ENVIRONMENT IMPACT ASSESSMENT FOR THE PROPOSED SPECIAL ECONOMIC ZONE OFAN URBAN AREA

Abstract

A nation's socioeconomic progress is influenced by the development of its infrastructure. But as industrialization accelerates, its effects on the environment are overlooked, which leads to air, water, and land pollution. Ecological imbalance has a number of detrimental effects on living things, including global warming, health issues, disturbed animals, and natural disasters. Large scale developments, such as setting up of special economic zone (SEZ) requires a lot of environmental monitoring, clearance and management. Clustering of different industries, such as chemical, textile, leather, etc., within one particular area will have an accumulative impact on the environmental state of the region. By foreseeing the negative environmental effects of a new, future development project on the neighborhood, the Environment Impact Assessment (EIA) serves as an important decision-making tool. This paper analyzes the proposal of setting up of a SEZ in Pilani region of India by assessing its environmental repercussions through environment management tool called EIA. The results of this article will help practitioners understand the decision criteria needed to establish new industries.

Keywords: Environment Impact Assessment (EIA), Environmental Pollution, Environment Management Plan (EMP), Special Economic Zone (SEZ).

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I. INTRODUCTION

Special Economic Zones (SEZ) are special designated areas for the setting up of new industries, encourages lots of foreign investors and investments, which helps in economic growth of the area in and around the proposed zone. The laws of trading within the zone are slightly different from other parts of the country, and there are also tax relaxation policies for the trading businesses [1]. SEZ plays a crucial role towards the tremendous growth of bounding areas, especially in the developing countries, however the advantages are constrained outside the area of coverage, i.e., within 50 km of radius [2].If implemented properly, industrialization and infrastructure development can be achieved around SEZ areas[3].

Due to accumulation of industries in SEZ, surrounding environment, human health and biodiversity would be vulnerable due to toxic emissions in the air, discharge of harmful chemicals into the nearest water body, etc. Hence, it becomes utmost important to restrain and categorize excessive number of industries by enforcement of law and policies andalso strict assessment of environment [4]. The term 'environment assessment' is a decision-making process, which helps in finding out the positive or negative effects of a developmental project on the surrounding environment [5]. A policymaking four-step Rapid Health Impact Assessment model was obtained for Songkhla SEZ [6]. The establishment of SEZ requires many valuable resourceful lands such as, agricultural, forest and mangroves. For the sustainable development of zones, improved and strategic environmental impact assessment is required [7].Man made disruptions towards environment has already poisoned the ecosystem that much, so that any further development for economic growth also will hamper the environment and sustainability [10].For the sustainability of SEZs, eco-industrial development is the most appropriate approach, through which an eco-system balance will be achieved[11]. Environmental factor is a key factor that affects sustainability in the SEZs, particularly in developing countries. An approach of multi-criteria analysis is the most effective tool for the sustainability of all sorts of construction related projects and activities [12].Nong Khai Province incorporated Geographical Information System (GIS) and Multi Criteria Analysis (MCA) tools for the SEZs geographical assessment [13]. As per EIA Notification 2020, there are 43 sectors of developmental activities and for all such activities environmental clearance is required [14]. Establishing of SEZ in the areas which are susceptible to environmental degradation and the industries which requires in bulk resources like water, energy, etc., for their operation needs special consideration [15].

The framework of zones in SEZs should be implemented by considering the adverse impacts on the environment caused due to the developmental activities, if not implemented properly, the whole society and surrounding areas will be on risk of distinction [16]. This research investigates Environment Impact Assessment (EIA) for the proposed Socio-Economic Zone (SEZ) in Pilani. The adverse environmental impacts because of the setting up of new industries in the vicinity of proposed site has been studied. The investigation of air, water and soil were conducted through various on-site equipment and laboratory experiments. Once the impact is assessed for all environmental parameters, mitigation measures, such as, waste management, water treatment techniques, etc., are suggested for the identified impacts. This study assesses environmental impacts of the project proposed in SEZ of Pilani region of India. The main objective of the paper is to develop special economic zone in accordance with environmental policies to enable sustainable infrastructure and economic development

of the state.

II. STUDY AREA

1. **Project Location:** The site of the project is in the Pilani city, Jhunjhunu district of Rajasthan, India. The connectivity of the site with the surrounding areas is very strong. The location of the site is closest to the state highway-13 (SH- 13 connecting to Alwar to Rajgarh) near Pilani town. The site is adjacent to the State Highway-13 (SH- 13 connected from Alwar and Rajgarh) close to Pilani as shown in Fig 1.

