International Journal of Scientific Research and Engineering Development-– Volume 8 Issue 4, July Year 2025
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

COMPREHENSIVE EMERGENCY RESPONSE PLAN FOR HAZARDOUS MATERIALS INCIDENTS IN BAUAN, BATANGAS

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Abstract:

This action plan aims to strengthen its ability to anticipate, prepare for, respond to, and recover from multi-hazard incidents caused by hazardous materials. By utilizing science-based, community-driven methods, the plan fosters disaster risk awareness, early warning systems, and sustainable preparedness. The plan is structured around four thematic pillars: Prevention and Mitigation, Preparedness, Response, Rehabilitation, and Recovery, ensuring a comprehensive approach to disaster risk reduction. Despite proactive efforts, research reveals gaps in hazard knowledge, PPE availability, and support for vulnerable populations. Surveys conducted with barangay officials highlight inconsistencies in disaster response effectiveness within communities.

Keywords: Disaster Risk Reduction and Management (DRRM), Multi-hazard planning, Hazardous Materials, Spills, Leakage, Taytay Personal Protective Equipment, Local government unit (LGU), Bauan Batangas, Private Industries, Specialized Equipment

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1. INTRODUCTION

Bauan Batangas is a first-class municipality in the second district of the Province of Batangas. It is regarded as one of the most strategically situated towns for its impressive accessibility through the modern road network and distinct coastline. The municipality of Bauan is divided with two Bays the Balayan Bay the tourist attraction bay area which consist of Brgy. (Orense, Colvo, Sampaguita, Locloc, and San Pablo) and Batangas Bay that is the industrialized part of Bauan consist of Brgy (San Pedro, Santa Maria, San Miguel, San Andres I, San Andres Proper, Sto. Domingo, Aplaya, and New Danglayan, and their main livelihood is the marine resources.

Water transport system is very important in the municipality of Bauan since it is classified as a coastal municipality. It is used in the development of trade and industry in the municipality, particularly in transporting cargo, goods and services. Table 7 shows the ports located in Bauan; one government port and seven private ports. Private ports were owned by industrial companies along Batangas bay while the government port was operated by the Philippine Ports Authority (PPA). These ports may impose HAZMAT hazards as they can be used as a facility to transfer different types of goods in Batangas province if not managed well.

The municipality of Bauan has 52 existing and registered industrial establishments. Most of these establishments were located at the western part of the municipality on the coastal areas. 16 out of the 52 industrial establishments are exactly located at the coastal barangays of Bauan and it involves chemicals, fuel oils, industrial oils as part of their operations and it impose high risk of occurrence of HAZMAT disaster

2. SCOPE AND LIMITATION

This plan aims to address the safety of responders and the general public, health and environmental effects of this multi-hazard disaster. The proposed action plan will focus on the whole coastal area that can be affected by hazardous materials incidents.

The scope of this plan includes identifying hazmat fire & spillage health risks and immediate response strategies to prevent wider impact of this multi-

hazard disaster. The plan explores to provide initiatives on preparedness such to know the current awareness of the responder to choose what specific equipment to use and proficiency in using the equipment in handling Hazmat fire & spillage, also to know the current knowledge of the communities on what are the immediate actions they should do if there will be a exposure of hazardous material odors through the conduct of Semi-structured questionnaires to gather valuable data that can significantly help in developing this action plan

3. SIGNIFICANCE OF THE PLAN

The proposed action plan will provide a framework for identifying high-risk areas, high risk members of the community on respiratory hazards that may impose of a hazardous material disaster, implement effective mitigation controls on the industrial establishments and improve the response technique of the LGU and other national agency responder.

Further, the action plan is dedicated to enhancing the awareness and knowledge of the communities and barangay officials regarding hazardous materials. Education and seminars will be proposed in order to ensure that the communities and the first responders are knowledgeable on the hazard and what are the immediate measures that they need to perform

4. RESEARCH DESIGN

In the exploratory research phase, a multi-hazard scenario assessment was conducted to examine the risks associated with hazardous materials spills, leaks, and fires in Bauan, a municipality with a strong industrial presence. Given the high concentration of industrial facilities, shipyards, and fuel storage depots in the area, the study analyzed the types of hazardous substances handled, the likelihood of accidental spills and leaks, and the potential for fire ignition.

Following the exploratory phase, descriptive research will be conducted to quantify the impact of hazardous materials incidents through structured surveys. These surveys will target a carefully selected sample of industrial workers, safety officers, local residents, and emergency responders to assess their awareness, preparedness, and experiences related to spills, leaks, and fires involving hazardous materials.

