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RADIOLOGICAL IMPACTS OF NORM AND POLY AROMATIC HYDROCARBON IN PETROLEUM INDUSTRY PROCESS ON MARINE ECOSYSTEM AT THE RED SEA, EGYPT

Kh. M. Zakaria
Nuclear and Radiological Regulatory Authority, Egypt

ABSTRACT: *This study was designed to realized the hazardous effects on marine ecosystem,and assess the impacts of (NORM) ^{238}U, ^{232}Th, and ^{40}K radioactivity and Polycyclic aromatic hydrocarbons in petroleum industry at red sea coastline in Abu Zenima and Abu Rudeis sites. Polycyclic aromatic hydrocarbons(PAHs) individuals Naphthalene, Acenaphthalene, Acenaphthylene, Fluorene, phenanthrene and Fluoranthene were analysed with HPLC with fluorescence detection for sea water, sediments and marine organisms Bivalves , coral reef and starfish. HPGe gamma ray spectrometric technique used for measured The ^{238}U, ^{232}Th, and ^{40}K radioactivity concentration in sea water, sediments and marine organisms Bivalves , coral reef and starfish in both Abu Zenima and Abu Rudeis sites. The data revealed an increase in the ^{238}U, ^{232}Th, and ^{40}K and (PAHs) individuals for sea water, sediments and marine organisms Bivalves , coral reef and starfish in Abu Zenima and Abu Rudeis sites respectively as compared to international maximum allowable concentrations. On the other hand,^{238}U, ^{232}Th, and ^{40}K and (PAHs) individuals for sea water, sediments and marine organismsBivalves , coral reef and starfish were recorded higher concentration levels in Abu Zenima sitesthan Abu Rudeis sites. The data revealed an increase in concentration of (NORM) ^{238}U, ^{232}Th and ^{40}K and PAHs individuals for starfish and coral reef than bivalves marine organisms for both Abu Zenima and Abu Rudeis sites respectively as compared to international maximum allowable concentrations.*

KEY WORDS: *NORM, poly Aromatic Hydrocarbon, Petroleum Industry, Radiological Impacts, Marine Ecosystem*

INTRODUCTION

The oil and hence polycyclic aromatic hydrocarbons **(**PAHs**)** are naturally present in the marine environment, although levels have increased significantly following human extraction and use of oil and gas[1]. Naturally occurring radioactive materials **(**NORM) generally contain radionuclides found in nature, i.e., thorium, uranium, and their progeny [2]. The TENORM waste is produced from several industrial sectors such as uranium and metal mining, phosphate ores? processing, and petroleum industry [3]. The petroleum waste (scale or sludge) have been produced by two mechanisms: either incorporation or precipitation onto the production equipment such as: pipelines, storage tank, pumps[4]. The precipitated TENORM wastes around walls of the petroleum pipes reduce their efficiency and then disposed and replaced periodically by new ones [5]. In the last decade, attention was focused on the environmental and health impact from the release of TENORM wastes.

Studies of naturally occurring radioisotopes of uranium and thorium decay series and primordial potassium in aquatic environment provide information on the environmental pollutants in water bodies, whereas marine invertebrates include sea slugs, sea anemones, starfish, octopuses, clams, sponges, sea worms, crabs, lobsters , coral reef and Bivalves, most of these animals are found close to the shore[6].The possible radionuclide transfer provide an easy assimilation of radiation exposure into human body following their consumption [7, 8]. Moreover, marine organisms such as filter feeders and

piscivorous have the capacity of bioaccumulating more radionuclides and toxic elements from water due to the physical and chemical nature of their body surfaces and feeding habit in their natural habitat, and thus, the determination of radioactivity in the marine organisms and estuaries marine animals assumes greater importance[8]. The level of natural radionuclides in marine organisms (^{226}Ra, ^{228}Ra and ^{40}K) in mostly consumed marine fishes and shell fishes due to their importance as sources of high-quality protein[9].

Releases of radionuclides TE NORM from marine petroleum industry (^{226}Ra, ^{228}Ra and ^{40}K) effects on aquatic animals and marine food chains [9]. Among the many radionuclides discharged into marine environments, (^{226}Ra, ^{228}Ra and ^{40}K) the fate of these radionuclides in the aquatic food chain is essential for a realistic assessment of the risk of their potential impact on human health[10].The contribution of naturally occurring radionuclides reflected in the sediments and marine coastline water. The radiation dose received and accumulated in the body by marine fauna comes from the naturally occurring uranium series [11].

On the other hand petroleum industry in marine have the Polyaromatic hydrocarbons (PAHs) beside ^{238}U, ^{226}Ra, ^{232}Th and ^{40}K are formed during the manufactured oils in marine and sea water [11].Oil and its derivatives PAHs have been found to be toxic to a wide array of marine organisms from marine invertebrates to large seabirds and marine mammals[12]. The effects of PAH son single organisms may add up to affect populations and communities, as well as whole ecosystems[12]. Phytoplankton, the major primary producer in the marine environment, is also sensitive to environmental stressors such as pollution. Phytoplankton plays a crucial role in the inflow of primary energy to coastal food webs, thereby changes in phytoplankton may cause significant damages to the functioning of marine ecosystems[13].

Abu Zenima and Abu Rudeis located on Suez gulf, this area have many oil offshore platform, several of these offshore platforms have been in operation to extract and process oil , processing and petroleum products distribution activities and have resulted in tremendous impacts on the safety and environmental conditions in the Suez Gulf. PAHs leaks and spills have resulted in serious contamination to the Suez gulf. PAHs contain many aromatic generation compounds such as naphthalene, acenaphthalene, acenaphthylene, fluorene, phenanthrene, fluoranthene Each PAHs can also be released into the environment, mainly due to offshore oil production or petroleum transportation[14]. Each PAHs have bad impacts contamination on bivalves and particularly mussels coral reef and star fish and marine invertebrates the status of the of the marine environment for large number of pollutants[15]. Where, PAHs are lipophilic and coplanar; they can accumulate in adipose tissues or secretions. Coral reefs are threatened by small chronic PAHs spills in particular, but larger acute oil spills may also affect coral reefs[15]. Observed biological impacts of oil spills in reef areas range from mass mortality of fish and invertebrates to apparently marine ecosystem devastation [16].PAHs components can dissolve in water to some extent which exposes the corals to potentially toxic compounds. However, toxic concentrations are only encountered in the uppermost part of the water-column[16]. In the Suez Gulf PAHs easily gets trapped in the mangroves and usually persists for a very long time. The PAHs is subject to microbial degradation which may be a rather rapid process in aerobic environments. However, if the PAHs is buried within the anaerobic sediments, bio-degradation proceeds very slowly[17].