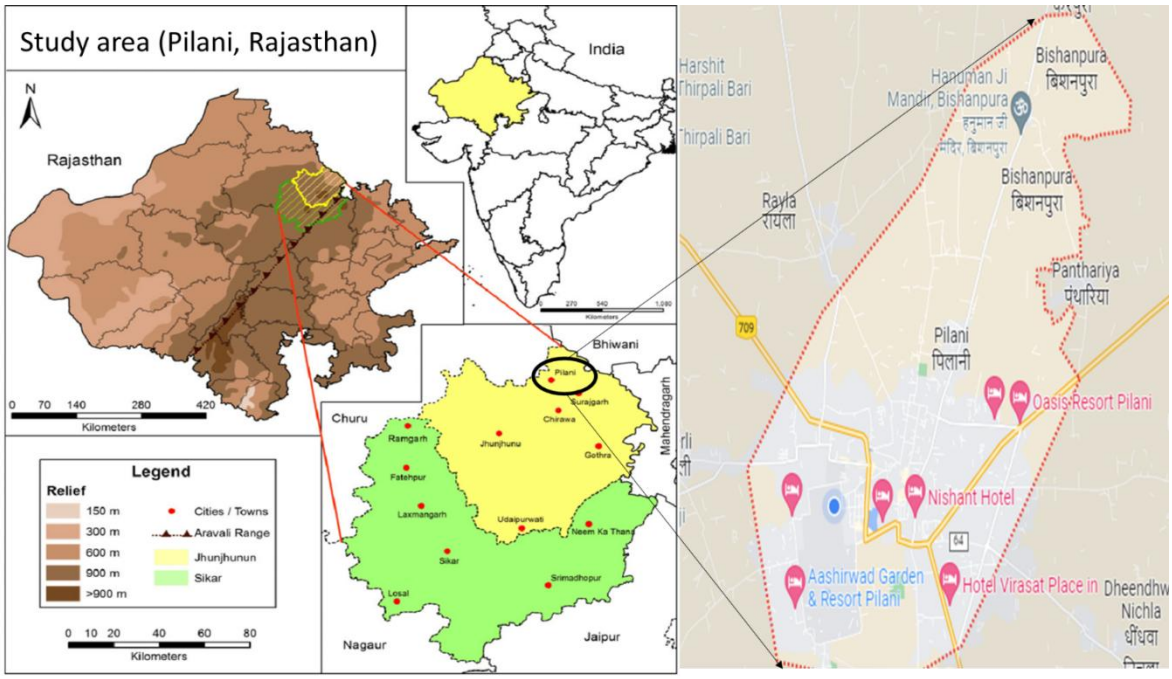

Figure 1: Study area chosen for representing SEZs.

The site of the project is around 42.7km from main line of railway station of Churu connected from Alwar towards Rajgarh. Nearest airport is Delhi which is at a distance of about 200 kms. by road. The designated area for the setting up of industries in SEZ is surrounded by boundaries of villages, such as Jherli, Thirpali Badi Village, Thirpalichotti, Chahar, Chandgothi and Hamir was. The latitude coordinate of the project is28°22'19"North and longitude is 75°35'31"East. The proposed SEZ site is having plain and undulated topographical feature.

2. **Project Components:** This project will encompass a variety of industries, including engineering, automobiles and auto ancillaries, drugs and pharmaceuticals, apparel, agro, food processing, Information Technology, gems and jewellery, plastics, chemical, leather products, educational facilities, and accommodation for the people working in the region. The setting up of project will be on a 2352-acre plot of land. The project's land allocation is made up of 44% Non-Processing Area and 56% Processing Area designated for multi-product enterprises. The timeframe of the project will be over a period of 5 years beginning with the starting of construction, by getting EIA approval/clearance. Table1

outlines the specifics of the multi-product SEZ's projected land use.

