

Oil refineries in Kurdistan: A study of their environmental impact on, humans and their livelihood

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Abstract

This study aims to analyze the environmental impact of Oil refineries in Kurdistan. Petroleum refining is the largest industry of region and a vital part of its economy. Unfortunately, environmental hazards associated with refineries have caused increased concern for humans and their livelihood for communities in close proximity to them. This update provides a general overview of the processes involved and some of the environmental hazards associated with petroleum refining, including enormous amount of ammonia, sulphides, phenol and hydrocarbons etc. Currently, refineries pollute at unacceptable and unhealthy levels in the Kurdistan region. These include metals like lead which makes it hard for children to learn. They also contain dust particles called PM10, which can get deep into lungs and harms our ability to breathe.

Furthermore, studies have found that petroleum effluents be not only be lethal but also, have sub-lethal effects on growth and reproduction in areas close to the outfall. Lastly, the paper examines the effectiveness of environmental policies, institutions and laws in Kurdistan in the protection of the environment from oil refineries pollution. The study specifically highlights failures of the regulatory agencies to control environmental degradation due to legislative and administrative gaps in the current legal and regulatory framework of awarding petroleum refiners' responsibilities. It was also observed that the legislative, regulatory and administrative structure is inadequate to support environmental protection from oil refineries due to several reasons, including lack of a court to examine special cases of oil and gas impacts on the environment, low levels of awareness within local populations to respond to environmental violations, and lack of consistent policies of redress. The paper proposes that the recently released law on petroleum refineries in Kurdistan be strictly enforced and that UK legislation be approved as an advanced country for study.

Keywords: oil refinery effluent petrochemical, liabilities to protect environment, environmental impacts, regulator, lack of comprehensive law

1. Introduction

Petroleum refineries are generally set up to transform or refine unprocessed crude oil into more useful products, using both physical extraction processes and chemical conversion. Physical separation methods isolate the crude oil mixture without changing the chemical properties of its components, as well as the processes of chemical processing that are either thermal or catalytic ^[1].

Now day's sociality many countries around the world depending on the production, trade of oil or refining, as their main source of economies. Yet, these activities can cause severe damage to the environment and agriculture, either knowingly or unintentionally. Petroleum refineries separate crude oil into a wide range of petroleum products through a series of physical and chemical separation techniques. There are various procedures involved which include heating and chemical reactions ^[2]. The refining industry supplies several widely used everyday products including petroleum gas, kerosene, diesel fuel, motor oil, asphalt, and waxes ^[3].

While each of these mentioned products impacting environment in one way another.

Environmental hazards associated with refineries in Kurdistan have caused increased concern for communities in close proximity to them. Recent research highlights that Oil refineries have caused smog and air pollution and currently pollute at unacceptable, unhealthy levels and they produce about 100 chemicals every day ^[4]. Thus, they have become a great problem in Iraq-Kurdistan and as a topic of great concern due to its harmful effects on the quality of life and reduces renewable and non-renewable natural sources as well as a is a major threat to the life of the coming generations. These include metals like lead which makes it hard for children to learn well as unsafe dust particles called PM10, that get deep into our lungs and harms our ability to breathe ^[5].

While, the number of petroleum refinery and other related industrial activity has increased over the past decade within Iraqi Kurdistan region. But still there are almost no studies or little information about the environmental status of the areas around the refinery locations, and the concerns of a possible environmental pollution that will cause health and

¹Angela O. Mamuduand Kevin Igwilo (2019) 'The Design of an Integrated Crude Oil Distillation Column with Submerged Combustion Technology' <<https://openchemicalengineeringjournal.com/volume/13/page/7/fulltext/>> access date 2/2/2020

² Groundwork (undated) 'Oil Refineries, your health and the environment: what you need to know What is an oil refinery?' <<file:///C:/Users/IT%20LOBBY/Desktop/Oil%20Refineries.pdf>> accessed date 2/2/2020

³ Gary J.H., Handwerk G.E. (2005) 'Petroleum Refining: Technology and

Economics, Taylor & Francis' <<https://nptel.ac.in/content/storage2/courses/103103029/pdf/mod2.pdf>> accessed date 2/2/2020

⁴ Ibid

⁵ ibid

life threats to living organisms as a result of spillage of petroleum (crude oil) and petroleum-by products, dumping of waste and other polluting activities which can also reduce the usability of land for development ^[6].