MATERIALS AND METHODS

Study area

The investigated area expanded along the coast of Suez gulf , Abu Zenima 29°3'20"N 33°6'11"E to Abu Rudeis 28°53′N 33°11′E

Sampling and sample preparation

Six representative superficial shore sediment, sea water and marine organisms samples (Bivalves , Coral reef and Star fish) were collected from six different stations located along the offshore oil platforms in Abu Zenima (Abu Zenima1 , Abu Zenima 2 and Abu Zenima 3) , and Abu Rudeis 1 , Abu Rudeis2 and Abu Rudeis3). An area of about 25×25 cm^2 up to a depth of 5 cm was cut out using the stainless steel template for guidance[18].The collected shore sediment and sea water samples were transferred to labelled polyethylene bags, closed and transported to the laboratory for preparation and chemical analysis. The shore sediment samples were air-dried at room temperature for a week. And also were dried in an oven at 80°C (for 48h) till constant dry weight was obtained, crushed and homogenized. Then milled and sieved through 0.4mm mesh sieves and stored for further analysis. Water samples, 5 liter of each, were collected using the water sampler. They were collected in polyethylene containers. Then, the samples were acidified with Nitric acid to pH lower than 2 to avoid micro-organisms growth. The samples were stored for radioactivity and Polycyclic aromatic hydrocarbons measurements. The marine organisms samples of Coral reef, Bivalves and Star fish were collected from Abu Zenima and Abu Rudeis and transported to the laboratory in ice boxes and stored at (-10^{o}C) until subjected for further analysis ,about 20 individuals of each species were collected from the study area; at the same locations of the water samples. The samples of marine organisms were then cut into smaller pieces to ensure effective grinding .The cleaned samples were dried in an oven at70 ^{o}C for five days (until there was no detectable change in the mass of the samples) to ensure that the sample were completely moisture free, a constant dry weight being obtained. Dried samples were ground to fine grain sizes by using a stainless steel cutter blender, and sieved in order to obtain homogeneity. All homogenized samples were divided into two parts. The first part was transferred into 250 ml sizes Marinelli beaker, sealed hermetically ,and left for about 4 weeks at room temperature in order to attain secular equilibrium among the ^{238}U-series and ^{232}Th-series precursors with their short–lived progenies[19].The second part was kept in laboratory room temperature for using it in analysis the polycyclic aromatic hydrocarbons Individuals.

Radioactivity measurements:

The activity concentration of the natural radioactivity ^{238}U, ^{232}Th and ^{40}K in the investigated samples were determined using a high-resolution HPGe γ-spectrometry system with 30% counting efficiency. This was performed by taking 250 cm^3 counting vials filled up to a height of 7 cm, which correspond to 170 cm^3. The measurement duration was up to 80 000 sec and were carried out in the Laboratory of Egyptian Nuclear and Radiological Regulatory Authority. The obtained spectra were analyzed. The determination of the presence of radionuclides and calculation of their activities were based on the following gamma-ray transitions (in keV): the ^{226}Ra activities (or ^{238}U activities for samples assumed to be in radioactive equilibrium) were estimated from ^{234}Th (92.38keV, 5.6%), while γ-energies of ^{214}Pb (351.9 keV , 35.8%) and ^{214}Bi (609.3,45%), 1764.5 keV, 17%) and ^{226}Ra (185.99 KeV , 3.5%)were used to estimate the concentration of ^{226}Ra . The Gamma- ray energies of ^{212}Pb (238.6 keV, 45%), and ^{228}Ac (338.4 keV, 12.3%), (911.07 keV, 29%), (968.90 keV, 17 %) were used to estimate the concentration of ^{232}Th. The activity concentrations of ^{40}K were measured directly by its own gamma rays (1460.8 keV, 10.7%). In order to determine the background distribution due to naturally occurring radionuclides in the environment around the detector, an empty polystyrene container was counted in the same manner as the samples. The activity concentrations were calculated after measurement and

subtraction of the background. The activities were determined from measuring their respective decay daughters [20, 21].

PAHs (Polycyclic aromatic hydrocarbons) measurements

Water samples (2.5-L) were collected in glass bottles at the water surface and 50 cm below water level from the six different sites on Abu Zenima and Abu Rudeis. The bottles were covered with screw caps and the samples were immediately transported to the laboratory for analysis. Water samples were filtered to remove sand and debris. Sediment samples (about 2 kg for each sample) were taken from the same locations and time for water sampling at a depth 5 cm of sediment surface. The water was removed from the sediments by decantation and then transferred to the laboratory. Samples were air dried in dark for 48 hours before analysis. Marine organisms (Bivalves , coral reef and star fish) were caught by fishermen three representative samples from the different sites at Abu Zenima and Abu Rudeis at the same times as water and sediment sampling. They were transport to the laboratory. Standard solutions of reference materials were prepared in hexane. A stock solution containing the following PAHs was used for quantitation: naphthalene, acenaphthalene, acenaphthylene, fluorene, phenanthrene, fluoranthene by dilution to create a series of calibration standards of PAHs at 0.1, 0.25, 0.5, 1.0, 5.0 and 10µg/ml. All solvents used in this study were of HPLC grade and were purchased from Alliance Bio, USA. Anhydrous Sodium sulfate and potassium hydroxide were of analytical grade PAHs were analyzed by using HPLC with fluorescence detection atChemistry Department, Egyptian Petroleum Research Institution (EPRI). The mobile phase was a mixture of acetonitrile and water with a gradient concentration mode of acetonitrile. The flow rate was 1 mL/min. The time program of the fluorescence detector was set to detect at optimum excitation and emission wavelength for each PAHs according to laboratory detection method [22, 23].