Table 1 Land use characteristics of the study area

SPECIFICATION	AREA (ACRES)	PERCENTAGE (%)
PROCESSING		
Red Category Industries	200	9
Information Technology, Biotech, Engineering, Gems and Jewellery, Apparel, Agro,	40	2
Orange and Green and Category Industry-1	224	9
Orange and Green and Category Industry-1	426	18
Social Infrastructure Area	30	1
Utility Area	30	1
Green Area	180	8
Road Area	199	8
TOTAL	1329	56
NON-PROCESSING		
Residential	451	19
Commercial	207	9
Social Infrastructure Area	36	1
Utility Area	30	1
Green Area	124	5
Road Area	175	8
TOTAL	1023	44
GRAND TOTAL	2352	100

3. **Environmental Setting of the Study Area:** The baseline environmental status was assessed using primary and secondary data from agencies including the Indian Meteorological Department, Geological Survey of India, State Ground Water Department, Central Ground Water Board, State Pollution Control Board, Census of India, and Local Forest Department. The site's border information is listed below:

North : Jherli, Thirpali Badi Village, Thirpalichotti.
South : Chirawa
East : Open space
West : SH-13 and open space.

III. MAJOR ENVIRONMENTAL ISSUES DUE TO THE PROPOSED PROJECT

It is important to draw attention to the main problems of concern that emerged from the analysis of the current baseline environmental conditions and all project activities scheduled for the building and operating stage before impact assessments of various environmental components are undertaken. The constructional and operational phases of the project execution can be used to broadly classify the primary project activities. The following is a summary of the main concerns surrounding this project:

1. **Air Environment:** Suspended Particulate Matter (SPM)/ Respirable Suspended Particulate Matter (RSPM)are the primary air pollutants of concern during the construction period as the effects of other emissions, such as SO2, NOx, and CO, will not be substantial because the sources are such that the emissions are scattered both spatially and temporally. At each of the eight locations, the monitored average for all metrics were below the National Ambient Air Quality Standards (NAAQS). Vehicle traffic created by the proposed project and traffic on SH-13 will be the main sources of air pollution. In the SEZ region, broad enough roadways are planned to accommodate two-way traffic and to comply with fire requirements. Throughout construction, water sprinklers will be used to control dust.

2. **Noise Environment:** In the impact zone, 8 places recorded noise levels. The monitoring program's findings showed that levels during the day and at night are within the established thresholds everywhere. The main sources of noise pollution during the operational time will be internal traffic, industrial operations, and access road traffic. The ideal combination of mitigation measures, such as low noise generating units and noise barriers, will be necessary to prevent unwanted noise exposure to the residents of SEZ and the sensitive receptors within the research area.

3. **Water Environment:** Analysis of the ground water samples and comparison with IS: 10500: 1991 standards was done. At every location, Total Dissolved Solids (TDS) was higher than the desired level. All other factors were within acceptable drinking water guideline ranges. The area's geology is to blame for the high amount of TDS. The planned project will typically use 3 Million litres per day (MLD) of water during the building phase and 40 MLD during the operation phase. To conserve resources, a plan for rainwater gathering and water conservation will be adopted.

4. **Municipal Solid Waste:** The project's operational phase is expected to produce 20 TPD of solid trash. The majority of garbage will come from commercial, institutional, residential, and industrial sources and tasks like street sweeping and drain cleaning. The Solid trash Management Rules 2000 must be followed when collecting, sorting, moving, treating, and disposing of biodegradable and non-biodegradable trash.

5. **Biomedical Waste:** This garbage from hospitals contains potentially dangerous ingredients like antibiotics, medications, chemicals, and syringes, among others. Additionally, it must be handled in accordance with the 2000 Bio-Medical Waste (Management and Handling) Amendment Rules.

6. **Biological environment:** Since there are no ecologically significant forests within the research area, the predominant terrestrial and aquatic ecological environments are of negligible consequence. However, the project will offer a quality environment with a natural setting, thoughtfully planned green belt, and open spaces with landscapes such that it not only improves the residents' quality of life but also the microclimate.

7. **E-Waste Management:** Two years following the project's occupancy phase, the e-waste is most likely to be produced. The e-waste produced will either be stored on site in a designated chamber or recycled (exchanged with suppliers or replenished and reused). All sorts of garbage will be kept in an accurate inventory. When the SPCB specifies an authorized contractor, the e-waste will be processed in accordance with the established protocols and other relevant laws.

