Environmental Impact Assessment of an Underground Pipeline: A Case Study from India

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Abstract: **Domestic as well as industrial gas pipe line serves great purposes of any nation. The area which covers the layout of these pipelines also causes severe environmental impact on the natural resources of a nation. In the present study, emphasize has been given on environmental impact assessment and risk analysis. The study has been done on a proposed underground pipeline in Maharashtra, India. The present work highlights the type of impact and the concentration of environmental pollutant at particular project site. This pipeline is used for the transportation of LPG, which is highly inflammable material. The major pollutants studied in the present study are Sulphur dioxide, oxides of nitrogen (NO_X), particulate matter (PM_{10}), ($PM_{2.5}$) and suspended particulate matter (SPM). The results suggest that the average SPM, PM_{10}, $PM_{2.5}$, SO_2, and NO_x concentration found is in the order of 129 μg/m^3, 58.9 μg/m^3, 27.8 μg/m^3, 9.74 μg/m^3 and 16.12 μg/m^3 respectively at different monitoring station located in project site. The result further showed the concentration of pollutant is within the permissible concentration as per the international standard. The impact on ambient air quality is assessed considering the existing baseline air quality.**

Key Words: Environmental impact assessment, risk analysis, nitrogen dioxide, suspended particulate matter, PM_{10}

I. INTRODUCTION

An environmental impact assessment (EIA) is an assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the environmental, social and economic aspects [1].EIAs have two roles - legal and educational. The legal one is to ensure that development projects has a minimal impact on the environment in its entire 'lifecycle' - i.e. during design, construction, use, maintenance, and demolition[2]. Many countries including India now have laws stipulating that unless an EIA study is carried out (particularly for large infrastructure projects), permission for construction will not be granted by the local authority [3]. But countries in Africa, EIA processes as a 'hindrance' to development as environment is not yet a priority [4]. The educational one is equally important to educate those involved in professionals and users of the potential.

The "Air Quality Impact Assessment Study" involves defining of assimilative capacity of regional environmental systems, determination of residual assimilative capacity, resource accounting of supportive resources, generation of alternate developmental scenarios, their impact consequence analysis, evaluation of scenarios through sustainability criteria, viz. equitable quality of life levels, environmental degradation-compliance status, ecological loading and delineation of preferred developmental scenario[5]. With a view to delineate the regional environmental assimilative capacity and to plan proper development of project activity in Maharashtra region of India, Ministry of environment and forest (MoEF) has proposed to undertake a study for carrying out regional Environmental Impact Assessment study of project activity in Maharashtra region and to arrive at proper management plan to sustain existing mining without damage to environmental components.

Development of EIA/EMP (Environmental management plan) is the most valuable interdisciplinary objective decision making tool with respect to overall management of developmental activities, process technologies and project sites[6]. It is an anticipatory mechanism, which establishes quantitative values for parameters indicating the quality of environment and natural systems before, during and after the proposed developmental activities, thus allowing measures that ensure environmental compatibility and economic efficacy for achieving the goal of sustainable societal development. Since the studies cover entire region for collection of relevant environmental data, an integrated approach can be followed by the concerned Government Departments while granting requisite permits/mining leases to the developers in an environment friendly manner.

Risk analysis includes identification of various credible and non-credible failure scenarios and consequences of those scenarios leading to various phenomena like dispersion, pool fire, jet fire, un-confined vapour cloud explosion, BLEVE etc.[7]. Frequency of the failure cases, magnitude of hazards and hazard distances have also been dealt with.

II. MATERIAL AND METHOD

SITE DESCRIPTION

The underground LPG pipeline originate from BPCL Uran bottling plant which is located near Bhendkhal village under Uran tehsil of Raigad district of Maharashtra. Geographically, the take-off point of the proposed pipeline is located at longitude 72^{0}58'35" East and latitude 18^{0}52'39" North at Uran and the terminating point is located at longitude 74^{0}04'42" East and latitude 18^{o}41'34" North at Shikrapur. The pipeline has three tap-off points i.e. first for Usar at 15.73 Km (provision for proposed bottling plant), second for HPCL's Chakan bottling plant at 114.49 Km and the third for IOCL's Chakan bottling plant at 132.42 Km in between Uran&Shikrapur. The HPCL's Chakan bottling plant is geographically located at 73^{0}47'19" East and 18^{0}44'45"

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North whereas IOCL's Chakan bottling plant at 73^{0}54'34" East and 18^{0}44'29" North. All the four terminals are located in the industrial area having all infrastructural facilities.