RESULTS AND DISCUSSION

Radioactivity and radionuclide in water and sediment in coastline in Abu Zenima and Abu Rudeis

Table (1) reveledthe activity concentrations of, ^{238}U, ^{232}Th and ^{40}K for sea water coastline in three sites at Abu Zenima1 , Abu Zenima2 and Abu Zenima3. The activity concentrations of ^{238}U, ^{232}Th and ^{40}K in seawater at site of Abu Zenima1 19.6 mBq/L , 16.8 mBq/L and 1340.7 mBq/L respectively . on the other hand ^{238}U, ^{232}Th and ^{40}K recorded in Abu Zenima2 highly activity 24.6 mBq/L , 20.8 mBq/L and 1448.7 mBq/L respectively . Also in site of Abu Zenima3^{238}U, ^{232}Th and ^{40}K were recorded 25.2 mBq/L , 22.6 mBq/L and 1270.4 mBq/L respectively. On the other hand table (2) reveled ^{238}U, ^{232}Th and ^{40}K in sea water at Abu Rudeis^{1}recorded 10.2 mBq/L , 7.33 mBq/L and 632.5 mBq/L respectively. Also ^{238}U, ^{232}Th and ^{40}K recorded in sea water at Abu Rudeis^{2}9.47 mBq/L 13.9 mBq/L and 735.3 mBq/L respectively . Also table 5 revealed levels of ^{238}U, ^{232}Th and ^{40}K in sea water at Abu Rudeis (3)14.25 mBq/L , 19.3 mBq/L and 946.4 mBq/L. Regarding to the present data and in compared to International permissible limits for NORMS radionuclide's in table (3) , where data in the present study for ^{238}U, and ^{232}Th lay under the International permissible limits for NORMS radionuclide's in red sea 25 mBq/L and 36 mBq/L for ^{238}U, and ^{232}Th respectively .On the other hand El Afifi et al. [24] was recorded high levels activity concentration for ^{238}U, ^{232}Th and ^{40}K in the TE-NORM waste at four different sites for petroleum and gas production in Egypt, in the South Sinai Governorate, in the Suez Gulf area, in the Matrouh Governorate , Abu Rudeis onshore oil and gas field and Gabal El Zeit offshore oil and gas field at the Suez Gulf. The results showed that the average activity concentrations of ^{226}Ra changed between 5.9 and 68.9 kBq/kg (dry weight) in the waste samples from Gabal El Zeit and Abu Rudeis fields, respectively. In Gabal El Zeit field, the lower activity concentrations (28.6 kBq/kg) of ^{226}R were found in granular sample, while higher values (56.6 kBq/kg) were found in the massive samples [25,26].

Regarding the table (1) reveled sediment concentration of ^{238}U, ^{232}Th and ^{40}K for sea water coastline at Abu Zenima1 , Abu Zenima2 and Abu Zenima3 , where238U, 232Th and 40K recorded in sediment coastline at Abu Zenima1 22.5 Bq/kg-1 , 24.53 Bq/kg-1 and 1658.6 Bq/kg-1 respectively. On the other hand Abu Zenima 2 recorded highly concentration in where^{238}U, ^{232}Th and ^{40}K in costal sediment than Abu Zenima1 , where concentrations levels 26.3Bq/kg-1 , 28.22 Bq/kg-1 and 1680.5 Bq/kg-1 respectively . Also Abu Zenima 3 recorded moderate levels for ^{238}U, ^{232}Th and ^{40}K in costal sediment . Also table (5) reveled sediment concentration ^{238}U, ^{232}Th and ^{40}K for sea water coastline at Abu Rudeis (1), (2) and (3) sites . The Abu Rudies (3) site recorded highly concentration 238U, 232Th and 40K than Abu Rudeis (1), (2) , at levels 18.68 Bq/kg-1 , 23.3 Bq/kg-1 and 1240.3 Bq/kg-1 respectively. This results were confirmed with **Uosif et al (2008)[27]**, who noticed highly activity in ^{232}Th and ^{40}K in beach sediment at Suez gulf. On the other hand table (4) highly activity in ^{232}Th and ^{40}K in beach sediment at Suez gulf as compared to North east coast of Tamilnadu, India and other studies in different beaches of the world. The Egyptian beach sediments recorded ^{238}U, ^{232}Th and ^{40}K 26.53 Bq/kg-1 , 177 Bq/kg-1 and 815 Bq/kg-1 respectively. Many causes for increased the level of concentration ^{238}U, ^{232}Th and ^{40}K in Red sea coastline. The petroleum industries in red sea coastline are considered the highly important factors for increased activity concentration in Red sea coastline , the scales and petroleum sludge contains many radioactive nuclides and highly concentration NORMS and TE-NORMS. By the way many companies in past time following the regulations and criteria for radiation safety regarding waste of NORMS and TE- NORMS . These regulation which settled by UNSCEAR, and ICRP and IEAE. After year of 2012 most of petroleum companies have many problems in cost for preservation of radioactive waste. The decreased price of petroleum oil effect on regulation issues especially environmental safety and eco-marine safety. So most of the petroleum companies in Red sea coastline discharge the sludge and oil waste in sea water . Also many petroleum accident take place in these industries , which resulting of discharged the huge of petroleum oils in sea water . On the other hand ,cracks in petroleum pipelines under sea water led to discharged oils and formed oils spots in coastline of sea water. **Gazineu and Hazin(2008)[29]** , were recorded average activity concentration of ^{226}Ra, ^{232}Th and ^{40}K in the scale, sludge and sand samples collected from disposal wasted petroleum pipes concentration of soil (33 and 45 Bq kg−1 for ^{238}U and ^{232}Th series respectively) which indicates its contamination with radionuclide from TENORM in the wasted petroleum pipes. ^{228}Ra activity concentration is ranged from 32 to 50 kBq kg−1 for Scale and from 1 to 1.9 kBq kg−1 for sludge. The sand samples have average ^{228}Ra activity concentration equal to 0.042 kBqkg−1 which within the worldwide average **[30].** Many oil-field brines are particularly rich in chloride, enhancing the solubility of other elements including the radioactive element radium. Radium concentrations tend to be higher in more saline water **[31].** Some of this saline, radium bearing water is also extracted with the oil and gas. Some radium and radium daughter compounds are slightly soluble in water and may become mobilized when this production water is brought to the surface **[32].**