To further enrich the analysis, Key Informant Interviews (KII) and Focus Group Discussions (FGDs) will be conducted to gather qualitative data for SWOC (Strengths, Weaknesses, Opportunities, and Challenges) and PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analyses. FGDs facilitated interactive discussions among community members, and local responder to capture lived experiences, adaptive strategies, and challenges in disaster response and recovery

5. RESULT FROM SURVEY

Table 1. Type of the Respondents

Type	Qty	Percentage
MDRRMO	4	13.33%
Coast Guard	4	13.33%
BFP	4	13.33%
MENRO	4	13.33%
Brgy. Officials	4	13.33%
Communities	10	33.33%
Total	**30**	**100%**

Table 1 shows the diverse composition of respondents, offering essential representation for creating a comprehensive multi-hazard community preparedness action plan in the municipality of Bauan. The respondents came from various sectors, reflecting a balanced approach to community-based preparedness. Communities in sitio Pag-asa the highly vulnerable area for HazMat incidents, constituted the largest group, with 10 participants, showcasing significant community involvement in disaster risk reduction initiatives.

Table 2: Questions with high rating

Questions	Percentage
Awareness on Health Hazard	100%
Awareness on Emergency Contact Information	96%
Needs improvement on hazardous material response	93%
They are affected by HazMat Disaster	73%

Table 3: Questions with low rating

Questions	Percentage
Capability to identify HazMat	46%
Knowledge to respond on HazMat	46%
Sufficient PPE for HazMat Response	30%
Collborations between private and LGU	40%

On the other hand, open-ended responses emphasized three key gaps:

- Establishment of Specialized ICS for HazMat Response
- Lacking of GIS mapping for possible effect of HazMat Disaster
- Limited personnel for HazMat Disaster Response

6. SWOC ANALYSIS

Table 4. SWOC ANALYSIS

STRENGTH	WEAKNESS
Emergency Communication: Brgy, Officials and local communities know whom to contact in case of HazMat Incidents	**Lacking of Equipment**: 90% from the responders says that they are lacking of equipment and PPE for HazMat Response.
Understanding Risks: Communities and responders understand the HazMat associates with high risk of health hazards.	**Public Private Partnership**: There is a need on the improvement of collaboration between Industries that handles HazMat in conducting simulation drills.
Evacuation Response: Most of the local community members know the designated area of evacuation and there is already visible signages to the way of evacuation area	**Budget Allocation**: Due to low likelihood of this type of Incident the allocation of budget for preparedness, response and recovery for this incident is not being prioritized.
Supportive LGU Leadership: Local executives actively support DRRM planning and have allocated funding for preparedness and response.	**Manpower Allocation**: There is a limited no. of personnels on the side of government for strict implementation of policy and constant monitoring.

7. PESTEL ANALYSIS

OPPORTUNITIES	CHALLENGES
Collaborations on Government Agencies: Strengthening the inspections and policies of DENR, BFP, PCG and LGU.	**Preparedness Drills**: There is lacking on consistency in conducting HazMat Emergency Response Drills
Private Sector Involvement: More active partnerships and collaborations between LGU and Private Industries	**Data Privacy**: Confidentiality of Hazardous Materials and availability of information from private industries
Incident Command System: Develop specific HazMat team with proper training related to HazMat Response	**Resource Constraints**: Financial and bureaucratic barriers delay procurement and implementation of critical interventions.

POLITICAL

The Municipal Disaster Risk Reduction and Management Office (MDRRMO) of Bauan has been proactive in enhancing resilience and ensuring the safety of its community during disasters. However, there is a need to focus on creating a local action plan specifically for responding to hazardous material incidents in Bauan's coastal areas. A review of their vulnerability assessment reveals that chemical spills are identified as a potential hazard, with certain barangays being particularly vulnerable to such disasters.

ECONOMIC

Bauan, Batangas, is a first-class municipality located in the second district of the Province of Batangas. It is renowned for its strategic location, offering excellent accessibility through a modern road network and a distinctive coastline. Situated 120 kilometers south of Manila and 7 kilometers west of the provincial capital, Batangas City, Bauan has become one of the most industrialized municipalities in the province.

SOCIOCULTURAL

According to the DRRMH Plan, a total of 228 families in the coastal areas of Bauan would be significantly impacted by HazMat incidents. These families comprise 672 individuals, including 465 people aged 19 to 61 and above, and 207 individuals aged 0 to 18 years. The town is home to 13 coastal barangays, with marine resources serving as the primary livelihood for its residents. Hazardous Material Response requires a collaborative effort from various local agencies, with each agency fulfilling specific roles by applying the principles of the Incident Command System.

TECHNOLOGICAL

Raising public awareness about hazardous materials can be effectively achieved through electronic advertising using gadgets, as many people today are inclined to utilize such platforms. The local government of Bauan, with the backing of its local chief executive, may consider allocating funds for training programs and acquiring equipment such as gas & chemical detectors and personal protective gear for HazMat hazards to support its local responders.