IV. ENVIRONMENTAL ASSESSMENT MANAGEMENT PLAN

The Environmental Management Plan (EMP) focuses on the process for putting the recommendations for rules and actions to avoid, reduce, and mitigate the project's environmental impacts. The Environment Management Plan would include all mitigation measures for each item-wise action to be carried out during the project's development, operation, and complete life cycle in order to avoid negative environmental consequences. EMP will cover the following topics:

- Managing lands
- Reducing air pollution
- Management of Water
- Solid Waste Administration
- Control of Noise and Vibration
- Energy Effectiveness

1. **Land Management:** Land management plan would provide an inventory and description of project land, resources and present guidance for the management of its use. Topsoil should be removed and piled separately in order to preserve it and reduce soil disturbance. Topsoil must be used for landscaping once the construction has been completed. There are other steps that would be taken to stop soil erosion and contamination.
   - Spending a certain amount of time in a limited space.
   - Leak-proof containers must be used for oil and grease storage and transportation in order to prevent oil and grease from contaminating the soil.
   - Use of organic fertilizers for green belt & landscaping will be initiated.
   - Construction of erosion prevention through beam

     To establish land management policies and strategies that recognizes and protects natural resources. Green belt development may be the most economical and practical methods of shading some buildings. Trees automatically adjust shading to the seasons. They may substantially improve the appearance of the property. A vegetation management plan would be developed and implemented. The choice of plant species is influenced by a number of variables, including soil, elevation, and climate. The plant should display the following traits:

- The species ought to have rapid growth and excellent penetrability.
- The species should form a dense canopy and be wind-firm and deeply anchored.
- The species must be naturally occurring and accessible in the area.
- Birds, insects, and butterflies are drawn to certain tree species.
- Low-maintenance green cover that is sustainable.

2. **Air Pollution Management:** Every time a vehicle crosses a paved surface, such as a road or parking lot, particulate emissions are produced. The direct emissions from vehicles, such as exhaust, brake and tire wear emissions, and the resuspension of loose material on the road surface, are what cause particulate emissions from paved roads. When a car moves on an unpaved road, the power of the wheels striking the surface crushes the road's topography. The road surface will be exposed to a strong air current in a turbulent shear with the rolling wheels lifted and dropped particles. The amount of dust that is emitted from a particular stretch of unpaved road changes linearly with the amount of traffic. The source variables that describe the state of a particular road and the related vehicle traffic also affect dust emission.

Table 2: Impact & Management of Air Pollution

Impact	Management
Dust and vehicle exhaust emissions are the two main pollutants that are expected to be present during construction. Sources of fugitive emissions include excavation, building operations, road construction, dust from bare soils and unpaved roads, overloaded trucks, raw material storage, transit, and material handling.	To keep the soil moist and reduce fugitive emissions when trucks are moving, the haul road will regularly receive a watering. Storage of construction materials will be protected. To keep air emissions within the building, the construction site will be protected with tarps. Checks for pollution control and efficient usage of the vehicles. To prevent overloading, all transportation trucks shall be properly covered with tarps. By using materials with low levels of VOC emissions, provisions will be made to prevent sick building syndrome.

Following actions will be taken to assure better air quality:

- Programs that promote the use of a variety of transportation options, including non-motorized modes like walking and bicycling when practical, which lower vehicle emissions.
- The project's proponents will make an effort to reduce pollutants that harm air quality and/or cause global environmental issues including the "greenhouse effect."
- Reduce one-way traffic congestion through road construction and repair, better directional signage, and parking management.

3. **Water Management:** The projected development will require a total of 1050 kilo litres per day (KLD) of water per day. The home fresh water demand will be 815 KLD, while the water needed for the green belt will be 715 KLD, both of which will be supplied by recycled water (from the STP). The STP will utilize extended aeration with a 1000 KLD

capacity. The generated waste water will be processed at sewage treatment facilities and repurposed for flushing and gardening. In order to reduce the impact on ground water, rain water harvesting will be used to collect the most runoff and recharge the aquifer.

Table 3: Impact & Management of water

Impact	Management
Tankers and municipal water supplies will be used to meet the demand for water.	The municipal water supply and tankers will supply all the water needed during the construction period. Because there will be a total water demand of 20.0 KLD during construction, the effect on the water environment will be minimal.

4. **Solid waste management and handling plan:** Both during the construction phase and the operation phase, solid waste would be produced. Excavated materials, used bags, bricks, concrete, MS rods, tiles, wood, and other items will all be included in the solid waste that is anticipated to be produced throughout the construction period. For the management of solid waste, the following actions are suggested:
   - The excavation material, such as dirt and stones, will be stacked for reuse during later stages of building. Building yards are envisaged for the storage of construction materials.
   - Excavated top soil will be saved in a makeshift soil bank and used to landscape the IT project.
   - Remaining dirt must be used for road construction, site levelling, road refilling, selling to outside contractors for road building, etc.

