Original Article: Investigating Standard Environmental Management in Industries (Case Study of Oil Industry)

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ABSTRACT

In many countries of the world, with the help of scientific tools and methods, which are mainly rooted in the specialized foundations of industrial engineering, environmental experts have been able to play a worthy role in identifying and controlling the effects of development on the environment and proper management of environmental projects. The evolution that has occurred in the implementation of Barzeg projects, especially in the oil and gas industry, is the transformation of the project managers from an executor to agents for the application of different ideas, tools and technologies that can be used in all stages of construction, from the preliminary design stage to the design stage. Tufail, purchase of goods, implementation and supervision, implement their proposals after the approval of the employer and MC of the project. Now, despite such a trend and considering the need to protect the environment in different sectors and the requirement to implement the laws, it can be done by setting specific policies and by creating an environmental management system in the form of a long-term and comprehensive program that the stages of the project, from design to its demolition, by entering the project to prevent the creation of adverse effects on the environment, established a preventive and controlling system. In this article, by examining the existing trends in the implementation of projects, as well as adapting them to environmental management trends such as EMS, EIA, SEA, and using control tools, management trends regarding the reduction of adverse environmental effects are discussed.

Introduction

Economic development as a basic pillar in the set of policies of each country is closely related to industry and technology on the one hand and environmental pollution on the other hand [1-3]. The experience of developed countries shows that pursuing economic development goals with an emphasis on the industrial sector and unprincipled exploitation of the environment poses serious risks to sustainable development. Air pollution is one of the environmental problems that has intensified with industrialization and increased energy consumption. Considering industry's primary role in developing

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countries' processes, the relationship between industrial activities and the amount of pollution caused by the industry is significant [4-6]. Regarding the degree of importance, energy industries have always played a significant role in the national economy, macro and development planning, and policies, and have good efficiency. Considering the potentials and capacities, these industries can expand and prosper in other necessary and prerequisite activities and in the direction of non-oil exports. They can play an essential and priority role in terms of weight and value. In line with these economic interests, the environmental damage caused by energy-intensive industries such as steel, aluminum, petrochemical, and cement is inevitable [7-9]. These damages include improper land use change, production of pollution, and destruction of natural resources in the region. Prevention and control of this damage are possible through environmental assessment, proper management, approval of necessary bills and laws, using the necessary tools, and correct and timely monitoring. Environmental impact assessment is a tool to ensure a project's proper and correct implementation. It can be considered a method to determine, predict and interpret the effects of a proposed project on society and the environment (Figure 1) [10].

This method is considered one of the most used tools in environmental decision-making. One of the issues in environmental planning, decision-making, and assessment is the existence of data with uncertainty [11].