Table (1): Concentration of ^{238}U, ^{232}Th and ^{40}K in seawater and coastal sediments collected from different locations along the Abu Zenima coastline

Radionuclide's	Sites Abu Zenima 1		Abu Zenima 2		Abu Zenima 3	
	Water (mBq/L)	Sediment (Bq/kg^{-1})	Water (mBq/L)	Sediment (Bq/kg^{-1})	Water (mBq/L)	Sediment (Bq/kg)
^{238}U	19.6±0.42	22.5±0.61	24.6±0.54	26.3±0.41	25.2 ±0.31	29.6±0.48
^{232}Th	16.8 ±0.22	24.53±0.82	20.8±0.62	28.22±0.58	22.6±0.24	27.5±0.44
^{40}K	1340.7±3.22	1658.6±4.91	1448.7±3.8	1680.5±5.2	1270.4±2.3	1545.8± 3.9

Table (2) : Concentration of ^{238}U, ^{232}Th and ^{40}K in seawater and coastal sediments collected from different locations along the Abu Rudeis coastline

Radionuclides	Sites Abu Rudeis 1		Abu Rudeis 2		Abu Rudeis 3	
	Water (Bq/L)	Sediment (Bq/kg)	Water (Bq/L)	Sediment (Bq/kg)	Water (Bq/L)	Sediment (Bq/kg)
^{238}U	10.2 ±0.22	12.3±0.24	9.47±0.18	13.46±0.16	14.25 ±0.17	18.68±0.21
^{232}Th	7.33 ±0.14	14.63±0.17	13.9±0.24	16.44±0.28	19.32±0.19	23.33±0.32
^{40}K	632.5±2.4	789.4±2.2	735.3±3.1	822.94±3.5	946.4±3.7	1240.3± 4.1

Table (3): International permissible limits for NORMS radionuclides ^{238}U, ^{232}Th and ^{40}K in sea watermBq/L **(EPA,1997**)

Location	Mean activity concentration (mBq/L)		
	^{238}U (mBq/L)	^{232}Th(mBq/L)	^{40}K(mBq/L)
The Mediterranean Sea	22	30	350
The Caribbean Sea	25	35	320
The Black Sea	27	37	275
The Red Sea	25	36	325
The Baltic Sea	30	33	400

Table (4): Comparison of activity concentrations of 238U, 232Th and 40K in beach sediment samples of North east coast of Tamilnadu, India and other studies in different beaches of the world

Location	Mean activity concentration(Bq/ kg)			Reference
	^{238}U	^{232}Th	^{40}K	
World	25	25	370	UNSC EAR2000
India	28.67	63.83	327.6	UNSC EAR2000
Beach sand Egypt	-	177	815	Uosif et al (2008)
Beach sand Read sea coast Egypt	23.1	7.2	338	Harb (2008)
Hungary	28.67	27.96	302.4	UNSC EAR2000
Kuwait	36	6	22.7	Saad and Al-Azmi (2002)
Nigeria	16	24	35	Arogunjo et al (2004)
Kalpak kamin Tamilnadu India	112	1455.8	351	Kannan et al (2002)
Ullal in K arna taka, India	374	158	158	Radhakrishna et al (1993)
North east coast of Tamilnadu , India	7.82	24.52	274.87	Ramasamy et al (2009)

3.2. Radioactivity and radionuclide for marine organisms in coastline at Abu Zenima and Abu Rudeis sites

Table (5) reveled the ^{238}U, ^{232}Th and ^{40}K concentration in marine organisms Bivalves , coral reef and star fish at red sea coastline in Abu Zenima sites. The concentration of ^{238}U, ^{232}Th and ^{40}K in Bivalves in Abu Zenima1 10.55 Bq/kg , 9.2 Bq/kg and 355.7 Bq/kg respectively. Also the coral reef recorded in Abu Zenima 1 15.86 Bq/kg , 19.86 and 575 Bq/kg respectively . the star fish was recorded 18.52 Bq/kg , 22.36 and 649.7 in Abu Zenima 1. On the other hand table (5) reveled the highly concentration for ^{238}U, ^{232}Th and ^{40}K in coral reef and star fish at Abu Zenima 2 and Abu Zenima 3 , where coral reef recorded in Abu Zenima2 21.3 Bq/kg , 24.85 Bq/kg and 650.8 respectively, Also coral reef in Abu zenima3 recorded 24.48 Bq/kg , 22.59 Bq/kg and 722.5 Bq/kg respectively .On the other hand table (6) reveled marine organisms Bivalves , coral reef and star fish Abu Rudeis sites recorded low concentration activity in^{238}U, ^{232}Th and ^{40}K than Abu Zenima sites . The coral reef and star fish was recorded highly activity concentration than Bivalves in^{238}U, ^{232}Th and ^{40}K where coral reef in Abu Rudeis1 11.34 Bq/kg , 12.61 Bq/kg and 346.81 Bq/kg respectively , and in Abu Rudeis2 11.37 Bq/kg , 13.85 Bq/kg and 396.83 Bq/kg respectively , while more activity concentration for ^{238}U, ^{232}Th and ^{40}K in coral reef was recorded in Abu Rudeis3 12.22 Bq/kg, 15.49 Bq/kg and 466.6 Bq/kg respectively. On the other star fish recorded highly activity concentrations in ^{238}U, ^{232}Th and ^{40}K at Abu Rudeis3 than Abu Rudeis1 and Abu Rudeis2 , 19.82 Bq/kg, 22.21 Bq/kg and 520.4 Bq/kg respectively . regarding to our results and compared to International permissible limits for ^{238}U, ^{232}Th and ^{40}K (Bq/kg dry weight) in some marine biota in sea water. Our results confirmed with **IEAE(1990)[33] and US EPA (1999)[34] in** table (7) where reveled the activity concentration in red sea of ^{238}U, ^{232}Th and ^{40}K for many biota and marine organisms like Fish (*Engraulis encrasicolus*) , Sepia *Officianalis*, Crabs , Diatom Amphora, (Om-Elkhlol "*Donax trunculus*, Gandofelly "*Tapes* decussates, Bivalves, Coral reef and Star fish . Bivalves was recorded activity concentration for ^{238}U, ^{232}Th and ^{40}K 18 Bq/kg , 37 Bq/kg and 214 Bq/kg respectively. Also coral reef and star fish in red sea were recorded 24 Bq/kg , 33 Bq/kg, 176 Bq/kg. 16 Bq/kg , 25 Bq/kg and 188 Bq/kg respectively. when compared the activity concentration of ^{40}K in marine biota Bivalves, Coral reef and Star fish at red sea coastline in Abu Zenima and Abu Rudeis sites, the highly activity and increased concentration of ^{40}K may be due to the petroleum industry in marine and petroleum platforms. this platforms discharged huge amount of petroleum waste in red sea coastline. On the other hand our results in table (4) and table (6) reveled the marine organisms have different concentration in ^{238}U, ^{232}Th and ^{40}K. The Bivalves recorded low