To evaluate the baseline status, an ambient air quality monitoring was carried out for one season (During 2011) in the study area as shown in Fig.1. The monitoring points were (a) Originating Point at BPCL Uran; (b) LPG Bottling Plant of HPCL at Chakan; (c) LPG Bottling Plant of IOCL at Chakan; (d) LPG Bottling of BPCL at Shikrapur; (e) 500-meters corridor on either side of 164.632 Km Pipeline Route. Each monitoring point have four sampling locations. Topography of the area; safety, accessibility and non-interference with general routine of the people residing near the station; dominant wind direction during the study period were the criteria which were taken into consideration during selection of the sampling locations.

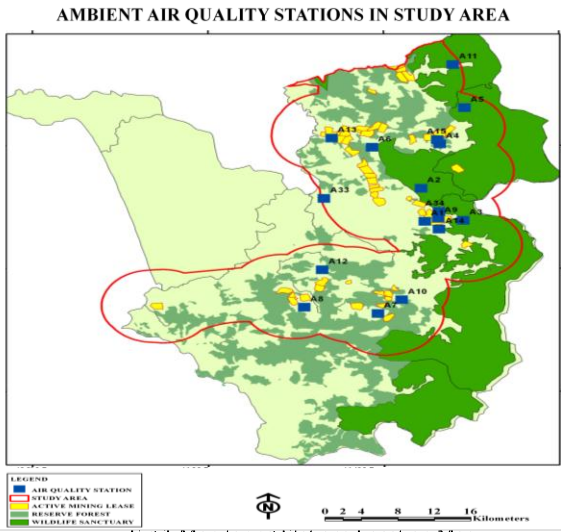

Fig.1 Monitoring Stations Location Map

METHOD USED FOR AIR QUALITY MEASUREMENT:

To measure various gaseous components present in the air, Table 1 depicts the method used for determining various reagent and its estimation method.

TABLE 1 METHOD USED FOR AIR QUALITY MEASUREMENT

S. No.	Gaseous reagent	Method for estimation
1	SPM analysis	Gravimetric method, TEOM method
2	SO_2 analysis	West & Geake method
3	NOx analysis	Jacob &Hochheiser modified ($NaOH$-$NaAsO_2$) Method
4	PM_{10} analysis	Gravimetric method, TEOM method
5	$PM_{2.5}$ analysis	Gravimetric method, TEOM method

III. RESULTS AND DISCUSSION:

In this section, the results obtained after laboratorial experimentation for the study area has been discussed. As depicted from Fig.2, the average Suspended particulate matter (SPM)concentration levels at different locations were observed to be ranging from 75 to 170 (μg/m^3),and hence, were within the permissible limit as per National Ambient Air Quality Standard (NAAQS).The max SPM concentration level found between123 to 276(μg/m^3), and minimum SPM concentration was between 49 to 92(μg/m^3). The maximum concentration of SPM were recorded at the station no. 16 i.e Sanaswadi Village Is 276(μg/m^3). On the contrary the SPM concentration along proposed route line is high due to vehicular transportation of LPG and due to emission of different industries present along the pipe line.

The maximum PM_{10} concentration levels at different location were observed to be ranging from 56 to97(μg/m^3) and the average conc. is 36 – 73(μg/m^3) as depicted in Fig.3 and at the locations viz. Gate no-6 Uran,Funde Village Uran, Main Gate Chakan Bottling Plant of IOCL etc. the concentration were found to be above permissible limits.The maximum $PM_{2.5}$ concentration levels at different location were observed to be ranging from 20 to48(μg/m^3) and the average conc. is 19 - 36 (μg/m^3). Theconcentration of PM_{10} was found to be below permissible limits.The same can also be depicted from the contour map of Fig.4.

