

Environmental Impact Assessment of Rural Solid Waste Disposal in West Bengal

Anshuman Pal^{1*} and Pankaj Kr Roy²

¹Capacity Building Manager (Engineering) ISGP Programme II, Panchayat and Rural Development Department, Government of West Bengal, Kolkata, India

²Dean of Faculty of Interdisciplinary Studies, Law and Management, Professor and Joint Director, School of Water Resources Engineering Director, School of Environmental Studies, Jadavpur University, Kolkata, West Bengal, India

***Corresponding author:** Anshuman Pal, Capacity Building Manager (Engineering) ISGP Programme II, Panchayat and Rural Development Department, Government of West Bengal, Kolkata, India, Tel: 8981232423; E-mail: pal.anshu@gmail.com

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Abstract

The environmental impact assessment of rural solid waste management in West Bengal were to evaluated using RIAM model to take into account waste generation, collection, transportation, disposal technology and energy recovery. Waste management system created many problems not only for the large cities, rural area also. Environmental impact assessment (EIA) is very much essential for the development works. Rapid impact assessment matrix is one of the essential ways that can be evaluated by EIA process. This method minimize the risk of environment pollution and introduces some degree of transparency. Using RIAM, EIA has been carried out different parameter of rural waste management system of west Bengal. The current system mainly depends on sanitary land filling, has manifested significant adverse environmental impacts causes methane emission from landfills. It has been also recommended that according to existing situation vermicomposting is the best process for rural solid waste management system. Source segregation of food waste can be one solution for better energy recovery system in environment friendly manner.

Keywords: Environmental Impact Assessment; Rapid Impact Assessment; Solid Waste

Abbreviation: SWM: Solid Waste Management; MSW: Municipal Solid Waste; Fig: Figure; EIA: Environmental Impact Assessment; CPCB: Central Pollution Control Board; PRDD: Panchayat and Rural Development Department; RIAM: Rapid Impact Assessment Matrix; RSWM: Rural Solid Waste Management System

Introduction

Environmental impact assessment (EIA) is a effective technique to evaluate the effect on environmental components of different sector based on the results of this assessment. To evaluating the effect of a proposed project on environmental point of view and it offers optimum solution to reduce negative impacts called environmental impact assessment.

Environmental cleanse is the mandatory proceeding for all types of project across the world. Solid waste generation is an issue of worldwide concern [1]. Land filling is the one of the major pollutant source of methane (CH₄) and also indirectly source of global warming also [2]. For a long run, Environmental point of view source segregation of organic waste could be improved the environment [3]. .In EIA different component of environmental need to be analysis regarding the impact of respective project. In EIA Process air, water, soil noise along with the socioeconomic aspect is studied in details. In this process also estimated the potential of impact of the proposed project. Based on the EIA analysis various mitigation measures of environmental problem are proposed. In this systematic process of environmental impact assessment (EIA) future consequences of a current or proposed action can be assess. Technical analysis and scientific application are required where's decision making and management is likely to be an art in EIA. EIA is a combination of science and technical analysis. The main aim of the EIA is providing an effective chance to demonstrate in which way environment may be mitigate the development process. In environmental point of view EIA also predicts the conflicts and constraints between the proposed project. It is also providing the idea of mitigation measures for minimizing the environmental impact. EIA is worked as a management tool for planned and decision maker.

In economically sound panning project both the cost- benefit analysis and cost-effective analysis need to be study, which is also part of an EIA. The direct and indirect benefit of EIA can be improved design or project location and raised environmental awareness. After the stock conference of 1972 and NECPE environmental issues in India were seriously considered. Environmental protection rule 1986 guideline is a important tool for the national decision makers. Environmental clearance and EIA process established in 1994 to assess the environmental impact of project to mitigation measured in the planning stage.