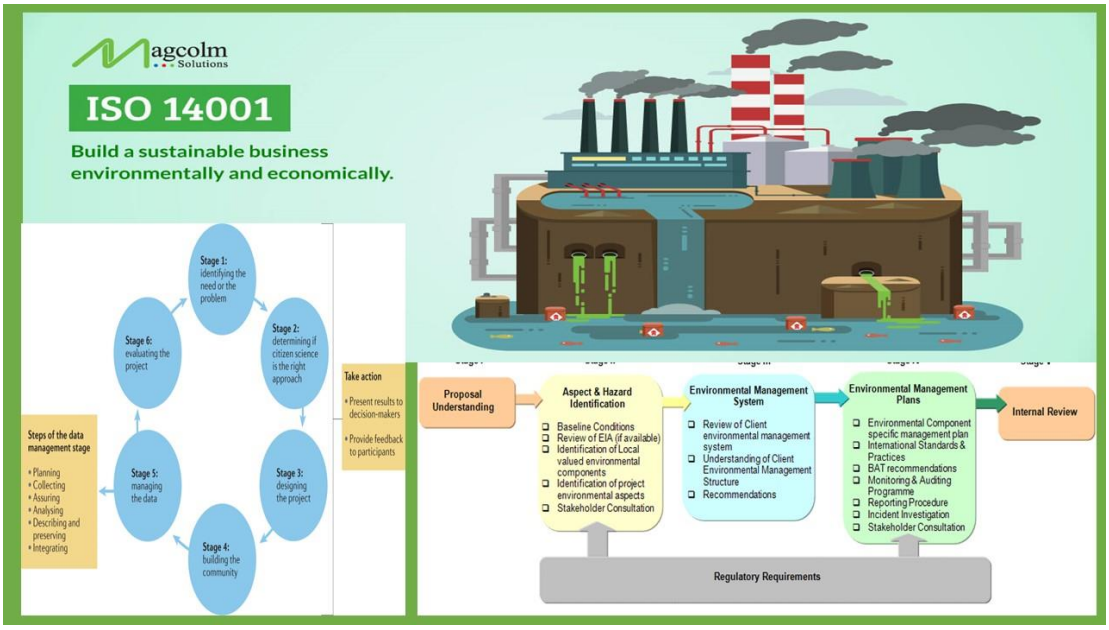

Figure 1. Citizen science in environmental and ecological sciences

In real-world decision-making situations, deterministic logic may face the decision-maker with fundamental limitations due to inherent ambiguities in the criteria. In general, it is accepted that most environmental decisions occur in an environment full of complex and ambiguous goals and restrictions. Therefore, the problem to be decided in the environment cannot be correctly and accurately defined using definite values. To face qualitative decision problems with ambiguous information in the environment, a fuzzy logic theory is proposed as a tool for modeling environmental systems. On the other hand, various methods have been proposed to evaluate the environmental

effects. Each of these methods has been used in different countries with changes. Still, it is clear that none of these methods have been able to completely cover all the effects caused by see the implementation of the project and suggest the most appropriate option. Still, these methods have become more appropriate and complete over time [12-14].

In the field of evaluating the effects of energy industries, various studies have been conducted so far.

Kibert *et al.* (2015) assessed the environmental impacts of energy industries on cement in Florida. For this study, they investigated the effects of two categories of environmental and socio-economic factors. Fuzzy hierarchical analysis weighed the indicators and evaluated the region's environment.

Çebi and Otay (2015), in a study, developed a multi-criteria and multi-stage fuzzy environment considering uncertainties to evaluate the effects of energy industries on the design [15].

In a study, Gomes *et al*. (2014) presented an intelligent system to assess the environmental impacts of energy industries on steel in Brazil. They investigated and evaluated the effects on four categories of economic, social, technical, and environmental factors. This study introduced a fuzzy multi-criteria hierarchical structure based on modeling and simulation to evaluate the effects of steel industries.

Al-Sharrah *et al*. (2010) evaluated the environmental impacts of energy industries on petrochemicals in Kuwait. They examined the effects on three sustainability aspects: environment, economy, and safety.

Tabatabai *et al*. (2012) carried out a study to evaluate the environmental effects of the Gorgan Petrochemical Industries factory construction project. They used the Iranian matrix method to evaluate the effects of this industry [16].

Sepehri Rad *et al*. (2013) studied the establishment of energy-intensive industries in the southern coasts of Sistan and Baluchistan province and its effect on eastern Iran's economic, social, and security development. They considered three industries producing basic metals, non-metallic mineral products, and materials and chemical products as energy-intensive industries.

In a study, Nouri *et al*. (2006) stated the strategic environmental assessment as a decision support tool in the strategic policies of Iran's industrial development [17-19].

The review of past research shows that in recent years, many types of research have been conducted in the environmental impact assessment of energy-intensive industries. Still, scientific and comprehensive work evaluating the environmental effects of energy-intensive industries in terms of reducing uncertainty, especially in the region. Studies of this research have not been done.