ENVIRONMENTAL

The Batangas Bay and the Balayan Bay serve as the municipality's fishing grounds. However, the volume of fish production of fishing barangays (coastal barangays) is very negligible compared to that of the other fishing communities in the country. Fisherman have noted a steady and sharp decline in their catch due to the establishment of industries along the coastal area. Nowadays, the preventive measure for this is the implementation of the "closed fishing season." It is a fisheries management initiative that calls for strengthening coastal protection and fishery resilience.

LEGAL

A review of the LDRRM Plan for the municipality of Bauan reveals that an Incident Command System has been established for Typhoons, Volcanic Eruptions, Earthquakes, and Pandemics. However, there is lacking system for HazMat disasters. Notably, Executive Order No. 52, series of 2021, mandates the use of the Incident Command System and its implementing guidelines as an on- scene disaster management mechanism for all hazard response teams within the municipality of Bauan.

Additionally, Executive Order No. 19 outlines the use of pre- emptive and forced evacuation procedures during emergencies caused by natural or man-made disasters. This order empowers local responders to enforce evacuations in highly vulnerable areas at significant risk of being affected by disasters, thereby helping to prevent the loss of lives and property

8. ACTION PLAN

8.1 Disaster Prevention and Mitigation

Table 5.

Action Plan for Goal 1 Objective 1.1

Goal 1	Enhance the enforcement and effectiveness of policies aimed at preventing hazardous material leaks and ensuring safe storage practices.
Objective 1.1	To strengthen policy enforcement through semi-annual inspections to establishments handling large volume (more than 500 liters) of hazardous materials by January 2026 targeting zero uninspected facility.
Outcome	Increased compliance rates demonstrate improved adherence to hazardous materials management regulations, reducing environmental and public health risks.
Programs, Projects, and Activities (PPA)	1.1.1. Establish clear compliance guidelines and auditing procedures 1.1.2. Implement an online platform for tracking inspections and corrective actions 1.1.3. Train inspectors on usage of Online system

As outlined in Table 5, this objective aims to enhance the enforcement and effectiveness of policies aimed at preventing hazardous material leaks and ensuring safe storage practices by strengthening policy enforcement through semi-annual inspections to establishments handling large volumes (more than 500 liters) of hazardous materials by January 2026. With the support of the private establishments and relevant agencies, the is expected that increased compliance rates demonstrate improved adherence to hazardous materials management regulations, reducing environmental and public health risks.

Table 6.

Action Plan for Goal 1 Objective 1.2

Goal 1	Enhance the enforcement and effectiveness of policies aimed at preventing hazardous material leaks and ensuring safe storage practices.
Objective 1.2	Create hazard mapping for leakage of hazardous materials on areas with high vulnerability by September 2025.
Outcome	Identified high risk areas and the different level of extent for disaster caused by hazardous materials spills.
Programs, Projects, and Activities (PPA)	1.2.1 Use GIS-based technology to visualize hazard-prone zones.

As outlined in Table 6, this objective aims to create hazard mapping for leakage of hazardous materials in areas with high vulnerability by September 2026. With the support of the private establishments and relevant agencies, the expected outcome is to create a GIS hazard mapping with identified high-risk areas and the different levels of extent for disasters caused by hazardous materials spills.

8.2 Disaster Preparedness

Table 8.
Action Plan for Goal 2 Objective 2.1

Goal 2	Enhance community awareness and hazard recognition skills related to hazardous material leaks, empowering members to take immediate and appropriate action to minimize risks and ensure safety.
Objective 2.1	To raise public awareness of the high-risk vulnerable population by conducting seminar regarding Hazardous materials.
Outcome	Members of the community are provided with guides and hazard warning tools for Hazardous materials.
Programs, Projects, and Activities (PPA)	2.1.1 Conduct of Community- Based Disaster Risk Reduction and Management Training 2.1.2 Fabrication of IEC Materials

As outlined in Table 8, this objective aims to enhance the public awareness of the high-risk vulnerable population on hazardous materials risk by conducting seminar regarding Hazardous materials. With the support of the private establishments and relevant agencies, the expected outcome is members of the community are provided with guides and hazard warning tools for Hazardous materials.

Table 9.
Action Plan for Goal 2 Objective 2.2

Goal 2	Enhance community awareness and hazard recognition skills related to hazardous material leaks, empowering members to take immediate and appropriate action to minimize risks and ensure safety.
Objective 2.2	To facilitate semiannual drills for Hazardous materials incidents with each Coastal Brgy. communities and local responders.
Outcome	Communities and local know what to do in case of actual HazMat Emergency.
Programs, Projects, and Activities (PPA)	2.2.1 Develop Memorandums of Understanding (MOUs) among government agencies, industry stakeholders 2.2.2 Organize drills simulating hazardous material leaks in different high-risk settings

As outlined in Table 9, this objective aims to facilitate semiannual drills for Hazardous materials incidents with participation from Coastal Brgy. communities and local responders. With the support of the private establishments and relevant agencies, the expected outcome is members of the coastal community and local responder are trained on what they will do in case of actual HazMat incidents occurs.