In addition to above, refineries release many gases like Sulphur dioxide (SO₂), nitrogen oxide (NO₂), carbon dioxide, carbon monoxide, methane, dioxins, hydrogen fluoride, chlorine, benzene and others ^[7]. The health effects Many of the gases discharged by refineries are harmful to humans, and can cause permanent damage (such as asthma, coughing, chest pain, choking, and bronchitis), skin irritations, nausea, eye problems, headaches, birth defects, leukemia, and cancers and even death. Young children and the elderly are the worst affected. Some studies have also shown that there is increased risk of diseases from residing in close proximity to these areas or sources of air pollution due to exposure to harmful pollutants. Specifically, residents within less than half a mile 5 have been shown to be at a higher risk than those within greater than half a mile to 5 miles of an oil well ^[8]. A recent study done in Durban presented that school children at a school located next to a refinery suffered between 30% - 40% more breathing problems than children living more than 10 km away ^[9]. This is because the colorless gas with a very strong smell, like rotten eggs as one live closer by can be more in risk of coursing difficult to breath and other illness as stated above. Exposure to SO₂ can provoke asthma attacks. SO₂ mixes easily in water, including moisture in the air to form an acid. Acid rain and early morning dew causes much damage to metals, stones, and the environment. On the other hand, the agriculture sector has been greatly hampered by decades of oil refineries operation in the farmland. The discharge from oil refineries has reduced in quantity and toxicity over recent decades, allowing many impacted environments. Certain agricultural industries such as crops, some fruits and vegetables, and livestock may offer the opportunity for the region to escape from this dependence. The KRG should establish a public-private authority close to one used in the UK to restore this sector which will be discussed further below.

Apart from its potential threats to the environment, the oil industry plays a positive role in society as well, creating many jobs and generating a significant volume of tax revenues and royalties to KRG ^[10]. Petroleum in Iraq and Kurdistan is considered as a single largest source of economic wealth and energy sources for decades, and despite the influx of potential alternative fuels, is predicted to continue well into the future ^[11]. The Petroleum refineries are considered part of the industrial sector in Kurdistan, and

they are an integral part of the economy. Currently providing thousands of jobs to Iraqi people whose jobs are connected to infrastructure for the processing, refining and distribution of petroleum fuels and who have decent economic and standard of livings ^[12]. Nevertheless, this is occurring in petroleum refineries, where various physical and chemical processes are used to turn crude oil into a wide variety of usable petroleum products. Depside all of the negative impacts of oil refineries listed above.

2. Reviewing Regulatory Framework for Environmental Protection and neglecting ecological impacts

The basic law which specifying the rights and responsibilities of Iraqi citizen in the field of environment protection is the constitution of Iraqi federal. Article 33 of the constitution lays down the right of al Iraqi citizen in two paragraphs. First part states that 'every individual has the right to live in safe environmental conditions and second paragraph states, the State shall undertake the protection and preservation of the environment and its biological' ^[13]. According to above statement a state authority under the duty and obligation to not only protect human beings in Iraq and Kurdistan but diversity too and order compensation for any damages inflicted to the health or property due to environmental delinquent acts.

Furthermore, the main legal document which regulates environment protection is the Environmental Protection and Improvement in Iraqi-Kurdistan Region. Article 3 ^[14] established that each person has the right to live in a safe and perfect environment and it is the duty of all people to work for the sake of environmental protection and its perfection. Further states that environmental protection and improvement must be respected in the planning processes at the level of projects, programs, and developing plans in different sectors in the region. Furthermore, article 12 of Environmental Protection and Improvement in Kurdistan Region ^[15] emphases that any person normal or moral, general, specific, mixed, or any agency, after execution of this law, perform an activity effects on the environment, must prepare a study to assess the environmental impact of activities and projects that will be constructed, then send it to the Ministry in order to make a suitable decision about it, in which the study must include evaluation of the positive and negative effects of the project, establishment or factory on the environment and prevent any treat that may causes of pollution, in which attains the engagement to the environmental instructions and controls. That includes the emergency emission states and the commitments to be made as well as the recycle and reuse of the waste is to minimize the possibility of throwing waste into any arable land or waterways.