Table 1. Classification of environmental effects caused by the activities of energy-intensive industries

Economic/Operational Components (EO)	Physical/Chemical Components (PC)
land use (EO1)	**Air quality range (PC1)**
Economic situation (EO2)	**Creating annoying and disturbing noise on humans (PC2)**
Transport Stream (EO3)	**Making disturbing noise of animal species (PC3)**
Creating employment (EO4)	**Quantity of surface and underground water (PC4)**
Patterns of area preparation (EO5)	**Surface and underground water quality (PC5)**
Urban Development Plans (EO6)	**Irrigation basins and their physical characteristics (PC6)**
Amount of income and expenses (EO7)	
Tourism plans (EO8)	

Future uses (EO9)	**Erosion, settlement and instability (PC7)** **Soil pollution and its permeability (PC8)** **Microclimate of the region (PC9)** **Spectacular ground collapse (PC10)** **Changing water channels and drainage patterns (PC11)**
Social/Cultural Components (SC)	**Biological/ecological components (BE)**
Demographic Structure and Population Growth (SC1) Quality of health and educational services (SC2) Human settlements (SC3) Landscape view (SC4) special and special places such as historical and religious monuments (SC5) Quality of living in the region (SC6) Population movement and migration (SC7) Participation and cooperation of the people of the region (SC8)	**Terrestrial and aquatic ecosystems (BE1)** **Habitats and habitats of species (BE2)** **Biodiversity of the region (BE3)** **Ecological/biological processes (BE4)** **Biologically sensitive areas (BE5)**

Fuzzy RIAM method

The RIAM method is based on analyzing the matrix of activities and environmental parameters. This method was first established by Pastaccia (1998) and used a specific standard for essential evaluation criteria. In this method, the effects of project activities on each of the environmental parameters are determined. For each environment component, a score is given using the defined criteria. After the evaluation based on the mentioned criteria and mathematical calculations, the range of effects is determined from very useful and very positive to very negative. Finally, the works are analyzed by using tables and graphs related to the components of the environment and the predicted effects [20-22].

Discussion and review

The environment is a huge and complex set of various factors that have been created due to a gradual evolution process of living organisms and components of the earth's surface. Industrialization is an activity that is directly related to the development of countries and human welfare. Meanwhile, the human environment is considered a platform for all kinds of development and a template for industry progress. The pollution caused by industrial activities has been a cause of concern for industry professionals and environmental authorities, and they are always looking for compatible policies and rational solutions to clean up the environment in a way that is in harmony with environmental considerations. In this direction and the last decade, industries have been required to establish an environmental management system. The environmental management system is a set of management actions that allow the organization to identify and evaluate the impact of its activities on the environment and ultimately improve its environmental performance. In the field of environmental risk assessment and its management, various research has been conducted, one of which is the research carried out in 2008 by Dr. Karbasi and his colleagues in the Darkhoin oil region. In this study, in the first step, the environmental

aspects of the Darkhoin operation unit (air pollutants, sound, and waste) were identified. Then, using the assessment matrix of environmental aspects, the impact of the activities on the environmental aspect was quantitatively estimated, and management solutions were presented to eliminate the calculated environmental risks. Also, another research was done in 2018 by Dr. Jozi and colleagues. This research evaluated the environmental risk of Tasuj-Selmas gas transmission lines using the indexing method. In this study, the types of environmental risks in pipelines are classified and prioritized based on indicators and criteria, and in the end, suggestions are made to reduce these risks [23].

Table 2. Unexpected activities and incidents of the operational site and its effects on environmental aspects

Effect on human health	Residue	Noise Pollution	soil pollution	air pollution	water pollution	activities	
*	-	*	*	*	-	Transportation of pipes and equipment	**1**
*	-	*	*	*	-	Lifting and moving pipes and equipment	**2**
*	*	*	*	*	-	The activity of preparing the welding site to complete the welding process	**3**
*	*	*	*	*	-	Grinding and using a stone cutting machine	**4**
*	*	-	*	*	-	Insulation of pipes	**5**
*	*	-	*	*	*	Production and distribution of acetylene	**6**
*	-	*	*	*	-	pressure test (hydrotest)	**7**
*	*	-	-	-	-	scaffolding	**8**
*	*	*	*	*	*	Construction and repair of access roads	**9**
*	*	*	*	*	*	Piling, piling, floor construction, and soil compaction	**10**
*	*	*	*	*	-	Storage of equipment, pipes, goods, and chemicals	**11**
*	*	*	*	*	-	painting	**12**
*	*	-	*	*	-	De-stressing	**13**
*	*	*	*	*	-	Sandblasting	**14**
*	*	*	*	*	*	Secondary incidents include fires and explosions caused by nearby projects	**15**
*	*	*	*	*	*	Sea transportation and unloading	**16**
*	-	*	*	*	-	Test of diesel tanks	**17**
*	*	-	-	-	-	Implementation of power supply networks	**18**
-	-	-	*	*	*	Waste production	**19**
-	-	-	*	*	*	Sewage production	**20**
*	-	*	*	-	*	Emergency evacuation of the site in emergencies	**21**

