

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued four times per year on paper and in electronic format.

For further information about this article or if you need reprints, please contact:

J. Nouri
Department of Environmental
Health Engineering,
Center for the Environmental
Research ,
School of Public Health,
Tehran University of Medical
Science,
Tehran, Iran

J. Med. Sci., 6 (1): 34-37
January-March, 2006

Environmental and Health Impact Assessment of Wastewater Treatment Plant

J. Nouri, R. Nabizadeh, M. Younesian, H.A. Norouzi and S.M. Tehrani

Environmental and health impact assessment of Hamadan wastewater treatment plants were studied for the treatment of wastewater produced at Hamadan, Bahar and Lalejin Cities, with the population of about one millions. In this study, a new method of EIA applied, using Leopold Matrix 3 dimensions to predict the negative and positive impacts of the project activities on environmental factors. After the data collection, processing and analyzing, Adkins and Burks check list along with new 3-dimensional Leopold Matrix were applied. This 3-dimensional method was a new method which was applied in this study for the first time in Iran. The scaling-ranking checklist was also applied which is a suitable approach for determination of intensity and importance of environmental impacts. The results obtained from this investigation showed that execution of the wastewater treatment plant could have some negative impacts, but may contain some important positive impacts particularly on the improvement of health conditions and environmental quality in the proposed project area. The mitigation measures have also been noticed for the project and in this regard some major management approaches were proposed at the construction and operational phases.

Key words: Wastewater treatment plant, environmental impact assessment (EIA), 3-dimensional leopold matrix, Hamadan

INTRODUCTION

Nowadays, collection, treatment and disposal of wastewater produced at the municipal communities can bring environmental and health hazards^[1]. This is an important problem at the urban development program for cities. So that in the recent decade by providing the local and national credits as well as international loans, a considerable progress has been seen in this regard. In some areas, in order to have specific climate conditions, groundwater specification, social and cultural particulars and environmental or health problems, the hazards of the non-treatment wastewater should be considered with high sensitivity. In the meantime, capital cities can be confronted with ever-increasing development in population and pollution^[2]. For example Hamadan city is located in the west of Iran, as the center of Hamadan province, nowadays is confronted with wastewater disposal problem. At the moment, the total wastewater volumes which are produced at this city are mixed with the wastewater produced at Bahar and Lalehjin cities where are located in 10 and 20 km far from Hamadan, respectively. The present disposal wastewater collection are transporting by old combined sewage system which are collecting and discharging in the Hamadan-Bahar Agricultural fields. These are discharged without any treatment process and are being used as direct irrigation. This operation has been caused some intense environmental pollution and health problems such as serious water and ground water pollution as well as an increase of parasitic disease in this area^[3,4]. In this condition, systematic collection and centralized treatment plan for the produced wastewater at Hamadan, Bahar and Lalehjin cities were approved by the local authority. In this regard, the preliminary action, as pre-feasibility and feasibility study of the location such as primary investigation, land possession, mapping, and finally wastewater treatment plan have been done. The studied area is located in the 10 km of the north east of Hamadan. At the moment, the mapping and design of the wastewater treatment plant have been finalized and in the next few months are going into constructional operations^[4].

The project goals are in primary and secondary treatments, sludge digestion and disposal, using of effluent to irrigation in order to improve the health conditions and environmental quality.

This study was performed at the municipal wastewater treatment plant of Hamadan in summer 2004 in a period of 12 months.