The SO_2 concentrations in all the locations were observed in the range 4.9 to 27.6 μg/m^3, with the average values in the range 7.1 to 14.2 μg/m^3. We find that the observed SO_2 concentrations as well as their average values are well below the limit specified for Sensitive Areas. Thus, it may be concluded that the SO_2 concentration in the area is well within the limits specified not only for Residential, rural and other areas but also for Sensitive areas. The same can also be depicted from the contour map of Fig.5.

As observed from Fig. 6, the NO_x concentrations in all the locations were observed in the range 9.4 to 33.1 μg/m^3, with the average values in the range 12.4 to 27.2 μg/m^3. The authors has found that the average NOx concentrations were well below 30 μg/m^3, which is the limit specified for Sensitive Areas. Thus, the NOx concentration is well within the limits.

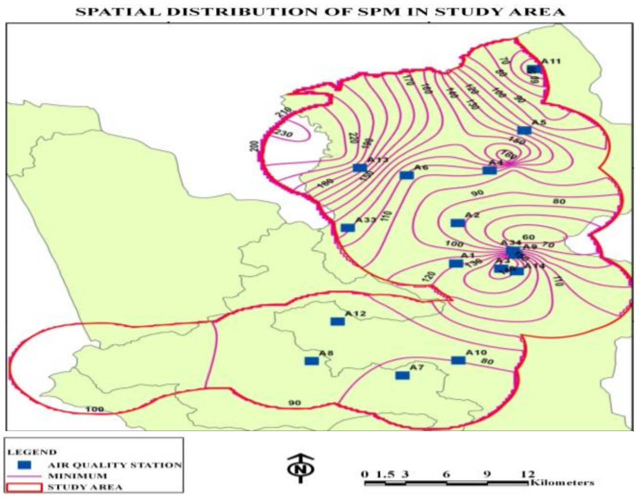

Fig. 2 Spatial distribution of mean SPM concentration levels in the study area

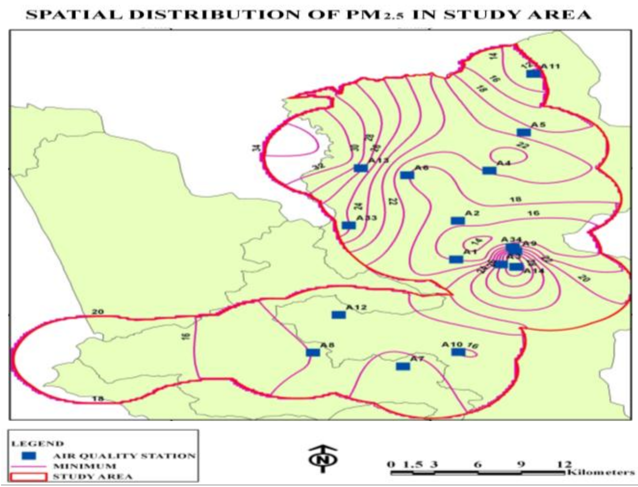

Fig 3 Spatial distribution of mean PM_{10} concentration levels in the study area