*	*	-	*	*	*	Industrial radiography	**22**
*	*	-	*	*	-	Nondestructive tests	**23**
*	*	*	*	*	-	Welding, electrode cutting, and electrode heating	**24**
*	*	*	*	*	-	Manual air and gas cutting, assembly work	**25**
*	*	*	*	*	-	Working in a closed area	**26**
*	*	*	*	*	-	Rust removal operation	**27**
*	*	*	*	*	-	Carpentry and wood cutting	**28**
*	*	*	*	-	*	Green space and gardening	**29**
*	*	*	*	*	-	Fiberglass pulp cutting	**30**
-	-	-	*	*	-	Mechanical and machinery repair	**31**
*	*	*	-	*	*	Cooking	**32**
*	*	-	*	*	*	fire extinguishing	**33**
*	*	*	*	*	-	Burning garbage	**34**
*	-	*	*	*	-	Waste production and industrial waste storage	**35**
*	-	*	*	*	-	Use of heavy and light vehicles on the site and the road	**36**
*	*	-	*	*	-	Satellite life, work activities on land, and operational site	**37**
*	*	-	-	-	-	Medical affairs	**38**
-	*	-	-	-	-	Manual cargo transportation	**39**
*	-	-	-	-	-	Players on the site	**40**
*	*	-	-	*	-	MT and PT destructive tests	**41**
*	*	*	*	*	*	The occurrence of war, earthquakes, and high waves (tsunami)	**42**
*	*	-	-	*	-	Ultrasonic tests and phase array	**43**

After determining the activities and identifying the effects of air, soil, water, sound, waste, and injuries caused by the mentioned activities, to quantify the risk resulting from these activities, tables of importance, effect, and occurrence frequency were prepared as follows.

Creating oil and chemical effluents, noise pollution, burning of separation gases, accumulation of chemical wastes, waste disposal, and other such issues are significant environmental challenges. Petrochemical units are one of the largest industries whose essential role in the country's economy is undeniable. At the same time, as a group of industrial conversion units that use oil and gas raw materials, they have significant effects on the ecosystem and the surrounding environment. Effects that are destructive and very dangerous if they are not contained and appropriate prevention is not foreseen.

The creation of oil and chemical effluents, noise pollution, burning of separation gases, accumulation of chemical wastes, waste disposal, and other such issues are significant environmental challenges that usually arise next to oil and petrochemical units and if they are investigated. If they are not accurate and standardized, they can be challenging. The interesting point here is that the emergence of petrochemical industries and products has had a tremendous impact on improving

environmental health and preventing public pollution and has contributed significantly to improving the environment. Despite this warning about the consequences related to the environmental consequences of petrochemicals, petrochemical companies have always tried to pay attention to the issue by referring to the standardization of their collection to control the damages and pollution that are created. The importance of this matter is to the extent that after three years of effort and study to reach a control model, the Ministry of Oil finally agreed to establish the HSE management system in the oil industry in 2001. It was decided that after reviewing the available resources in this regard, the model and guidelines for the establishment of the health, safety, and environmental management system should be placed on the agenda of the Central Safety and Fire Supervision Council, and one year later in 2010, by Bijan Namdar Zanganeh, the then Minister of Oil, to implement the requirements of the health, safety management system and the environment was announced at all levels of the oil industry. Examining human resources and resources, organizational structure, and required facilities were among the items that were placed on the agenda.

