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Research article

The Environmental Aspect & Impacts for Industrial Sites: Methodological Framework and Evaluation

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Abstract: Identifying linked environmental aspects and evaluating related impacts is a crucial requirement of any environmental management system for industrial facilities. Industrial sites should guarantee that a complete procedure for aspect identification and impact assessment is in place to fulfil international environmental protection and preservation requirements. The goal of this research was to develop a new procedure. Determine which environmental aspects of industrial sites (actions, products, and services) have or can have substantial consequences, and review and monitor their control regularly. Professional judgment will play an essential part in determining how to address significance in many cases, and this can be aided by collaboration with relevant stakeholders. The study's conclusion was creating a new environmental aspect evaluation system based on newly developed aspects and impacts rating matrix. Industrial sites could use this approach to identify and manage the environmental aspects of their operations.

Keywords: Assessment; Aspect and Impact; Environmental; Industrial Sites.

1. Introduction

The aim of the environmental aspects and impacts identification approach is to define a mechanism and assign responsibilities for identifying environmental aspects and their impacts associated with manufacturing division operations, processes, and activities and control significant environmental impacts.

This method's requirements include the following: the process owner and team define aspects for the selected activity/product/service. Identify the activities' inputs and outputs and the environmental elements and impacts that result from these inputs and outputs. Flow diagrams can be utilized to aid in identifying the organization's environmental aspects program. Each activity will require a diagram if they are to be used [1].

The identification procedure must consider the preliminary environmental evaluation findings and the aspect categories stated in the following bullet points. It is worth noting that not all the categories will apply to all departments or stages of a process.

The Aspects categories include Air emissions; Energy; Soil and water contamination; Biodiversity; Materials (Storage and Use); Effluent discharges; Solid Waste Generation; Sludge Generation; water consumption; Crude Oil consumption) and noise [2]–[4].

The certified Environmental Management System (EMS) has gained the most attention among the various environmental management strategies that multinational firms have embraced [5].

An environmental management system is critical in preventing pollution, particularly in the industrial and economic sectors, since it provides a systematic framework for all these sectors [6]. It is also a tool for bettering environmental performance [7].

It is worth noting that increased environmental performance benefits organizations not just for the environment but also for a good association between

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enhanced environmental and corporate performance [5], [8], [9].

Environmental aspect impact procedure is an option for promoting a company's environmental sustainability; it involves a structured approach to managing an organization's overall matters; it provides stability and meaning for companies to identify environmental issues through resource distribution [10], assessment of obligation, and process monitoring of techniques, methods, and methodologies; it certifies their accomplishments and focuses on continuous performance improvement [7].

Nevertheless, due to the ineffective application of the Environmental aspect impact technique, identifying the aspect and evaluating related impacts from many industrial sites remains inefficient and needs to be applied to reach the aim of this environmental tool [11].

The study describes the concepts of environmental aspect identification, associated impact assessment identification utilizing a newly developed rating matrix, and the new environmental impact aspect technique.

2. Research Methods

2.1. Environmental Aspect Impact (EAI) Process Map

Environmental Aspect & Impact Assessment [12]–[14] of Processes and activities shall be done for the following (given as an example but not limited to) processes as per the lists listed in Table 1 to ensure good management of environmental risks:

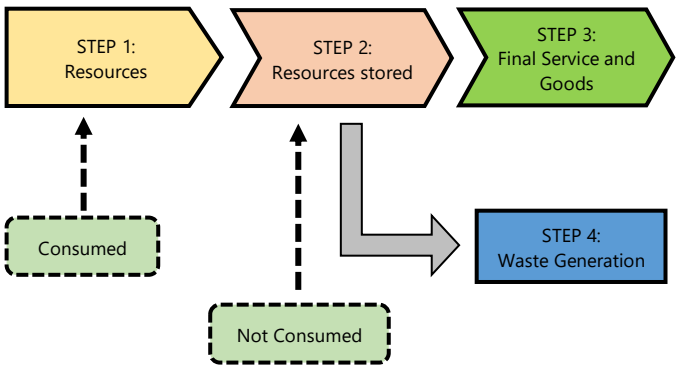

Figure 1. EAI Process Steps

Table 1. Environmental Aspect & Impact for some Processes and Activities

Environmental aspect (process, material used)	Environmental impact / Issue	Origin
Combustion of fuel	gases emission	Generators, heaters
Oil and gas igniting further into a heater	Gas, Oil leaks	Heaters & gas pipelines
Grease treatment	Generation of Grease waste	Pumps, Generators.
Oil change (transformer, Trucks, lube oil system, etc.)	Oil leaks, Oil waste	Maintenance workshops, transformers.
Collection of fly ash in the ash silo	Dust, solid waste	Ash silo
Maintenance of Air heaters	Carbon residues	Boiler
Industrial Wastewater discharges into sea/dam	The wastewater is mildly acidic.	Water treatment plant
Air pollution from stack emissions	SOX, NOX, COX, PM	Heaters, stack
Turning machines running Used Oil filters & Oil rags	Noise	Pumps, turbine, conveyor
Used Oil filters and rags	Hazardous waste	Maintenance
Desalination of seawater/ Wastewater generation	Brine solution/water pollution	Water treatment plant
chemical solution preparation for the water treatment process	Chemical spills	Chemical handling area
Waste generated from offices	Solid waste	Store and office
Electronic waste	Hazardous waste	Store and office
Food waste	Organic waste	Canteen
Indirect discharge of wastewater	Ecological wastewater is mildly acidic.	Evaporation ponds