Table 10.
Action Plan for Goal 3 Objective 3.1

Goal 3	Strengthen the institutional capacity of the local government unit of Bauan and to respond to hazardous material incidents.
Objective 3.1	Acquire 3 sessions for specialized training programs (Hazmat Awareness Level, Hazmat Operations Level, Hazmat Technician Level) for Hazardous Material Incidents Response.
Outcome	Competent and Certified HazMat Responders of Municipality of Bauan.
Programs, Projects, and Activities (PPA)	3.1.1 Conduct specialized training 3.1.2 Create structured strategies and plan covering chemical spill containment, toxic exposure mitigation, and emergency response coordination

As outlined in Table 10, this objective aims to acquire 3 sessions for specialized training programs (Hazmat Awareness Level, Hazmat Operations Level, Hazmat Technician Level) for Hazardous Material Incidents Response. With the support of the MDRRMO and LGU the expected outcome is our local responder will elevate their skills and be certified HazMat responders.

Table 11.
Action Plan for Goal 3 Objective 3.2

Goal 3	Strengthen the institutional capacity of the local government unit of Bauan and to respond to hazardous material incidents.
Objective 3.2	Equip the responders of Bauan with advance tools and proper protective equipment for hazardous materials response.
Outcome	HazMat Responders equipped with proper Tools (Multi Gas Detector and Air Monitoring device and PPE (Protective Suits and SCBA).
Programs, Projects, and Activities (PPA)	3.2.1 Procurement of Protective Clothing and Breathing Apparatus 3.2.2 Procurement of Air Monitoring devices and gas detectors

As outlined in Table 11, this objective aims to equip the responders of Bauan with advance tools and proper protective equipment for hazardous materials response. This advance tools and PPE will help them to properly and safely respond to any HazMat incidents. This equipment's and tools are a vital resource to have an effective HazMat response.

8.3 Disaster Response

Table 12.
Action Plan for Goal 4 Objective 4.1

Goal 4	Establish a specialized Response Team for hazardous materials (HazMat) incidents within the LGU.
Objective 4.1	Establish a specialized Incident Command System (ICS) for hazardous materials (HazMat) incidents within the LGU.
Outcome	ICS Team for HazMat Incidents.
Programs, Projects, and Activities (PPA)	4.1.1 Pass a Resolution thru Sangguniang Bayan to create HazMat-Specific ICS Team

As outlined in Table 12, this objective aims to establish a specialized Incident Command System (ICS) for hazardous materials (HazMat) incidents within the LGU. The specialized Incident Command System for Hazardous Materials is crucial for ensuring efficient, coordinated, and safe emergency response.

8.4 Disaster Rehabilitation and Recovery

Table 13.
Action Plan for Goal 5 Objective 5.1

Goal 5	Safeguard the livelihoods of vulnerable communities by implementing strategies that minimize the economic impact of hazardous materials incidents, while promoting sustainable alternative livelihood opportunities.
Objective 5.1	Establish alternative livelihood programs and provide training and capacity building by 1 month post disaster event to equip the community members with knowledge and skill for alternative livelihood.
Outcome	Community members will acquire new vocational skills and knowledge applicable to alternative livelihoods.
Programs, Projects, and Activities (PPA)	5.1.1 Assess community skill levels, local economic conditions, and viable livelihood options 5.1.2 Create structured training guides such as sustainable agriculture, eco-tourism, handicrafts, and small-scale manufacturing 5.1.3 Conduct sessions on Skilled Works food processing, aquaculture, or entrepreneurship

As outlined in Table 13, this objective aims to establish alternative livelihood programs and provide training and capacity building by 1 month post disaster event to equip the community members with knowledge and skill for alternative livelihood.

Table 14.
Action Plan for Goal 5 Objective 5.2

Goal 5	Safeguard the livelihoods of vulnerable communities by implementing strategies that minimize the economic impact of hazardous materials incidents, while promoting sustainable alternative livelihood opportunities.
Objective 5.2	Enhance financial support system programs by 2 weeks to 1 month post disaster event to support at least 20% of total household population in coastal Brgy. during early recovery phase.
Outcome	Community members will restore basic necessities, stabilize their livelihood, and mitigate economic hardships.
Programs, Projects, and Activities (PPA)	5.2.1 Provide small-scale funding for individuals rebuilding businesses or seeking alternative income 5.2.2 Allocate stipends for shelter, food security, medical expenses, and education 5.2.3 Engage banks and cooperatives to offer low-interest recovery loans and grant matching programs

As outlined in Table 14, this objective aims to enhance financial support system programs by 2

weeks to 1 month post disaster event to support on affected individuals during early recovery phase

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