Modeling the HSE management system of OGP member oil companies can be done by localizing the content according to the type of industry and existing facilities according to the principle of co-existence. The co-end principle explicitly declares that successful experiences of reputable companies with similar performance can speed up programs and create effective leaps in work. Today, in Iran's oil industry, insight and preparation for managing health, safety, and environment programs have been created in an integrated manner. As a strategic industry in the country, the oil industry has always been a pioneer in using international standards and standards and updating management systems. Based on this, it uses its maximum power to create healthy working environments and sustainable development. The integrated management system of health, safety, and environment in the oil industry shorten the way to achieve the goals: to create working environments without accidents, injuries, and environmental pollutants. While reducing costs and risks and increasing safety and opportunities, HSE also provides the possibility of an integrated and reliable audit. In this way, putting these three categories together under integrated management will have significant synergistic and synergistic effects on each other, and the positive results of its algebraic sum will be far more than in the past. Although the establishment of the health, safety, and environment management system was one of the significant effective measures to improve the environmental condition of the oil and refinery units, anyway, only a short visit to the suburbs of these units, such as Imam Port, inhaling the ammonia present in The air, seeing the effluents entering the sea and hearing the heartache of the natives who find their lives affected by these pollutions, make any fair person acknowledge the existence of these problems. In the meantime, the National Petrochemical Company has carried out activities such as industrial and sanitary wastewater treatment through accurate identification of wastewater and quantitative and qualitative measurement of pollutants in all petrochemical units and industrial. Sanitary wastewater treatment systems in all these complexes, which are currently in place in all Petrochemical complexes, wastewater produced in the complexes is collected and purified, and discharged into the environment according to the standards of the environmental organization. The resulting water is reused in the production line. Efforts to prevent air

pollution are being addressed according to quantitative and qualitative evaluation studies of pollutants and necessary measures to control them. While some complexes and the National Petrochemical Industries Company, with the support of some companies and industrialists, have taken action to collect and recycle plastic and PET waste, several projects to identify, classify, separate, process, and dispose of solid waste materials, both industrial and A city in the complexes is also being done in this regard. Conducting environmental research, process improvement and reduction of spills, water and wastewater treatment, air pollution control, and polymer waste recycling are among the axes that the National Petrochemical Company has started conducting related environmental research to develop the relationship between the industry and the university [24].

The development of green space and the integration of industry with green space is one of the main goals of the complexes. Officials always point out that according to environmental standards, 10% of the industrial space should be allocated to green space. Of course, higher percentages in petrochemicals are assigned. For example, 85 hectares of green space have been built in front of 65 hectares of industrial space in Isfahan Petrochemical. About 1000 hectares of green spaces have been built and maintained around 9 current production complexes. The noteworthy point is that the irrigation of these green spaces is done using purified industrial effluents, primarily from consumption.

The HSE management system has been a management tool to control and improve health, safety, and environmental performance in all development programs and industrial projects or organizational organizations by creating a creative cultural platform and a new and systematic attitude in line with sustainable development and human dignity. In an integrated manner, with the convergence and synergistic arrangement of human forces, facilities, and equipment, and by using an efficient training system, periodic audits, evaluation, and continuous improvement, it minimizes the adverse effects of the industry on the environment. It increases its positive effects by ensuring the safety. comprehensively all the employees and colleagues of the organization, equipment, and facilities and reducing accidents and injuries caused by work to zero through controlling or eliminating unsafe conditions and improving the health level of people through the application of managerial, engineering and executive control solutions at all levels of the organization as well as Protecting the environment becomes humanity's capital. With such an approach, in which risk management was considered to depend on the examination of health, safety, and environmental aspects and risks, companies' ability in the topics above increased and provided them with satisfactory and favorable results. In the oil industry, after examining the performance of successful companies such as Shell and Total. Also, managing programs related to incident control with the belief that creating a systematic process in the first place and developing a preventive attitude in the next step will enable our industries to plan and improve effective programs by using new tools and technology. Entered this field, but with all these interpretations, it seems that according to the extent of this industry and petrochemical activities, what is mentioned is lower than the required and expected level, of course, according to the announced development policies in this field, including It is the goals and priorities of this industry.