The following process summarizes the steps as a guideline to be followed during the EAIR process:

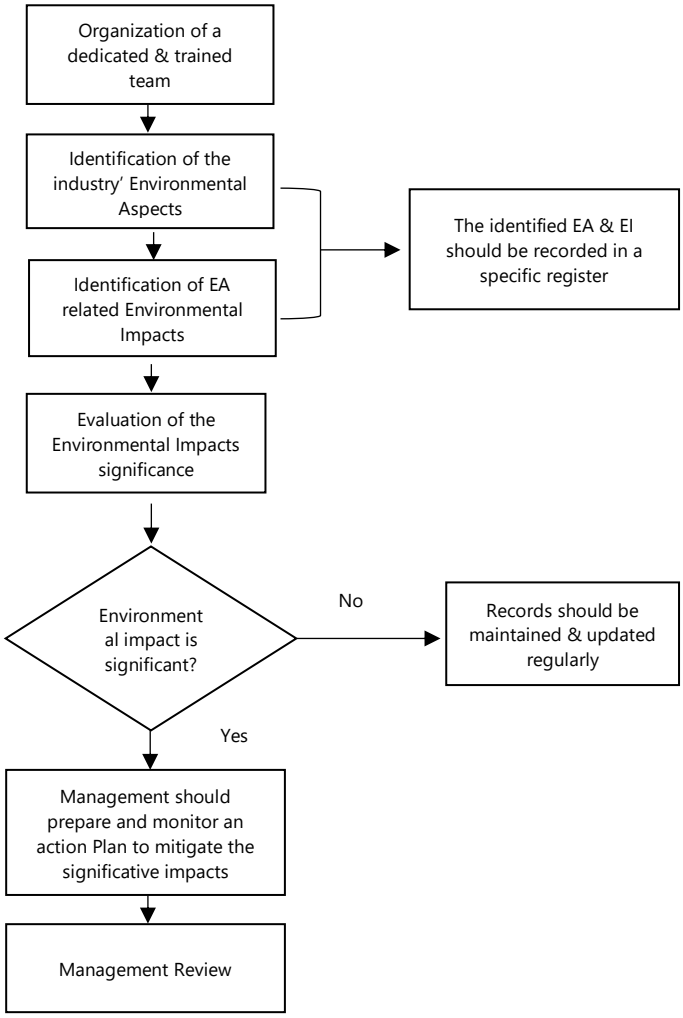

Figure 2. EAI Process Map

The Environmental Aspects during an industrial Process should include (but not limited to) [15]:

a. Oil consumption / spillage
b. Natural Gas consumption
c. Stack emissions
d. Outfall discharges
e. Chemical spillage and leakage
f. Chemical and Oil Storage
g. Hazardous & Non - Hazardous Waste generation
h. Fly ash generation
i. Sludge generation
j. Noise
k. Heat/Radiation

2.2. Identification of Environmental Aspects

The process owner and team should determine the environmental aspects for the specified activity/product/ service and must include:

a. Associated activity/sub-activity with the product/ process
b. Contribution to the process (raw material, energy resources, other utilities, etc.)
c. Process output (product, waste, heat/radiation/ illumination, etc.)
d. Emissions into the atmosphere (flue gases, fumes, particulate, noise, fugitive emissions, VOC, etc.)
e. Waste generation and disposal, land contamination, and outfall (Effluent) releases (liquid waste, chemical spillage, leakage, oil spills, etc.)
f. Aspect resulting from the process/activity
g. The consequences of the aspects (air, water, land, noise pollution, resource depletion).
h. Operation condition (Normal, Abnormal, emergency)

Identify the activities' inputs and outputs and the environmental features and repercussions that result from these inputs and outputs. This should include (where appropriate) identifying direct and indirect environmental characteristics under administrative control or influence and those emerging from normal, abnormal, or reasonably predicted emergencies.

Flow diagrams can be used to aid in the identification of the organization's environmental aspects program. Each activity will require a diagram if they are to be used. It is worth noting that these are only generic activities.