concentration for ^{238}U, ^{232}Th and ^{40}K , but coral reef and star fish recorded highly concentration for ^{238}U, ^{232}Th and ^{40}K in Abu Zenima and Abu Rudeis sites. The morphological structures and also chemical structures of Bivalves , where Bivalves have smooth surfaces from two sides and have no pores and have no pits on exoskeleton of their body . The morphological structures gained it more resistance against accumulation of oils waste , also the smooth exoskeleton prevent discharged the waste into internal organs for organism . On the other hand coral reef and star fish have roughly surface and contain more small pores on exoskeleton. Also the coral reef and star fish contain many pits and spiny exoskeleton. Morphological structures for coral reef and star fish led to make preservation of these organisms with huge amount form petroleum oil waste . So the elimination process from oil waste in coral reef and star fish become more difficult than any other types of marine organisms. By the way elimination and biodegradation process of ^{238}U, ^{232}Th and ^{40}K and other radioactive waste become very slowly and take more time. This data conformed with **Khan[35]** , who study the distribution of natural radionuclides like ^{226}Ra, ^{228}Ra, ^{40}K ^{238}U and man-made radionuclides in the dietary sources such as fish, crab, prawn, salt and drinking water from the aquatic environment. The natural radionuclides activity concentrations of in^{238}U, ^{232}Th and ^{40}K 14.9,22,641Bq kg-1 in marine samples fishes , Crab and Prawn. Among different type of marine fishes analysed, the maximum ^{226}Ra activity of 22 Bq kg-1 was observed in the fish *Sardinella* sp. and *Liognathus* sp. was found to accumulate the highest ^{228}Ra activity level**[**36].Among the shells of animals tested, Crustacean exoskeleton registered relatively higher level of ^{238}U, ^{232}Th and ^{40}K as compared to the shell of molluscan species. This is attributed to its chemical nature**[37].**

Table (5) : Concentration of ^{238}U, ^{232}Th and ^{40}K in marine organisms collected from different locations along the Abu Zenima coastline

Radionuclides	Sites Abu Zenima 1			Abu Zenima2			Abu Zenima 3		
	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)
^{238}U	10.55 ±0.21	15.86 ±0.32	18.52±0.24	9.21±0.13	21.37±0.25	19.63±0.28	8.22 ±0.11	24.48 ±0.29	20.43±0.21
^{232}Th	9.2 ±0.22	19.86 ±0.36	22.36±0.29	8.22±0.14	24.85±0.34	25.73±0.65	8.9±0.12	22.59±026	31.21±0.92
^{40}K	355.7±2.7	575.9 ±3.8	649.74±4.1	325.5±0.98	650.8±3.9	678.6±4.2	285.9±2.3	722.5±4.4	583.79± 1.13

Table (6): Concentration of ^{238}U, ^{232}Th and ^{40}K in marine organisms collected from different locations along the Abu Rudeis coastline

Radionuclides	Sites Abu Rudeis 1			Abu Rudeis 2			Abu Rudeis 3		
	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)	Bivalves (Bq/kg)	coral reef (Bq/kg)	star fish (Bq/kg)
^{238}U	6.24 ±0.11	11.34 ±0.25	13.55±0.29	10.2±0.14	11.37±0.12	18.57±0.28	9.11 ±0.14	12.22 ±0.28	19.82±0.31
^{232}Th	7.35 ±0.13	12.61 ±0.27	14.75±0.28	8.15±0.16	13.85±0.34	21.62±0.27	10.26±0.15	15.49±0.21	22.21±0.47
^{40}K	233.4±2.1	346.81 ±2.6	367.92±2.8	276.94±2.8	396.83±4.1	386.41±4.2	325.82±2.9	466.6±4.1	520.4± 4.2

Table (7): International permissible limits for ^{238}U, ^{232}Th and ^{40}K (Bq/kg dry weight) in some marine biota in sea water, IEAE (1990) , US,EPA (1999)

Locations	Species Marine organisms	Activity concentrations of ^{238}U	^{232}Th	^{40}K (mBq/kg dry weight
The Mediterranean Sea	Fish (Engraulis encrasicolus)	22	43	101
	Sepia Officianalis	35	38	125
	Crab	30	45	112
	Diatom *Amphora*	18	47	120
	(Om-Elkhlol "Donax trunculus	9	55	135
	Gandofelly "Tapes decussates	25	60	140
	Bivalves	18	32	196
	Coral reef	23	33	188
	Star fish	15	22	179
The red sea	Fish (*Engraulis encrasicolus*)	26	35	210
	Sepia Officianalis	15	22	255
	Crab	18	33	240
	Diatom *Amphora*	15	21	222
	(Om-Elkhlol "Donax trunculus	13	22	287
	Gandofelly "Tapes decussates	22	18	270
	Bivalves	18	37	214
	Coral reef	24	33	176
	Star fish	16	25	188
Baltic sea	Fish (*Engraulis encrasicolus*)	29	35	288
	Sepia Officianalis	23	37	320
	Crab	25	23	310
	Diatom *Amphora*	22	25	355
	(Om-Elkhlol "Donax trunculus	18	33	345
	Gandofelly "Tapes decussates	16	26	322
	Bivalves	19	27	366
	Coral reef	22	34	295
	Star fish	18	28	325

Poly Aromatic Hydrocarbons PAHs for seawater and coastal sediments at Abu Zenima and Abu Rudeis