MATERIALS AND METHODS

The local wastewater collection, processing and analyzing were performed at the site and laboratory in the region. Environmental impact assessment method was done according to the Adkins and Burk checklist^[5,6], along with new 3-dimensional Leopold matrix and scaling-ranking checklist which were applied for the three alternative choices such as; execution, non-execution, execution with consideration of environmental criteria. Adkins and Burk checklist was applied for the intensity of impacts due to the different activities of project in construction and operational phases. Study was performed in three types of the environment, consisting physicochemical, biological and socio-economical environments at the three zones consist of immediate, under direct impacts and indirect impact zones. For changing the qualitative impacts intensity to quantitative indexes, the numbering method in Adkins and Burk checklist were applied, so that numbers-5 for most negative impact intensity up to +5 for the most positive impact intensity. Also, in this investigation the extent and importance of impacts were assessed, to approach the Leopold matrix method which is accepted and creditable method nowadays. In this study a new 3-dimensional Leopold matrix was applied. This 3-dimensional method is a new method which is applied in this research for the first time in Iran, in order to predict the intensity, extent and importance of projects activities impacts on environmental factors. For numbering the extent of impacts; 1 for the impacts that happen in immediate zone, 3 for under direct impacts zone and 5 for under indirect impacts zone. Also for numbering the importance of impacts 0.25 to low importance, 0.5 to medium importance, 0.75 to high importance and 1 to very high importance in the 3-dimensional Leopold matrix. To evaluate and compare the negative and positive impacts, the scaling-ranking checklist is also applied which is a suitable approach for showing the impacts of important activities on environmental factors, and determining the extent and quality of impacts. The managerial procedures and technical as well as mitigation measures were also advised in order to support positive impacts and decreasing of negative impacts.

RESULTS

The major efficacious activities that could be defined to this plan in two phases are commonly consist; excavation, backfilling, road construction, building materials handling, noise creation, ground water drafting,

Table 1: Environmental impact assessment of Hamadan wastewater treatment plant, with considering the three alternative choices at physico-chemical, biological and socio-economical environments

		Choices					
		1		2		3	
		+	-	+	-	+	-
Environment	Environmental factors						
Physico-chemical	Surface water quality	-	-	2.50	-	2.50	-
	Surface water quantity	-	-	-	-	-	-
	Ground water quality	-	4.50	3.75	-	7.50	-
	Ground water quantity	1.5	-	-	4.75	-	4.50
	Ambient air quality	-	-	-	12.50	-	5.25
	Soil quality	-	7.50	5.00	11.00	7.50	4.25
	Soil erosion	-	-	0.50	3.00	0.50	1.50
	Wastewater situation	-	7.50	20.25	-	27.00	-
	Noise quality	-	-	-	12.50	-	4.00
	Sum		1.5	19.50	32.00	43.75	45.00
Biological	Aquatic plants	-	-	-	5.00	-	2.50
	Aquatic animals	-	-	-	-	-	-
	Dry plants	-	-	-	5.00	-	4.50
	Dry animals	-	-	-	3.00	-	3.00
Sum		-	-	-	13.00	-	10.00
Socio-economical	Population	-	-	-	-	-	-
	Agriculture	-	3.00	-	20.50	-	10.25
	Employment and outcome	-	7.50	35.00	-	35.00	-
	Tourism	-	-	5.00	-	5.00	-
	Development plans	-	-	14.00	-	14.00	-
	Health and welfare	-	18.75	16.00	-	27.75	-
Sum		-	1.25	15.00	-	12.50	-
Sum		-	30.50	85.00	20.50	94.25	10.25

Choice 1: Execution, Choice 2: Non-execution, Choice 3: Execution with environmental considerations

Table 2: The scaling-ranking of EIA at the Hamadan wastewater treatment plant with considering of the three alternative choices

		Choices					
		1		2		3	
		+	-	+	-	+	-
Environment							
Physico-chemical		1.5	19.5	32	43.75	45.00	19.50
Biological		0.0	0.0	0	13.00	0.00	10.00
Socio-economical		0.0	30.5	85	20.50	94.25	10.25
Sum		1.5	50.0	117	77.25	139.25	39.75

Table 3: Conclusion of the three alternative choices for Hamadan wastewater treatment plant