Moreover, the offence under article 21 ^[16] anyone who causes environmental damage by his or her own acts, neglect or acts under his or her supervision, intervention or influence by individuals or adherents, or by conflict with the laws or regulations and orders, shall be liable and obliged to compensate, eradicate the disability and restore the state as before within a span of time specified by the Ministry.

⁶ Jaffe, A. M. (2007). Iraq's oil sector: past, present and future. James A. Baker III Institute for Public Policy and the Japan Petroleum Energy Center. Rice University.

⁷ Iraq constitution (2005) Article 33

⁸ McKenzie, L. M., Witter, R. Z., Newman, L. S., & Adgate, J. L. (2012). Human health risk assessment of air emissions from development of unconventional natural gas resources. *Science of the Total Environment*.

⁹ Legal Resources Center Dbn(undated) 'Oil Refineries, your health and the environment' <

<https://www.groundwork.org.za/factsheets/Oil%20Refineries.pdf>> accessed date 2/2/2020

¹⁰ USAID, I. (2008). Kurdistan Region: Economic Development Assessment.

¹¹ Karzan Sulaivany (2018) 'Kurdistan Region oil production consistent with over 10M bpd exported in March'<

<https://www.kurdistan24.net/en/economy/afb6bc74-3570-48fa-8e79-390686e2c262> > accessed date 21/2/2020

¹² Ibid (9)

¹³ Iraq constitution (2005) Article 33

¹⁴ Law No. 8 of 2008 Environmental Protection and Improvement in Iraqi Kurdistan Region.

¹⁵ Ibid

¹⁶ Ibid

In the case of neglecting or do not submitting to perform it, the Ministry after notifying the owner, can take over the procedures and action to remove the impairment and the offender tolerates all the loss for this purpose, in addition to the administrative costs by applying the laws of Iraqi civil law 1951 about the responsibility rules in everything when there is no text forenamed about this law ^[17].

Similarly, article 13 ^[18] is another related article which requires from the Minister to request from moral or normal person, or from any agency, before execution of this law, perform an activity affecting the environment, to prepare a study for environmental impact assessment (EIA) of their projects if they need requirements of protecting the environment. In case of negligence or not following up with this law Article 41 ^[19] empower the Minister or his appointed agent can warn any establishment, project or any agency or environmental pollutant source to remove the effected and harmful factor to the environment during a period not exceed ten days from the date of informing the warning or can stop the work, close it and withdraw the environmental consent temporarily until the pollution has been treated and this is organized by instructions.

Article 42 ^[20] is stricter in this area which illustrate that the causer, may also be punishable by imprisonment for a period not less than one month or by a fine not less than 150000 one hundred and fifty thousand dinars and not to exceed than 200 000 000 two hundred million dinars or by both punishments. Furthermore, the punishment can impose a fine not less than 100 000 one hundred thousand dinars on each general director of the dissent and not exceed 10 000 000 ten million dinars on each person who disagrees with the rules of this law, the regulations and the instructions issued in accordance with it ^[21]. However, apart from all the above-mentioned articles, the main problem relating to the causer or offender could be that Kurdistan region is lake of specified court in the area of environmental damage which make the process of implementation harder in order to prosecute the causer. Thus, one may clearly argue that making such articles listed is being pointless without any specific tribunal to enforce the rule.

For example, Article 22 ^[22] of the above-mentioned law states that the exercise and discharge of any of the harmful substances, liquid, gaseous, radioactive or thermal into or into water sources is forbidden if they are not handled in accordance with the usual standards. In addition, Article 28 also prohibiting any activity leads directly or indirectly to impair the soil of agriculture lands degree or deteriorating or polluting it, in a degree that effect on the productive ability or any activity may leads to damage the land areas specialized for grassland, according to the issued regulations and instructions depending on this law. That's including any industrial, commercial, or service activity on agricultural

lands opposite to the verdicts of this law ^[23]. Though, photos bellow can be seen as a good example of how the damages are severe to the society, lands and one can easily establish that these articles above are clearly been breached by many if not all refineries are currently operating in Kurdistan. Meanwhile, fleeing the law and punishment, or with little charge from local or civil courts.