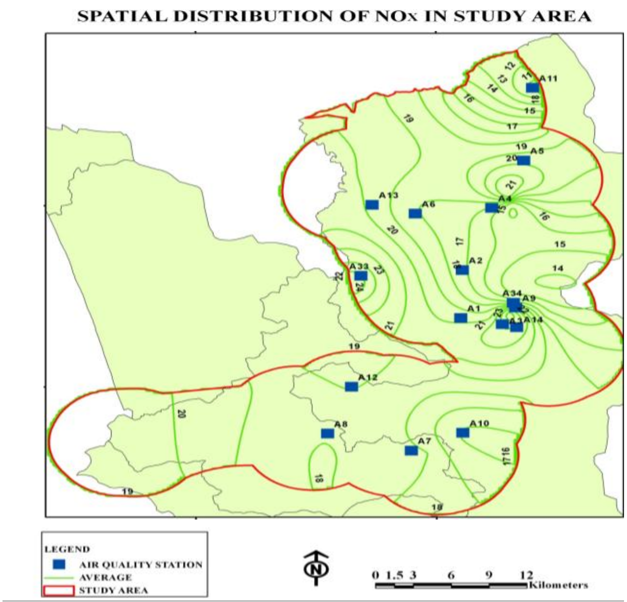

Fig.4Spatial distribution of mean SO_2 concentration levels in the Study Area

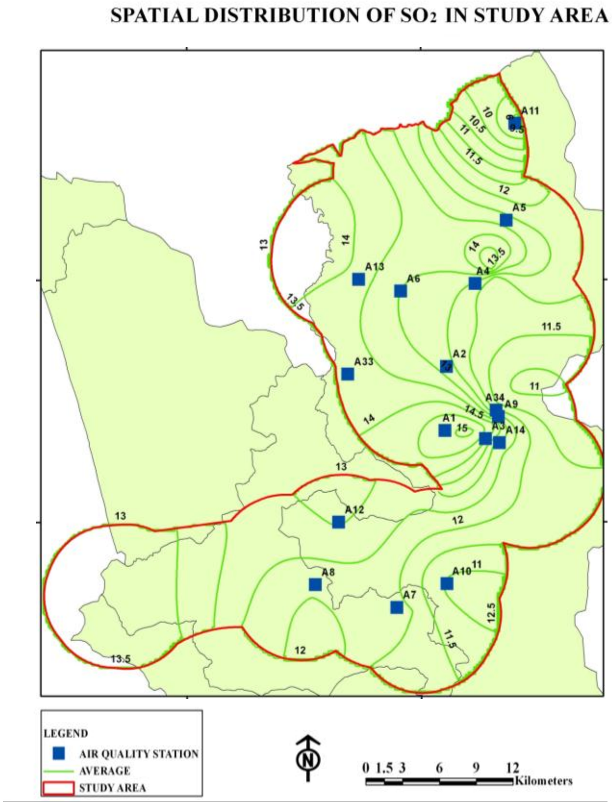

Fig 5 Spatial distribution of mean NO_X concentration levels in the study area

IV. CONCLUSIONS

The major pollutants studied in the present study are Sulphur dioxide, oxides of nitrogen (NO_X), particulate matter (PM_{10}), ($PM_{2.5}$) and suspended particulate matter (SPM). The results suggest that the average SPM, PM_{10}, $PM_{2.5}$, SO_2 and NO_x concentration found is in the order of 129 µg/m^3,58.9 µg/m^3,27.8 µg/m^3,9.74 µg/m^{3}and 16.12 µg/m^3 respectively at different monitoring station located in project site. The result further showed the concentration of pollutant is within the permissible concentration as per the international standard. The impact on ambient air quality is assessed considering the existing baseline air quality.

REFERENCES

[1] Glasson, J; Therivel, R; Chadwick A, "Introduction to Environmental Impact Assessment," pp.127-135, 2005.

[2] Carroll, B. and Turpin T., "Environmental impact assessment handbook, second edition,"pp.138-145, 2009.

[3] Jay, S., Jones, C., Slinn, P., Wood, C., "Environmental Impact Assessment: Retrospect and Prospect Environmental Impact Assessment Review," 27: 287-300, 2007.

[4] Lenzen M.,Murray,S,Kotry B.,Dey C., "Environmental Impact Assessment including indirect effect – a case study using input-output analysis," Environmental impact assessment Review, 23, pp.263-282, 2003.

[5] Birnbaum. R.,"The Air Quality Committee (AQC) Canada – United States Air Quality Agreement," 1994.

[6] EEA,"National and central estimates for air emissions from road transport. Technical report no 74. European Environment Agency," Copenhagen, 2002.

[7] EPA,"Users Guide for the Calpuff Dispersion Model. EPA-454/B-95-006. Office of AirQuality Planning and Standards Emissions, Monitoring, and Analysis Division," U.S. Environmental Protection Agency, Research Triangle Park, NC, 1995