Polycyclic aromatic hydrocarbons (PAHs), are known as prevalent contaminants in marine environment. Tables (8,9) showed the distribution and concentration levels of Poly aromatic hydrocarbons PAHs found in seawater and coastal sediments in Abu Zenima and Abu Rudeis coastline . Our results revealed that increased concentration levels of PAHs in Abu Zenima sites than Abu Rudeis sites. The data recorded that Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene in sea water at Abu Zenima1 34.6, 22.8,18.4, 12.13, 9.23and 15.3 ng/L respectively . On the other hand Abu Zenima2 and Abu Zenima3 recorded highly levels for PAHs, Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene 95.3, 37.58 , 66.54, 22.16, 21.8 and 34.78 ng/L in Abu Zenima2 respectively; 135.68,45.37, 95.56, 35.27, 40.58, 55.38 ng/L in in Abu Zenima3 respectively. On the other hand and regarding to results in table (9) showedconcentration levels of Poly Aromatic Hydrocarbons PAHs found in seawater at Abu Rudeis. The Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene in Abu Rudeis1 were recorded levels 22.2 , 11.8, 8.42, 6.75, 4.69, 8.33 ng/L respectively. on the other hand table (9) showed highly concentration levels of PAHs in seawater at Abu Rudeis2 and Abu Rudeis3 were Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene recorded in Abu Rudeis2 45.6, 22.33, 28.35, 12.63, 12.39and 18.73ng/L respectively; also Abu Rudeis3 were recorded 76.21, 25.68, 53.78,16.86, 22.47and 32.48 respectively. Spilled petroleum products are the largest single source of PAHs. Crude oils contain up to 10 percent PAHs, while the PAH content of shale oils and coal-derived synthetics can be as high as 15 percent. Incomplete combustion of wood and fossil fuels are important sources, as are incineration of garbage, steel and coke production, coal liquefaction, and coal gasification. Although most emissions stem from human activities, there are some natural sources such as microorganisms that are known to produce small amounts of PAHs. Produced water from both oil and gas platforms contains PAHs. Taking into account the large volumes of produced water discharged from oil production, the yearly input of PAHs into the environment, even from a single offshore oil field, may be significant. These results was found to be in agreement with that observed by **Omayma 2015[39]**,who observed that the petroleum company's takes water from Suez bay and mixed it with fresh water to utilize in washing the crude oil and different cooling purposes, some oily smuggling occurs for water. The oily water is characterized by that they contain a high proportion of the oils which is caused by refinery production units (Coking - distillation - oils), liquidation warehouses crude and petroleum products, water waste companies neighboring filter wards pumps, Trenchant grids crude and petroleum products. The increased of PAHs was due to found the more petroleum operations in this sites. On the other hand the treatment plant cannot process in the company anymore, which is directly (untreated) discharged intoAbu Zenima sites. Also the conjugated crude and petroleum products , which have TE- NORM and PAHs may be increased for marine environmental pollutants stress.

The sediments and biota , Bivalves , coral reef and starfish were affected by different concentration of PAHs . Tables (8 ,9) showed an increase in PAHs Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene at Abu Zenima sites than Abu Rudeis sites. The sediments in Abu Zenima1 were recorded for PAHs Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene 44.3, 28.5 , 55.2 , 18.3, 16.74 and 25.64 ng/g dw respectively as compared to Maximum allowable concentrationstable (12). On the other hand PAHs Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene in Abu Zenima2 and Abu Zenima3 sites were recorded 122.5 , 64.22 , 73.25 , 28.36, 33.59 and 40.22 ng/g dw respectively;155.25, 86.49, 112.35, 43.62, 55.93and 79.24 ng/g dw respectively as compared to Maximum allowable Concentrations table (12). Table (9) showed also the concentration in the costal

sediments for for PAHs Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene at Abu Rudeis1 34.5 , 14.3 , 22.73, 9.44 , 9.55 and 13.62 ng/g dw respectively . By the way Abu Rudeis2and Abu Rudeis3 sites were recorded 62.34, 33.52, 42.29, 15.79, 15.64 and 26.73 ng/g dw respectively; 92.57, 37, 65.43, 22.43, 29.77 and 44.82 ng/g dw respectively. These results was found to be in agreement with that observed by **Hussain *et al*, 1998**[39], who observed the relatively high concentrations of Naphthalene, Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene at certain locations Suez Gulf Abu Zenima sites. In the present study PAHs individuals for sediment at Abu Zenima sites (Naphthalene ,Acenaphthene , Acenaphthyle and Fluoranthene were recorded highly concentration than other PAHs individuals. In this study and when the results compared to the national environmental standard , it was noticed that the low concentration in total and individuals PAHs . this results was found to be in agreement with that observed by **El Nemr,2004[40]**who recorded thatPAHs in the sediments of the Suez Gulf may produce adverse effects on certain organisms living in and coming into contact with the sediments. However, The individual PAH concentrations in this study were lower than the national sediment quality criteria proposed by the **USEPA (1993)**[41] for fluoranthene (3000 ng g−1), acenaphthylene (2400 ng g−1) and phenanthrene (2400 ng g−1).

Table (8): Distribution and concentration levels of Poly Aromatic Hydrocarbons PAHs found in seawater and coastal sediments in Abu Zenima coastline

PAHs	**Sites** Abu Zenima 1		Abu Zenima 2		Abu Zenima 3	
	Sea water ng/L	Costal sediments ng/g dw	Sea water ng/L	Costal sediments ng/g dw	Sea water ng/L	Costal sediments ng/g dw
Naphthalene $C_{10}H_8$	34.6±1.2	44.3±2.42	95.3±4.62	122.5±5.33	135.68±6.4	155.25±6.8
Acenaphthylene $C_{12}H_8$	22.8±0.92	28.5±0.83	37.58±1.2	64.22±2.93	45.37±2.2	86.49±3.1
Acenaphthene $C_{12}H_{10}$	18.4±0.73	55.2±2.35	66.54±3.7	73.25±2.84	95.56±2.73	112.35±3.86
Fluorene $C_{13}H_{10}$	12.13 ±0.8	18.37 ±1.13	22.16±0.92	28.36±1.34	35.27±1.45	43.62±1.67
Phenathrene $C_{14}H_{10}$	9.23±0.45	16.74±0.73	21.8±1.9	33.59±1.44	40.58±2.26	55.93±2.41
Fluoranthene $C_{16}H_{10}$	15.3±0.93	25.64±1.35	34.78±1.6	40.22±1.63	55.38±1.55	79.24±2.11