Although some of the refineries have recently been penalized for breaching environmental laws, but due to their association with the oligarchs, or politicians and officials, the process is so difficult to tackle these issues, while Article 29 of Kurdistan's Petroleum Law is meant to ensure that those affected are either bodily or economically are appropriately compensated, and same ^[24]. Article also clearly forbids the use of private properties by the oil companies or oil manufactures.

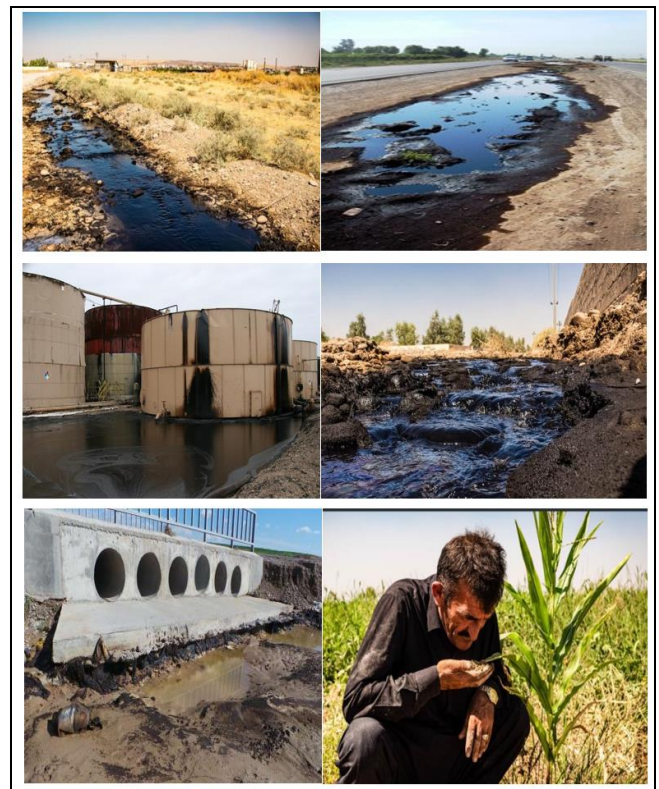


Fig 1: Self-taking images above are taken from the project area (mainly from KAR refinery)

According to Al-Jubury oil refiners polluting water sources with oil waste and toxic chemicals, and destroying agricultural land, leading to desertification, economic losses and threatening food security ^[25]. Organisms are poisoned as the concentrations of toxins increase, and are passed through the food chain and these poisonous chemicals cause cancer and damage internal organs in people and animals, when the soil is harmed, so all the organisms that directly and indirectly require fertile soil to survive, were harmed. By deliberate contamination of rivers, lakes and streams with

¹⁷ Almusaed, A., & Almssad, A. (2015). Building materials in eco-energy houses from Iraq and Iran. *Case Studies in Construction Materials*, 2, 42-54.

¹⁸ Law No. 8 of 2008 Environmental Protection and Improvement in Iraqi Kurdistan Region (Article 13)

¹⁹ Law No. 8 of 2008 Environmental Protection and Improvement in Iraqi Kurdistan Region (Article 14)

²⁰ Ibid (Article 42)

²¹ Ibid

²² Ibid (n 19)

²³ Ibrahim, R. K., Zebari, H. N., & Abdulkareem, H. A. (2016). Potential of Energy Conservation in Residential Building Regulations–Kurdistan, Iraq. *Procedia Environmental Sciences*, 34(2016), 506-513.

²⁴(28) – 2007. OIL AND GAS LAW OF THE KURDISTAN REGION – IRAQ (article 29)

²⁵ Jaafar, R. M., Chettri, J. K., Dalsgaard, I., Al-Jubury, A., Kania, P. W., Skov, J., & Buchmann, K. (2015). Effects of adjuvant Montanide™ ISA 763 A VG in rainbow trout injection vaccinated against *Yersinia ruckeri*. *Fish & shellfish immunology*, 47(2), 797-806.

toxic waste and oil contaminants²⁶. Consequently, the productivity of the main cereal crops wheat, barley, and rice has fallen intensely²⁷.

