 3 ann. French.
- European Economic Council (EEC). Council Directive 67/548 / EEC of 27 June on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labeling of dangerous substances. [Online] Available:<https://aluplex-signaletique.fr/wp>

- content/uploads/2019/04/directive\_67.548.cee\_as.pdf
21. INERIS. Study of dangerous scenarios in service stations. General Directorate of Risks (DGR). Final report. French; 2002.
  22. Johnson OE and Umoren QM. Assessment of Occupational Hazards, Health Problems and Safety Practices of Filling Station Attendants in Uyo, Nigeria. *Journal of Community Medicine and Primary Health Care*. 2018;30(1):47-57.
  23. INRS. Gas stations and other petroleum product distribution stations. Prevent risks during maintenance operations. Document prepared with the assistance of the "Technical and Safety" commission of the National Federation of Sanitation and Industrial Maintenance Unions (FNSA). ED 6256, December. 2016:68. French.

---

© 2021 Mounir et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle4.com/review-history/74103>