Table (9) : Distribution and concentration levels of Poly Aromatic Hydrocarbons PAHs found in seawater and coastal sediments in Abu Rudeis

PAHs	Abu Rudeis1		Abu Rudeis2		Abu Rudeis3	
	Sea water ng/L	Costal sediments ng/g dw	Sea water ng/L	Costal sediments ng/g dw	Sea water ng/L	Costal sediments ng/g dw
Naphthalene $C_{10}H_8$	22.2±0.9	34.5±1.33	45.6±1.62	62.34±1.83	76.21±2.3	92.57±2.7
Acenaphthylene $C_{12}H_8$	11.8±0.53	14.3±0.44	22.33±0.82	33.52±1.11	25.68±1.21	37±1.25
Acenaphthene $C_{12}H_{10}$	8.42±0.31	22.73±0.84	28.35±0.96	42.29±1.25	53.78±1.42	65.43±1.85
Fluorene $C_{13}H_{10}$	6.75 ±0.21	9.44 ±0.32	12.63±0.42	15.79±0.53	16.86±0.58	22.43±0.77
Phenathrene $C_{14}H_{10}$	4.69±0.26	9.55±0.28	12.39±0.29	15.64±0.31	22.47±0.37	29.77±0.41
Fluoranthene $C_{16}H_{10}$	8.33±0.32	13.62±0.36	18.73±0.42	26.73±0.43	32.48±0.48	44.82±.0.51

The present work also monitoring the marine organisms (Bivalves , coral reef and starfish) in coastline at Suez Gulf in Abu Zenima and Abu Rudeis sites. Tables (10 ,11) showed the Distribution and concentration levels of PAHs individuals in Abu Zenima and Abu Rudeis sites. Table (10) showed the increased PAHs individuals, Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene in starfish and coral reef than Bivalves. On other hand PAHs individuals recorded highly concentration in Abu Zenima3 and Abu Zenima2, than Abu Zenima1. Where levels was recorded in Abu Zenima1 for concentrations of Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene in Bivalves 6.4 , 1.2, 3.2, 7.4, 4.4 and 1.9 μg g^{-1} dry weight respectively. On the other hand coral reef and starfish recorded highly concentration than Bivalves, where levels reaching to 8.68, 3.2, 2.55,15 .3, 7.9 and 2,6 μg g^{-1} dry weight respectively; 12.3, 6.25, 5.11, 18.7, 18.7 and 4.7 μg g^{-1} dry weight respectively. The Bivalves , coral reef and starfish in Abu Zenima3 and Abu Zenima2 recorded highly levels in concentrations for Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene , where Bivalves recorded in Abu Zenima2 9.65, 3.8, 7.8, 9.5, 11.7 and 3.5 μg g^{-1} dry weight respectively. Also coral reef and starfish were recorded in Abu Zenima2 9.22 , 7.24, 8.9, 11.2, 13.8 and 4.6 μg g^{-1} dry weight respectively; 13.7 , 11.4, 7.9, 19.3, 17.2 and 6.8 μg g^{-1} dry weight respectively. On the other hand Bivalves were recorded in Abu Zenima3 for Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene 12.9, 4.8, 5.3, 14.7, 16.8 and 9.3 μg g^{-1} dry weight respectively .The coral reef and starfish also recorded15.3, 9.2, 8.8, 22.6, 19.4 and 12.3 μg g^{-1} dry weight respectively; 18.7, 12.3 , 13.6, 28.4, 22.6 and 16.8 μg g^{-1} dry weight respectively. When compared our results with the data of Maximum allowable Concentrations (MACs) USEPA: 1993 in table (12) , where recorded for Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene 0.007, 0.008 , 0.007, 0.001, 0.009 and 0.009µg/kgdry weight respectively. the concentration levels of PAHs individuals in Abu Zenima sites were recorded higher than that in Maximum allowable Concentrations (MACs) USEPA for PAHs in marine organisms[41] . These results was found to be in agreement with **Al Deep *et al.* (2007)[42],** who was observed the accumulation of total PAHs were more pronounced in the tissues of higher lipids contents, which increase in the large and old individuals, and they found that the coral reef and starfish comes second regarding to their PAHs accumulations ratios after the dwelling fish species. Size of the marine organisms may be not only contribute to change the accumulation factors responsible for the quantities of pollutants such as time exposure and lipids

contents but also in the factors responsible for the pollutants selectivity. For example, **Maioli *et al*., (2010)[43]** demonstrated that coral reef and starfish of greater size accumulated PAHs of low molecular mass , whereas the smaller mussels had accumulated greater concentrations of high molecular mass PAHs Metabolism may explain this pattern, because it is suspected that PAH of High Molecular Mass (HMW) are more rapidly metabolized than Low Molecular Mass (LMW) due to differences in enzyme affinity**[44].** The increased of concentration levels of PAHs individuals in Bivalves , coral reef and starfish at Abu Zenima were be attributed to the presence of many petroleum industrial marine plates in this region at south canal. also this petroleum plates discharge some oils into the water plus to their incomplete fuel combustion emissions [45]. On the other hand table (11) showed the low level concentration of PAHs individuals in Abu Rudeis sites as compared to Abu Zenima sites in table (10) and Maximum allowable Concentrations (MACs) USEPA forPAHs in marine organisms in table(12). The Naphthalene , Acenaphthylene , Acenaphthene, Fluorene, Phenathrene and Fluoranthene were recorded in Bivalves at Abu Rudeis1 1.28, 0.79, 0.21, 1.31, 1.73 and 0.28μg g^{-1} dry weight respectively. The impact of PAHs individuals and TE- NORM ^{238}U, ^{232}Th and ^{40}K in marine organisms make dangerous effects on marine ecosystem. This effects were to be attributed for spreading the petroleum marine plates in these sites and areas. On the other hand many of these petroleum industries do not have following environmental regulations and marine protection standards during process for removal petroleum waste. Also during the process of oil transportations and drilling for sludge and oil tanks. The accumulation of double effects of and also many effects of hazardous materials like TE- NORM ^{238}U, ^{232}Th ,^{40}K and PAHs individuals may be devastation the marine ecosystems in red sea coastline and Gulf of Suez.