The RIAM method is effective approach for evaluation of environmental and human impact with respect to potential operation. Rapid Impact assessment matrix (RIAM) is a organizing tool to analysis the EIA method. RIAM is a simple structured and flexible method for both executing and evaluating EIAs. In this RIAM method the element of method minimizes are subjectivity and introduces some degree of transparency [4]. In solid waste management system energy recovery should must for the land filling mechanism as a alternative disposal technique [5]. Waste recycling is the best model for control waste management system [6].

Material and Methods

West Bengal is located in the eastern part of India between the Himalayas and the Bay of Bengal. The latitude of West Bengal is 22.978624° N, and the longitude is 87.747803° E of India shown in Figure 1. The area of West Bengal is 88.752 km². The states are near sea level, with the average elevation being 5.18m. As the states are starts from the Himalaya to near the sea the states have a temperature variation uniform throughout the year. The temperature ranges from 14 to 25° C in the winter and 23 to 36° C in the summer. Annual rainfall is around 1600 mm. The humidity level is very high during the summer season.

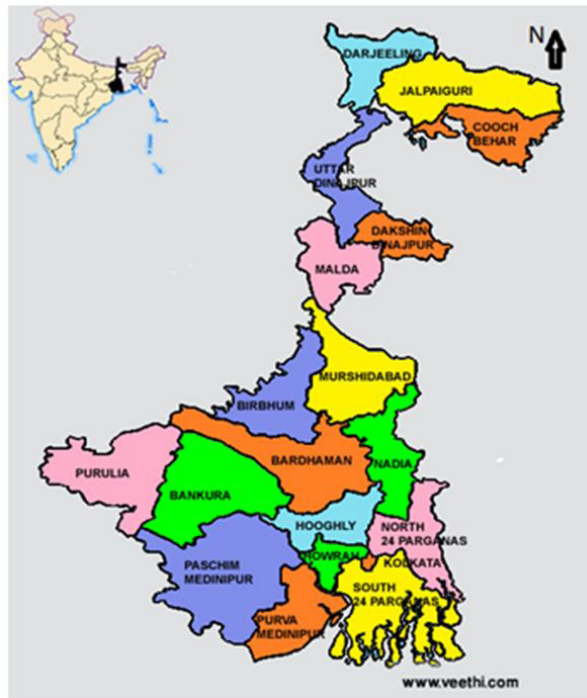


Figure 1: Map showing the study area of West Bengal

RIAM process is a important assessment criteria based on standard definition to provide an accurate score for each condition.

The assessment criteria divided into two groups: -

1. Individual can change the obtained score, which is a important condition.
2. Individual should not be capable of changing the obtained score depends on value of situation.

The value indicates the group of criteria by using the series of simple formula.

Individual component wise score is formulated. The scoring system requires multiplication of given criteria in Group (A). To provide identical results for different condition summation of scores is required to ensure the weight of expressed score. Scores for Group(B) are added to provide the sum. Individual scores cannot influence the overall score. The sum of Group (B) is need to multiplied by the group A to provide the final ES Scores.

The process of RIAM can be expressed as follows:

$$A1 \times A2 = AT \dots\dots\dots (1)$$

$$B1 + B2 + B3 = BT \dots\dots\dots (2)$$

$$AT \times BT = ES \dots\dots\dots (3)$$

RIAM method [7]

| Criteria | Scale | Description |
|---------------------------------|-------|--|
| A1 Importance of condition | 4 | Important to national/international interest |
| | 3 | Important to regional/national interests |
| | 2 | Important to areas immediately outside the local |
| | 1 | Important only to the local condition |
| | 0 | No importance |
| A2: Magnitude of change/ effect | 3 | Major positive benefit |
| | 2 | Significant improvement in status quo |
| | 1 | Improvement in status quo |
| | 0 | No change/status quo |
| | -1 | Negative change in status quo |
| | -2 | Significant negative disbenefit or change |
| | -3 | Major disbenefit or change |
| B1: Permanence | 1 | No change/not applicable |
| | 2 | Temporary |
| | 3 | Permanent |
| B2: Reversibility | 1 | No change/not applicable |
| | 2 | Reversible |
| | 3 | Irreversible |
| B3: Cumulative | 1 | No change/not applicable |
| | 2 | Non-cumulative/single |
| | 3 | Cumulative/synergisti |