In addition, Gulala Xalid also mentioned in her thesis that most of the country's food requirements are imported while agriculture was once a vital part of the northern economy, a region once known as Iraq's 'bread basket'²⁸. Iraq and its area (Kurdistan) therefore need to introduce new system for monitoring the environmental impact of refineries in Kurdistan to revive this sector and release contaminants from refineries into air, water and land. This can be done by studying from developed countries such as the UK how they control using the Integrated Pollution Control (IPC) and Environmental program. The legislation provides a dynamic system of regulation which can respond to improvements in industry practice in the field of pollution control by requiring industry to apply the Best Available Technology Not Entailing Excessive Costs (BATNEEC) to control emissions to air, land and water. It is an integrated system in that it requires the use of the control measures which offer best practical environmental option (BPEO) to ensure that the control of emissions to one environmental medium is not to the detriment of the others. The system is site-specific in order that the specific operational and environmental conditions at a site can be taken into account. IPC is enforced by the Environment Agency and the system of site authorisations and regular reporting ensures that IPC is applied. IPC authorisations are also the means by which international commitments as they apply to refineries are implemented²⁹.

More recently, through the 2016 Energy Act³⁰, which introduced a right for the Oil and Gas Authority (OGA) to send a notice of sanction to a person that it suspects has failed to fulfill a duty related to petroleum, the UK has amended its laws in this regard. Such a mistake could entail, among other issues, non-compliance with the terms and conditions of a license. Such a sanction is served beforehand. A sanction notice take an enforcement notice which requiring the recipient to comply with the terms specified in the notice; otherwise a financial penalty notice requiring payment of not exceeding £1 million, although in some particular cases may this right to increase to £5 million or a revocation notice revoking the recipient's licence; and, or an operator removal notice in this case requiring a licensee to remove its operator³¹. The Act also enables a more comprehensive charging of the oil and gas industry for permits and licences for environmental and decommissioning activity. This interim step will encourage and assist agricultural producers by creating a body to market their produce, to manage its transportation outside the region, to make it available in the local markets at reasonable prices, and to improve the produce in terms of

quality and quantity. Certain regulatory bodies include the Health and Safety Executive (HSE), which is responsible for health and safety, and the Hazardous Installations Authority, which is responsible for regulating and facilitating changes in health and safety across the oil and gas sector³². Therefore, there are many ways for a refinery to reduce the amount of pollution it causes. This is can be done by requiring the refinery to install some equipment³³. Although, refinery companies do not want to spend money on reducing pollution unless they are forced to do so.

Additionally, all refineries in UK use primary treatment processes³⁴. Which mean Material recycling and reuse is exemplified on a refinery by recycling the desalters from sour water stripper bottoms. The treatment processes fall into three main categories as follows: primary treatment this consists of the simple separation of gross oil content from solids using techniques such as API separators and plate interceptors. Secondary care progresses further³⁵.

Finally, a key aspect in the operation of treatment plant is the need for refineries to balance the effluent waters before they enter the wastewater treatment plant itself, and particularly upstream of the biological treatment stage. This could help to eliminate excursions from discharge consents caused by process of refining³⁶. Similar method can therefore be employed by the KRG to reduce the environmental impact caused by the Kurdistan refineries. Locals in some villages also recently complained that their drinking water and air sources are being polluted by waste products from illegal refineries, such as toxic gases and various liquid chemicals. In some areas, pollution from the refinery has affected the land, so it is no longer suitable for agriculture. Nevertheless, that not only polluted land or air but also greatly affected the health of the people children are particularly affected by contamination from the soil.

3. Recommendations for KRG

1. this study therefore, recommends that there is the need for updating, the Environmental Protection and Improvement in Iraqi Kurdistan Region which governing air pollution is outdated and lake of detailed of petroleum sector and needs to be revised to be in line with international standards and as mentioned above UK Energy Act 2016 can be seen as an good example and be learned form.
2. Improve the effectiveness of environmental policies with respect to a number of priority environmental objectives adopted nationally or internationally; adhere to and continue to pursue established long-term

³² Gary, J. H., Handwerk, G. E., & Kaiser, M. J. (2007). *Petroleum refining: technology and economics*. CRC press.