In this regard, the relevant experts announced some things that affect the environment, and sometimes their absence in

petrochemical industries has increased the complications related to the industrial activities of these units. In the meantime, the lack of use of modern technologies is one of the cases that experts claim, comparing the state of pollution in the country's industries, such as the petrochemical industry, with the aforementioned industries in developed countries shows a direct relationship between the lack of modern and efficient technologies and environmental pollution. As an example of polymer products that are currently produced, they are made of monomers and dangerous organic raw materials that are very carcinogenic. Some of these materials remain in the polymer while converting raw materials into products, which are disposed of at the end of the process and lead to environmental pollution. The main reason for these problems is the lack of appropriate technologies in advanced countries. Since the country's petrochemical industry does not benefit from modern and efficient technologies that consume raw materials entirely and turn them into polymers, complete processing is not done, and the damaged materials are thrown into the environment. When a new environmental standard is established, due to environmental pressures to eliminate existing pollution, it incurs a lot of cost and manpower to reduce a percentage of pollution. Calculations have clarified if the new technology used in the desired industry meets the desired standards. In addition to reducing pollution with its high efficiency, it also increases productivity. Therefore, preserving the environment can also improve technology. This method is used in European countries, and technologies that have reached the end of their life and do not comply with the mentioned standards are collected. Of course, sometimes these technologies are sent to developing countries, and Iran has not been unlucky.

Industrial and sanitary wastewater treatment

Accurate identification of wastewater and quantitative and qualitative measurement of pollutants have been made in all petrochemical units, and industrial and sanitary wastewater treatment systems have been established in all complexes. According to Petrochemical reports, in all petrochemical complexes, wastewater produced in the complexes is collected, purified, and discharged into the environment according to the standards of the Environmental Organization. The resulting water is used again in the production line. In Arak Petrochemical, industrial wastewater is used as process water or in green space irrigation (Figure 2). In the Razi Petrochemical Complex and Bandar Imam, the industrial wastewater management program is being carried out and is being followed seriously. Even in some areas, such as Mahshahr, while the industrial units have not yet been put into operation, the refineries are in the stage of operation and start-up.

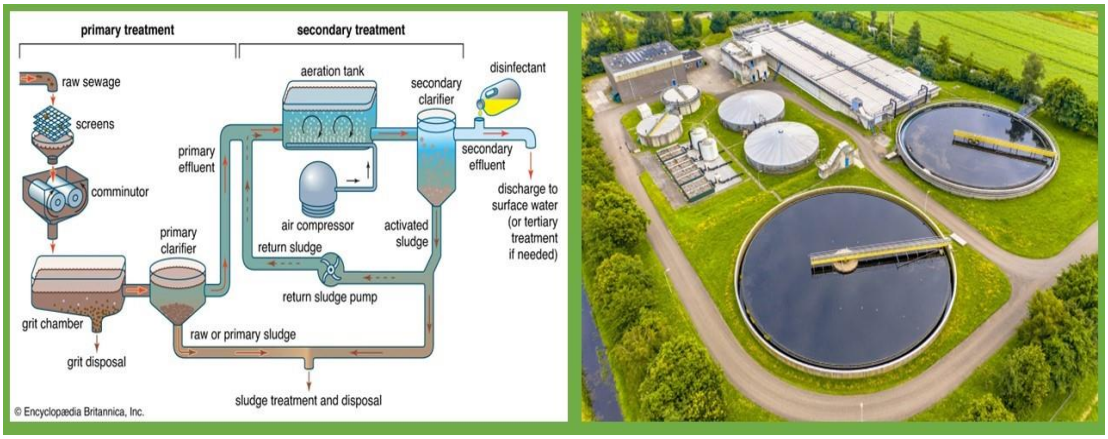

Figure 2. How to Handle Wastewater Treatment and Disposal?