Table 1: Assessment criteria

| Environmental Score | Range bands | Description of range bands |
|---------------------|-------------|----------------------------|
| +72 to +108 | +E | Major Positive |
| +36 to +71 | +D | Significant Positive |
| +19 to +35 | +C | Moderately Positive |
| +10 to +18 | +B | Positive |
| +1 to +9 | +A | Slightly Positive |
| 0 | N | No Change |
| -1 to -9 | -A | Slightly negative |
| -10 to -18 | -B | Negative |
| -10 to -35 | -C | Moderately negative |
| -36 to -71 | -D | Significant negative |
| -72 to -108 | -E | Major negative |

Table 2: Conversion of ESs to range bands

Results and Discussion

Rapid EIA study has been carried out for assessment the rural solid waste management system. It has been concluded that rural solid waste management system is the best disposal and vermicomposting is the most preferred technique in rural context. In this rapid environmental impact assessment study, the matrix (Table 1) has been developed to identified the negative impact on social physio chemical parameter of environment and also the probable mitigation which can be adopted (Table 2).

This study shown that in 1st case there is no negative impact due to rural solid waste management unit. On the other hand, this solid waste management unit is least costly solution, to maintain the rural area clean and waste free zone.

The major positive impact of this waste management unit is prevention the air, water, land pollution. It is creating a huge difference between ambient qualities. In this waste management unit concentration of harmful substance reduced significantly, as a result no negative impact noticed.

After the initial stage leachate problem has been solved, It will not creating any problem to ground water resources. The products (vermi-compost) from the treatment unit are selling in a very low cost Rs 8 /Kg due to high concentration of NPK values. The

impact of odor related problem could be reducing further if maintain properly. It is expected that the by-product of vermicomposting contents very high concentration nutrient values and low concentration of pollution and if possible, it can be used for cultivation also. Comparison of RIAM with other EIA method: As compare to others method of EIA RIAM method able to define the criteria against which value to be judge. The parameter checking of EIA should be done based on the cost, time, accuracy, and technology, and transparency, environmental and social point of view.

Sensitivity analysis: Sensitivity analysis for uncertainty of some data in above mentioned modelling system and potential of influence in result, generally sensitivity analysis is used to identify the overall impact and specific changes in parameters. In long term planning (integrated disposal, source segregation, vermicompost preparation, bio gas generation) seems to be better choice for rural solid waste management system in west Bengal. The benefit of this type of system in terms of minimizing and avoiding the environmental impact of ecological, social environmental, which is mainly of the strict waste management system and monitoring.

It is an important precondition for effective energy recovery system that source segregation of food waste to ensure the decrease water content and increasing the heating value of remaining waste. Proper source segregation of food waste and energy recovery are the important concern area for obtaining an environment friendly waste management system. These results can provide technical help to the policy maker for effective rural waste management system in future (Table 3).