		Choices		
		1	2	3
Physico-chemical		-18.0	-11.75	+ 25.5
Biological		0.0	-13.00	-10.0
Socio-economical		-30.5	+ 64.50	+ 84.0
Sum		-48.5	+ 39.75	+ 99.5

facilities construction, emission to air, recruitment and employment, accident and events, dust creation, enclosure and fencing, effluent disposal, sludge disposal, chemical materials handling, solid waste production, wastewater treatment and green-belt construction. So some of this could have positive and also negative impacts but some of them have both positive and negative impacts together. One of the important negative impacts is the annihilation of about 12 h. of fertilized agricultural lands at Hamadan-Bahar field that have been allocated for construction of facilities, such as buildings

and roads to the plan. This action as being appeared in the checklist, effects the quality of soil, agriculture and plants in area. But the positive impacts of new job opportunities, provincial development projects and the most important of all, the improvement of people health and welfare conditions will explain this project. The obtained values of 3-dimensional Leopold matrix for any three choices with a view to be negative or positive impacts are being showed in the scaling-ranking check list (Table 1). In order to add up and extract the obtained data from check list, Table 2 and 3 were formed and the final investigation results are being shown as the sum of negative and positive impacts for three choices, separately.

DISCUSSION

Sustainable development is the socio-economical development with minimum dangerous impacts on

environmental factors, and together with environmental consideration in different level of the decision making and the execution in any projects are requisite approaches to sustainable development goals^[7,8]. The basic objective of Hamadan wastewater treatment plant is treatment of the wastewater produced at the mentioned cities in order to have the opportunity to meet with the effluent standards with regard to improvement of environmental quality and health level at this area. But in order to have access to this objective, to establish equilibrium between project activities and existing environment is a requisite. Such as observation the wastewater treatment plant has several activities in the construction and operational phases that if non-observance environmental considerations at time which is occurred will be having irretrievable detriments on the environmental factors and health of people in the effected area. The results obtained from this EIA study showing that the maximum negative impacts were predicted on the physicochemical environments and positive impacts were predicted on the socioeconomic environments particularly on the health and the welfare factors. Also, the biological environments were exposed to minimum negative impacts and positive impacts were predicted on physicochemical environment. But generally, the final results are showing to prevail the positive impacts on negative impacts in the execution with environmental considerations choice of study. Also in the execution choice, this situation was happened too, but because of the existence of the considerable different between the two mentioned choice, selection of the execution with environmental considerations choice as a superior choice could have excessive environmental, socioeconomic and health interests at effected area. Evidently, one of the basic requisite at this project is having a scientific and punctual environmental management program which consist technical and management method to control and reduction the likely

hazards particularly in operational phases. With this propose the most efficient and easiest way for collection of wastewater and the most agreeable methods with environmental conditions should be chosen. The mitigation measures have also been taken into consideration for the project and in this regard some major management approach was proposed at the construction and operational phases.

REFERENCES

1. Ellis, F. and S. Brigit, 2002. Assessing health consequences in an environmental impact assessment. The case of Amsterdam Airport Schiphol. *Environmental Impact Assessment Review*, 22: 633-653.
2. Monavari, M., 2002. *Environmental Impact Assessment of Landfill Sites*. Tehran Municipality Publication.
3. Mahab-Ghods, 1992. Consultant, Hamadan and Suburb Wastewater Plan Studies. Hamadan Water and Wastewater Company Publication.
4. Management and Planning Organization, 2004. *General Studies Plan of Hamadan Province*. MPO Publications.
5. Canter, L., 2003. *Environmental Impact Assessment*. McGraw Hill Publisher, New York.
6. Eceleston, C., 2000. *Environmental Impact Statements*. John Wiley and Sons Inc., New York.
7. Finizo, A. and S. Villa, 2002. Environmental risk assessment for pesticides. *Environ. Impact Assess. Rev.*, 22: 235-248.
8. Shariat, M. and M. Monavvari, 1997. *Environmental Impact Assessment*. Department of the Environment Publication, Tehran, Iran.