Table (10) : Distribution and concentration levels of PAHs found in marine organisms of different sampling sites in Abu Zenima coastline

PAHs μg g^{-1} dry weight	Abu Zenima 1			Abu Zenima 2			Abu Zenima 3		
	Bivalves	coral reef	star fish	Bivalves	coral reef	star fish	Bivalves	coral reef	star fish
Naphthalene $C_{10}H_8$	6.4±0.33	8.68±0.54	12.3±0.74	9.65±0.63	9.22±0.61	13.7±0.81	12.9±0.72	15.3±1.2	18.7±1.1
Acenaphthylene $C_{12}H_8$	1.2±0.02	3.2±0.13	6.25±1.1	3.8±0.8	7.24±0.9	11.4±1.3	4.8±0.62	9.2±0.73	12.3±0.92
Acenaphthene $C_{12}H_{10}$	3.2±0.2	2.55±0.11	5.11±0.7	7.8±0.4	8.9±0.6	7.9±0.4	5.3±0.22	8.8±0.6	13.6±0.8
Fluorene $C_{13}H_{10}$	7.4±4.6	15.3±1.2	18.7±0.9	9.5±0.33	11.2±0.8	19.3±1.2	14.7±0.7	22.6±0.8	28.4±1.3
Phenathrene $C_{14}H_{10}$	4.4±0.07	7.9±0.3	10.2±0.6	11.7±0.5	13.8±0.3	17.2±0.8	16.8±0.7	19.4±0.4	22.6±1.2
Fluoranthene $C_{16}H_{10}$	1.9±0.03	2,6±0.02	4.7±0.2	3,5±0.1	4.6±0.3	6.8±0.5	9.3±0.4	12.3±0.7	16.8±0.8

Table (11) : Distribution and concentration levels of PAHs found in marine organisms of different sampling sites in Abu Rudeis coastline

PAHs $\mu g\ g^{-1}$ dry weight	Abu Rudeis 1			Abu Rudeis 2			Abu Rudeis 3		
	Bivalves	coral reef	star fish	Bivalves	coral reef	star fish	Bivalves	coral reef	star fish
Naphthalene $C_{10}H_8$	1.28±0.02	1.63±0.03	2.14±0.01	2.43±0.05	5.42±0.08	7.21±0.26	3.79±0.06	9.35±0.37	11.22±0.28
Acenaphthylene $C_{12}H_8$	0.79±0.02	0.98±0.01	1.13±0.04	1.79±0.05	1.96±0.04	3.15±0.07	5.45±0.03	7.26±0.06	7.94±0.04
Acenaphthene $C_{12}H_{10}$	0.21±0.01	0.52±0.02	0.73±0.04	0.94±0.03	0.85±0.02	1.33±0.08	1.62±0.05	1.96±0.08	2.37±0.07
Fluorene $C_{13}H_{10}$	1.31±0.07	3.68±0.22	5.92±0.43	8.33±0.62	10.17±0.41	12.15±0.72	9.48±0.25	11.72±0.57	14.63±0.78
Phenathrene $C_{14}H_{10}$	1.73±0.04	3.12±0.05	6.47±0.48	3.56±0.44	6.97±0.37	8.84±0.39	5.28±0.46	9.34±0.68	12.39±0.52
Fluoranthene $C_{16}H_{10}$	0.28±0.024	0.59±0.028	0.85±0.053	0.46±0.027	0.89±0.046	1.26±0.22	0.89±0.42	1.94±0.47	2.64±0.79

Table (12) : Maximum allowable Concentrations (MACs) of PAHs in water , soil and marine organisms USEPA, 1993

PAH	MAC (water), ppm	MAC (soil), ppm	MAC marine organisms), µg/kgdry weight
Naphthalene	3.0	1.0	up to 0.007 µg/ kg
Phenanthrene	3.0	3.0	up to 0.009 µg/ kg
Fluoranthene	3.0	3.0	up to 0.009 µg/ kg
Acenaphthene	3.0	3.0	up to 0.007 µg/ kg
Acenaphthylene	3.0	3.0	up to 0.008 µg/ kg
Fluorene	3.0	3.0	up to 0.001 µg/ kg

CONCLUSION

The concentrations of natural radioactive series nuclides varied widely within the oil fields and from one oil field to another through spectrum of this study area. This study revealed the correlation between the effects of Naturally occurring radioactive materials **(**NORM) ^{238}U, ^{232}Th and ^{40}K on marine ecosystem. In this study , the increased of ^{238}U, ^{232}Th and ^{40}K in sea water and sediments were related to increased in PAHs individuals. The ^{238}U, ^{232}Th and ^{40}K in Abu Zenima 3 and Abu Zenima 2 sites were recorded higher concentration than Abu Zenima1. Also Abu Rudeis 3 and Abu Rudeis were recorded highly activity than site of Abu Rudeis1. The levels of ^{238}U, ^{232}Th and ^{40}K in sea water and sediments at Abu Zenima and Abu Rudeis were parrled and synchronized with levels of^{238}U, ^{232}Th and ^{40}K in sea water and sediments at Abu Zenima PAHs individuals in both sites. The study showed the increased level concentrations of ^{238}U, ^{232}Th and ^{40}K and PAHs individuals in sea water and sediments Abu Zenima sites than Abu Rudeis sites as compared to international Maximum allowable concentrations. On the other hand this study revealed the effect of **(**NORM) ^{238}U, ^{232}Th and ^{40}K and

PAHs individuals on marine organisms Bivalves , coral reef and starfish on both sites. The data revealed increased concentration of **(**NORM) ^{238}U, ^{232}Th and ^{40}K and PAHs individuals for starfish and coral reef than bivalves marine organisms for both Abu Zenima and Abu Rudeis sites respectively as compared to international maximum allowable concentrations. Regarding to these data , all petroleum industries in this sites must be take into consideration the roles and standers' of protection for marine ecosystem. On the other hand , the Egyptian government must be applied the regulation for marine environmental protection lows.

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