The main Aspects categories could include (but are not limited to):

a. Air emissions
b. Noise
c. Biodiversity
d. Energy consumption
e. Soil contamination
f. Water contamination
g. Materials (Storage and Use)
h. Management of Change (if any)
i. Effluent discharges
j. Solid Waste Generation
k. Sludge Generation
l. water consumption
m. other issues

3. Result and Discussions

3.1. Environmental Aspect Evaluation

The following new developed formula should be used to make the environmental aspect evaluation:

$$\boldsymbol{RS = Lh \times Co \times ECS \times Scale} \quad (1)$$

where:

Rating of Significance (RS)
Likelihood (Lh) : The likelihood of occurrence
Consequence this (Co) : Level of Influence
Scale : Industrial Physical Limitation

Existing control score (ECS) : Controls put in place by the site to reduce or eliminate the impact

Table 1. Environmental Significance Rating Matrix

Score	Likelihood	Consequence	Existing controls	Scale
5	Very likely (Daily basis)	Fatality Extreme Environmental Effects	No control measures are available	Outside the plant facilities (city-level)
4	Likely (Weekly basis)	Acute Health and safety effects Permanent Disability hazardous substance spill or leak requires external intervention	Control measure identification in progress	Outside the plant facilities (adjacent areas)
3	Possible (Monthly basis)	short-term impact on human health (medical treatment) hazardous substance spill or leak requires internal intervention	Control measure in place but not effective	Inside plant facilities
2	Unlikely (Yearly basis)	Slight health and safety Impacts Toxic and harmful material leak in an enclosed environment.	Less Effective controls measures in place	The departmental level which composed of many working areas
1	Very Unlikely (Bi-annually basis and above)	Unhealthy Workplace Conditions on a Short Basis Minor controlled spill	Effective monitored controls measure in place	Working areas (workshop, office, etc.)

3.2. Impact Evaluation and Significance Selection

An environmental aspects assessment aims to determine which detected environmental factors are essential. Professional judgment will play an essential part in determining how to address significance in many cases, and this can be aided by collaboration with relevant stakeholders. The extent of control over each environmental component and the severity of the environmental impact associated with each aspect is used to assess significance [16].

There would be a big or little environmental impact. The following criteria are used to judge whether an environmental impact is considerable or not:

- Regulatory and stator relevance
- Scale
- Consequences or severity
- Likelihood or Probability of occurrence
- Existing control measures.

The legal and regulatory requirements, their impacts, and other factors will determine the severity of an environmental impact. The probability of an aspect will be based on its likelihood. The significance will be assessed based on the grading. To classify the significant environmental aspects and mitigate the severity of their substantial environmental impacts, the following table will be used:

Table 2. Environmental Significance Rating Criteria

Criteria	Significance	Condition
Legal Requirements	It should be considered as a significant aspect	There is no rating given.
The Severity rating is more than 3.	It should be considered as a significant aspect	
Emergencies	It should be considered as a significant aspect	There is no rating given.
Total Rating of Significance is more than 60	It should be considered as a significant aspect	

The following list (but not limited to) of Aspects should be assessed using the criteria, and the results should be recorded. The following are some of the aspects (but not limited to): Wastewater discharges, Noise pollution and Land pollution, solid and hazardous waste generation and disposal, Spillage, Emissions, Energy, and water consumption.

All departments should prepare and revise the EAI registry regarding their departmental activities, which their departmental head should then review. Following acceptance, the EAIR will be made publicly available by making the file inaccessible. This record must be available to each Section for reference.

All relevant environmental issues that have been recognized must be treated and handled according to

local government requirements and any other applicable standards. If there are any uncontrollable critical components, an emergency reaction plan must be effectively implemented on site. An operational environmental management plan must be established and implemented to cover recognized significant features in the EAI register concerning each site's activities.

The process for identifying all legal and other standards to which the Organization adheres is defined by evaluating compliance with legislative and other requirements. After receiving the most current statutory requirements, the plant management will examine if the changes influence the environmental aspects-impact registry. If legal or other changes influence the documented aspect-impact study, the affected region will be subjected to the same aspect-impact research, keeping records.

Due to one or more of the following scenarios, the aspect register must be updated:

- Adding a new activity to the company or changing existing activities, products, or services.
- Any changes to legal requirements, such as laws or rules.
- Notes from an incident or an emergency that are useful.
- Any policy changes

4. Conclusion

This environmental methodological framework and evaluation aim to create a model that can assist industrial operators in reducing environmental risk. The goal is to create a new environmental aspect rating system that considers a variety of criteria.

To distinguish between significant environmental impacts that are tolerable and those that are not, determining the extent of an environmental impact requires understanding the potential ramifications if the danger materializes.

In conjunction with the consequences, scale, and current measure controls, the environmental aspect impact evaluation provides an excellent method for analyzing the possibility and deciding whether the environmental impact is tolerable. It also helps the sector decide which hazards should be addressed first.

However, conducting an environmental impact assessment demand considering the partiality that covers the complete process, particularly those that affect the use of the environmental evaluation score. Remember that the person in charge of characterizing the impact importance may be inexperienced with technical principles since alternative options may lead to a different presentation of the environmental element significant rating.

By sufficient basis and controlling environmental impacts from internal and external variables, each organization should ensure a thorough environmental aspect identification and impact evaluation strategy.

This new scoring-based environmental aspect impact evaluation process will aid industrial organizations in producing new recommendations to reduce the significance of all forms of hazardous environmental occurrences. These techniques are designed to reduce the severity of the event or the likelihood of it occurring. Environmental control measure is only applied to potentially hazardous environmental events whose estimated impact is excessive.

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