³³ Jones, D. S. J. (1995). *Elements of petroleum processing* (p. 22). New York: John Wiley & Sons.

³⁴ Ivan Radelyuk (2019) 'Pitfalls of Wastewater Treatment in Oil Refinery Enterprises in Kazakhstan—A System Approach' <<file:///C:/Users/IT%20LOBBY/Downloads/sustainability-11-01618.pdf>> accessed date 20/02/2020

³⁵ Foster Wheeler Energy Ltd (undated) 'A Strategic Review of the Petroleum Refinery Industry Sector' <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290271/sr-dpub21-e-e.pdf> accessed date 10/02/2020

³⁶ Foster Wheeler Energy Ltd (undated) 'A Strategic Review of the Petroleum Refinery Industry Sector' <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290271/sr-dpub21-e-e.pdf> accessed date 20/02/2020

²⁶ Al-Jubury R (2015) 'Iraq's continuing struggle with conflict pollution' <<https://reliefweb.int/report/iraq/iraq-s-continuing-struggle-conflict-pollution>> accessed on 16/2/2020

²⁷ GulalaXalid, (2015) 'Agriculture Ministry suffers from budget cuts' <<http://www.kurdistan24.net/en/interview/1f6ea0d1-b82a-47fc-8804-cbc1964207a4/Agriculture-Ministry-suffers-from-budget-cuts>> accessed on 16/2/2020

²⁸ Ibid

²⁹ Sorrell, S. (2001). The meaning of BATNEEC. *Journal of Environmental Policy & Planning*.

³⁰ Energy Act 2016 (section 20)

³¹ Bob Palmer (2019) 'Oil Regulation' <<https://gettingthedealthrough.com/area/24/jurisdiction/22/oil-regulation-united-kingdom/>> accessed date 4/2/2020

environmental objectives while closing the implementation gap in Kurdistan.

3. strengthen implementation of environmental policies and legislation, with appropriate supervision of enforcement for both pollution reduction. Especially the newly published regulation regarding refineries licenses and work permission (Regulation No1 2020)
4. Continue efforts to reduce discharges of oily wastewater and other substances from oil refineries. This is can be done by make an obligatory rule for the oil refineries to reuse their water discharge and not release to the arable land or rivers before making sure that the treatment and disposal of hazardous waste are organised in an environmentally sound and economically efficient manner.
5. Educating farmers on what functional measures are adoptable incase crude oil spillages or acquisition of farmland for crude oil exploration, exploitation and production that will be used for its best and economically viable purposes.

4. Conclusion

The paper has looked at oil refineries issues in Iraqi-Kurdistan region that has negative where unchecked oil refineries and exploration had taken place for the past decades. Throughout this paper has been established that the oil and gas manufactory, including legal and illegal refineries has negative effect on farms, farmers and village's livelihood. The interaction between land and heavy oil spillage resulted in destroying agricultural land, leading to losses and threatening food security of the region. The paper also evidence that the region used to be bread basket to whole Iraq yet, currently crude oil wastewater, polluted crop farms and leading to strong negative decreasing. The wastewater that resulted from the refineries contained high levels of pollutants and the quality at mixing point with the treated to the health of the people and they are already affected since the surrounded ground water sources were slightly polluted. The results of technical efficiency in crude oil polluted farms showed that the decreases more than 22% of the crop of farmers which makes it clear that crude oil pollution and the refineries have significant negative affect on agriculture.

Finally, while major concern for the petroleum refinery industry yet to this day they fail to carry out their job duties effectively since they continue to flout environmental regulations in their areas of operations and pay less consideration to environmental protection regimes that would have helped to abate oil pollution. The government on its part has not shown any commitment to enforcing the minimal environmental laws which it created for. Therefore, it's become clear that oil companies and the private refineries has significant effect on livelihood and agriculture in the region and specially in the refineries located area.

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