Trying to prevent air pollution

In removing air pollution from petrochemical industries' activity, quantitative and qualitative evaluation studies of pollutants have been carried out, and the necessary measures to control them are being carried out. Two plans are being studied simultaneously in the Razi complex to remove ammonia pollutants. Advanced devices for measuring atmospheric pollutants and closed-circuit cameras have been purchased in some complexes, such as Arak and Bandar Imam. Measurements of pollutants and the burning of existing torches are started on a daily and online basis.

Removal of solid waste

Several projects have been carried out for the identification, classification, separation, processing, and basic disposal of solid waste materials, both industrial and urban, in complexes. Also, with the support of some companies and industrialists, the National Company of Petrochemical Industries has taken action to collect and recycle plastic and PET wastes, one of our country's environmental problems today.

Conducting environmental research

To solve the environmental problems of petrochemical complexes and to develop the relationship between the industry and the university, the National Petrochemical Company has started conducting environmental research.

These activities are based on process improvement and waste reduction, water and sewage filtration, air pollution control, and polymer waste treatment. Of course, petrochemical environmental officials believe that there is effective and coherent communication between the managers of the complexes, the environmental offices, and the NPC environmental office. The senior managers of the College of Production Complexes are sufficiently familiar with environmental issues. They have a great interest in the field of environmental pollution removal and the expansion of green space. Because it will not be practical to carry out many environmental projects in all petrochemical complexes without the favorable opinion of the management of the complexes.

Conclusions

On the one hand, we are facing pollution observed in the areas around the petrochemical industries. In general, in the literature, the oil and gas industries, mainly petrochemical ones, are classified as environmentally polluting. However, we see

petrochemical industries daily; the country gets a new green industry standard, awards, and advertisements.

A) Examples of environmental pollution in petrochemical industries: In petrochemical industries and refineries, based on the type of consumption and production materials and the stage of the processes, the type and amount of pollution in these industries are different. In different processes, contamination is possible in the three stages of collecting raw materials, producing and converting intermediate materials, and collecting and storing the produced materials.

One of the environmental experts lists the following examples for all the above three stages: formaldehyde leakage caused by the production and transportation of methanol needed for acetic acid and MTBE production units, the entry of wastewater from Bandar Imam, Razi and Khark petrochemical complexes into Khormusi and the Persian Gulf. The leakage of aromatic substances such as benzene in Isfahan Petrochemical and the dispersion of sulfur in the surrounding space of complexes such as Razi Petrochemical due to open storage, as observed, these samples were mentioned from all three stages of raw material collection, production, and storage. Also, another expert listed examples of the various environmental effects of these pollutions: the destruction of natural corals in Asaluyeh and Naiband Bay to build new units, the destruction of the ecosystem of the Persian Gulf, and the transformation of Khormosi into a lagoon, due to not observing the correct principles of the placement of complexes. Petrochemicals, the loss of pearl oysters in the Persian Gulf due to the contamination of the waters with various harmful non-biodegradable chemicals, the hydrolysis of the eggs of aquatic organisms, the impoverishment and disappearance of aquatic animals in the infant stage, and the loss of the job security of fishermen and, as a result, efforts to catch in deep and distant places

B) Environmental activities of the National Petrochemical Industries Company: Instead of quoting the opinions of environmental experts, one should listen to the words of the officials of the National Petrochemical Industries Company and see what activities they have done to improve this situation and reduce pollution. The words of the petrochemical officials and the reports and plans of the past, present, and future of the National Petrochemical Industries Company show that this company has given a lot of priority to protecting the environment in the complexes. Obliging all petrochemical complexes to obtain certificates such as ISO14000 from reputable institutions such as SGS and DNV, which the Environmental Organization and the Standard Institute approve. Efforts to receive the first and second national environment awards and success in this matter and receiving the title of the best selected green industry, clean industry, and green industry by the complexes of Isfahan, Arak, Khorasan, Shiraz and Tabriz from the environmental organization, reduction of production waste, effort to filter the effluents and recycle the wastes and develop the existing green space, including petrochemical measures, to achieve the mentioned goals.

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