Table 4: Summary of the waste management

Sr. no.	Nature of Waste	Impacts	Management	Advantage
1	Papers & Cardboard	A biodegradable substance is paper. As it rots in the landfill, methane is created, a powerful greenhouse gas (20 times more powerful than CO2).	will be sold to merchants who will then sell it to businesses that produce handmade paper.	This will help in maintaining a non-polluted environment, help in avoiding nuisance.
2	Glass	Assuming 1 % breakage per year, the waste glass has to be dumped and is non-biodegradable, so it will create nuisance and serious injuries.	will be sent for reuse and recycling to the concerns.	This will help in creating a nuisance free environment and reduce landfill waste.
3	e-waste	Produces contaminated lactates which eventually	The recyclable hazardous waste	Many precious metals and toxic

		pollute the ground water. If disposed on the ground causes acidification of soil.	will be disposed of, and the recyclable non-hazardous waste will be sold to vendors.	substances which otherwise go as a waste will be recovered.
4	Biodegradable waste	If organic stuff is dumped on the ground, it progressively degrades, causing unpleasant health consequences.	Daily waste collection and storage in the designated bins will take place.	Thishelps in maintaining a clean environment.
5	Non-biodegradable waste	includes plastic and polythene bags, clogs drains, and has a negative influence on the environment.	will be gathered every day and delivered to the municipal corporation.	This helps in maintenance of environment and avoid the choking of drains which lead to unsanitary conditions
6	Landscape waste	Include litter, gardens trimmings, tree cutting, mowing and result in choking of drains.	Manure will be created by collecting and processing the organic waste.	This avoids storm water drains and will help in maintaining clean environment.

5. **Noise management:** There will be noise produced both during and after construction. D.G. set operation, heavy machinery, and vehicle movement are the main noise sources. Only in the event of a power outage will D.G will be used.

Table 5: Impact and Management Plan of noise in construction phase

Impact	**Management**
Road traffic may be one of the causes of noise during the construction phase.	Complete construction activity, particularly labor-intensive earthwork, will be carried out during the day. Raw material-carrying vehicle mobility will be restricted at night. With the use of tarpaulins, the construction site will be protected. The cars will receive routine maintenance, and best use will be made of them. For the piling activities, mud circulation technology will be used, which will lessen noise and vibration. The project site will be surrounded by temporary noise barriers. The employees will receive earplugs.

Table 6: Impact and Management Plan of noise in operation phase

Impact	Management
Road traffic may be one of the sources of noise in the post-construction era.	In order to provide a sound barrier between the building and the road, dense vegetation will be done around the perimeter. To ensure a smooth flow of cars, entry and exit points will be supervised by skilled, effective security personnel. The driveways will be wide enough that there won't be a backlog of cars during rush hour, which would raise noise levels.

6. **Energy management:** Energy management is the application of various data-based optimization techniques to lower the cost of energy supply.

Table 7: Impact & Management of Energy in construction phase

Impact	Management
Electricity from the grid is used for site equipment, elevator lighting, etc. transporting away building trash from the site. High inductive loads (such as motors, transformers, etc.) may lead to an out-of-phase shift in the current and voltage of the power supply. Nearly the entire town will experience disruption from light coming from outside the work zone. operating of construction machinery.	While waiting to enter the site, loading, and unloading, the transport vehicle's engines will be turned off. Construction materials with low energy embodied will be preferred. To achieve the specified primary energy efficiency, energy-efficient building materials including Gypsum Plaster Concrete, Sand Aggregates, Fly Ash Cement, and Blast Furnace Slag will be employed. Grid-connected electricity will be used as little as possible for site tools, elevators, lighting, etc. The use of on-site cut-off shield fixtures will limit light pollution. ensuring that all lights are pointed at a surface and not the sky or its surroundings. It will be kept to a minimum in accordance with security and safety. limiting the use of lights to the site's active regions.

Table 8: Impact& Management of Energy in operation phase

Impact	Management
High energy usage in the heating systems. Losses brought on by insufficient voltage supply. Service provisioning by electromagnetic radiation and interference (voltage spikes, overloads, and power factor anomalies). A heat island effect can be caused by heat that is both absorbed and emitted at a specific area of land.	To lower the energy use, certain energy-saving techniques will be implemented. Compact fluorescent lights that are energy-efficient should be utilized since they provide the same level of illumination while using less power than other GLS lamps. For exterior illumination, sodium vapor and LED light types must be used. Windows that are a good size to let in enough daylight. Technology for green roofs will be applied. It will assist in lowering the necessary cooling load, enhancing the microclimate, and so assisting in lowering energy usage. By using cut-off shield site fixtures, light emission will be decreased.