| Components | Physical and chemical | Environmental Score (ES) | Range Bands (RB) | A1 | A2 | B1 | B2 | B3 |
|------------|--|--------------------------|------------------|----|----|----|----|----|
| PC1 | Air pollution problem | -E | 81 | 4 | 2 | 2 | 2 | 3 |
| PC2 | Noise pollution problem | -D | -40 | 1 | 0 | 2 | 2 | 3 |
| PC3 | Ground water | +N | 0 | 3 | 1 | 2 | 2 | 3 |
| PC4 | Surface water pollution | N | 0 | 3 | 1 | 2 | 2 | 1 |
| PC5 | Odor emission | -C | -21 | 2 | -1 | 2 | 2 | 3 |
| PC6 | Soil errotion and instability | N | 0 | 3 | 2 | 3 | 3 | 3 |
| PC7 | Topography and landscape | N | 0 | 1 | 2 | 3 | 3 | 3 |
| PC8 | Micro climate changing | +A | +8 | 3 | 2 | 3 | 3 | 3 |
| PC9 | Soil fertility and soil quality | +B | +15 | 2 | 2 | 3 | 2 | 3 |
| | Biological /ecological components | | | | | | | |
| BE1 | Flora and fauna | +A | +7 | 1 | 1 | 1 | 2 | 3 |
| BE2 | Biodiversity | N | 0 | 4 | 1 | 1 | 2 | 3 |
| BE3 | Wildlife | N | 0 | 3 | 1 | 1 | 2 | 3 |
| BE4 | plant and animal habitats | +A | +8 | 2 | 1 | 1 | 3 | 3 |
| | Sociological /Cultural | | | | | | | |
| SC1 | Aesthetic | +C | +25 | 1 | 2 | 2 | 2 | 1 |
| SC2 | Communities living near disposal /treatment unit | +A | +9 | 2 | 1 | 3 | 3 | 3 |
| SC3 | Public Health | +B | +17 | 2 | 2 | 3 | 2 | 3 |
| SC4 | Public acceptance | +B | +13 | 2 | 1 | 3 | 2 | 1 |
| SC5 | Public awareness | +A | +8 | 2 | 0 | 2 | 2 | 1 |
| SC6 | Development near disposal/treatment unit | +C | +34 | 2 | 1 | 3 | 3 | 1 |
| SC7 | Density and population growth | N | 0 | 2 | 0 | 2 | 2 | 1 |
| SC8 | Tourism | +A | +8 | 2 | 0 | 1 | 1 | 1 |
| SC9 | Land use around the disposal site | -A | -7 | 2 | 1 | 3 | 3 | 1 |
| SC10 | Unemployment and creating job opportunities | +D | +56 | 3 | 3 | 2 | 2 | 1 |
| | Economical /Operational components | | | | | | | |
| EO1 | Technology | +C | +33 | 1 | 2 | 2 | 2 | 1 |
| EO2 | Expert operation | +B | +16 | 2 | 2 | 2 | 2 | 1 |
| EO3 | Energy | +A | +5 | 3 | 2 | 2 | 1 | 3 |
| EO4 | Land establishment | +A | +7 | 1 | 3 | 3 | 3 | 3 |
| EO5 | Water necessity | +A | +3 | 1 | 2 | 2 | 2 | 3 |
| EO6 | Chemical material | N | 0 | 0 | 2 | 2 | 2 | 3 |
| EO7 | Current cost | -A | -4 | -1 | 3 | 3 | 2 | 1 |
| EO8 | Marketing strategy | -B | -12 | -2 | 2 | 3 | 2 | 3 |
| EO9 | Reuse and material recovery | +A | +9 | 1 | 2 | 3 | 2 | 1 |
| EO10 | Investment cost | +A | +9 | 1 | 3 | 3 | 2 | 3 |

Table 3: Components of Biological /ecological components, Sociological /Cultural, Economical /Operational components

Conclusion

It is evaluated in this paper the current situation of rural solid waste management system (RSWM) of west Bengal, and environmental impact on global warming, ecological component, and social component. In present situation burning is the general disposal technique for rural habitats. The main disposal technology adopted in rural solid waste management system (RSWM) is vermi-composting preparation and land filling. The alternative technology for replacing the part of landfilling by incinerator or bio gas unit to generate environment friendly energy recovery system.

EIA is an effective tool to demonstrate the environment quality which may be improved or conserved during the development process. In this EIA process also predicts the negative in pact constraints of environment sand ecological point of view. The identical negative impact and its probable mitigation measures can be address by this EIA process. EIA is a cost benefit management tool for planner and decision maker to plan the environmentally sound project planning. EIA is a important tool for the approval process. The output verification of EIA process should be following during the implementation.

The direct and indirect benefits of EIA can be improved the environmental quality and also increase the awareness regarding the environmental related issues.

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