V. CONCLUSION

Maximizing human development and overcoming the effects of poverty are the main goals of economic development. The SEZs helps in enhancing existing human skills. As long as an adequate environmental management system is in place, there should be no negative impact from the proposed project. Numerous changes in the socioeconomic structure of the area inside and around the proposed SEZ are anticipated as a result of the emergence of various types of industries. The socioeconomic changes could be advantageous or harmful. The proposed SEZ is expected to increase population density in the surrounding area and in a few of the nearby villages, which is the general tendency of the socio-economic environment. This might be ascribed to the industry offering more direct and indirect employment-based opportunities. According to the environmental assessment, by properly implementing the actions outlined in the EIA and the EMP, the associated potential negative environmental impacts can be reduced to an acceptable level. The project won't have any substantial adverse environmental effects, according to the impacts and their mitigations, but it will help to improve the socio-economic conditions of the neighborhood around the site of the project and the city as a whole.

REFERENCES

[1] Ahmed, W., Tan, Q., Solangi, Y. A., & Ali, S. (2020). Sustainable and special economic zone selection under fuzzy environment: A case of Pakistan. Symmetry, 12(2), 242.
[2] Aung, T. S., Overland, I., Vakulchuk, R., & Xie, Y. (2022). The environmental burdens of special economic zones on the coastal and marine environment: A remote sensing assessment in Myanmar. Remote Sensing Applications: Society and Environment, 28, 100809.
[3] Benjatanawat, S., Isaramalai, S. A., & Muenhor, D. (2021). The Development of a Rapid Health Impact Assessment Model for Songkhla Special Economic Zone (SEZ) Policy in Southern Thailand. Iranian Journal of Public Health, 50(1), 130.
[4] Block, B., & Lane, P. (2019). Environmental and Social Impact Assessment for the Power Supply Component of the Mombasa SEZ Development Project.
[5] Hamzah, S., Pangemanan, D., & Aprianti, E. (2023). The environmental and sustainable factors on the special economic zones development. Civil Engineering Journal, 9(2), 334-342.
[6] Khalid, I., Ahmad, T., & Ullah, S. (2022). Environmental impact assessment of CPEC: a way forward for sustainable development. International Journal of Development Issues, 21(1), 159-171.
[7] Matsuzawa, S. (2023). The Case of the Thilawa Special Economic Zone in Myanmar. Assembling a rich and diverse set of scholarly contributions, the handbook reviews what we know about land grabbing and identifies fresh lines of inquiry. It is an excellent resource for scholars and activists., 401.
[8] Mugano, G. (2021). The Impact of Special Economic Zones. In Special Economic Zones: Economic Development in Africa (pp. 115-140). Cham: Springer International Publishing.
[9] Rathoure, A. K. (2021). Environment impact assessment (EIA) studies for developmental activities in India in context with EIA 2020. Oct. J. Environ. Res, 9(1), 21-45.
[10] Singh, A. (2021). Impact assessment of special economic zone on the development of its surrounding areas: a case of Indore (Doctoral dissertation, SPA Bhopal).
[11] Srisawat, A., & Wirojanagud, W. (2020). Site Selection for Special Economic Zone using Spatial Planning with Strategic Environmental Assessment Application Case Study of Nongkai Province. Thai Environmental Engineering Journal, 34(1), 45-55.
[12] Srisawat, A., & Wirojanagud, W. (2020). Spatial assessment of special economic zone development for decision making: case study of nong khai province. Journal of Environmental Management & Tourism, 11(8), 2083-2093.
[13] Tehrani, G.M., Tavakoly Sany, S.B., Hashim, R. et al. Predictive environmental impact assessment of total petroleum hydrocarbons in petrochemical wastewater effluent and surface sediment. Environ Earth Sci **75**, 177 (2016). https://doi.org/10.1007/s12665-015-4918-1.
[14] Teo, H. C., Lechner, A. M., Walton, G. W., Chan, F. K. S., Cheshmehzangi, A., Tan-Mullins, M., ... & Campos-Arceiz, A. (2019). Environmental impacts of infrastructure development under the belt and road initiative. Environments, 6(6), 72.
[15] Turgel, I., Bozhko, L., Pracheva, E., & Naizabekov, A. (2019). Impact of zones with special status on the environment (experience of Russia and Kazakhstan). Environmental and climate technologies, 23(2), 102-113.

