DISASTER

Governance in India

Series-9, Issue 1

CENTRE FOR DISASTER MANAGEMENT

Lal Bahadur Shastri National Academy of Administration, Mussoorie

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Director's Message

India, due to its specific geographical and geological conditions, is vulnerable to various natural disasters. In India, the incidents of flood, drought and other natural disasters are on the rise and pose a major challenge to the society in general and administration in particular. Each disaster heightens the sense of urgency to equip ourselves better in coping and managing them. In this context, the training of Civil servants in Disaster Management assumes critical significance.

The recurring incidence of such disasters necessitates learning from our own experience as well as the best practices adopted all over the world in the field of Disaster Management. Well documented best practices that can be circulated widely for creation of awareness at all levels of administration play an important role in such a context.

No Administrator can afford the luxury of waiting for any disaster to happen in his/her jurisdiction to learn from it. It is, therefore, imperative to be able to convey the experience of practitioners to each other, in an effort to educate about the variety and intensity of challenges faced in this dynamic field. The response might not have been the best in all cases but they would certainly be elucidating some aspects of disaster resilience to the discerning eye.

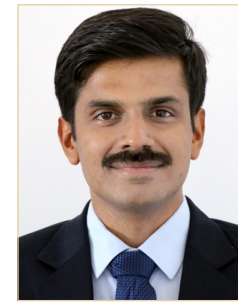
By virtue of the DM Act 2005, the District Magistrate/ Divisional Commissioner play a pivotal role as head of the District Disaster Management Authority (DDMA) and hence, it is essential that he /she should be well versed in the various aspects of Disaster Management.

It gives me immense pleasure to note that Centre for Disaster Management, LBSNAA is bringing out an edited case studies series "Disaster Governance in India" Series-9, Issue 1 for the year 2023-24 under the project "Capacity Building on Disaster Management for IAS/ Central Civil Services Officers." This compilation of case studies, learnings and experiences of the civil servants in the field, is an effort of the Academy that is sponsored by National Disaster Management Authority (NDMA), Government of India, New Delhi.

I hope this compilation will be useful for both the Officer Trainees and the Administrators in handling disasters and emergency situations across the country. I want to congratulate the CDM team for this publication and also place on record my appreciation for the contribution made by the faculty & staff of CDM who contributed in various capacities for bringing out this.

(Sriram Taranikanti)

Abhiram G. Sankar, IAS
Deputy Director & Director
Centre for Disaster Management



Preface

Disasters have never ceased to adversely affect human civilization. Natural disasters and manmade disasters have increased both in frequency and fury over the years. India has suffered enormously, in terms of loss in lives and livelihoods and damage to both public and private property due to recurrence of disasters. In response, various strategies have been formulated and implemented with regard to mitigation, prevention, response, rehabilitation and reconstruction. These activities span pre-disaster and post disaster time periods. All these efforts have the same underlying goal – to reduce the impact of disasters on our society!

No administrator can afford the luxury of waiting for a disaster to happen in his or her jurisdiction to learn from it. It is therefore imperative to be able to convey the experiences of practitioners to each other, in an effort to educate about the variety and intensity of challenges faced in this dynamic field. The responses might not have been the best in all cases–but they would certainly be elucidating some aspect of disaster resilience to the discerning eye.

In continuation to the successful publication of the fourth series of the publication "Disaster Governance in India" by the Centre for Disaster Management, it is our privilege to publish the Series-9, Issue 1 for the year 2023-2024. The book will be useful to administrators, at various levels, who are handling Disaster Management. It can also serve as a good reference material for ATIs and CTIs for their in-house courses.

I would like to thank the Centre for Disaster Management, Lal Bahadur Shastri National Academy of Administration who have been able to compile the best practices adopted by District Administrations, PSUs and other Institutions in the form of a Disaster Governance of in India, Series-9, Issue 1.

(Abhiram G. Sankar)

Contents

Regional Planning Lessons from the Delhi Floods of July 2023

Sudhir Krishna, IAS (retd.)

Abstract

Many Cities get flooded during rains. However, the July 2023 flooding of Delhi was a unique challenge, as many parts of the city remained flooded for days after the heavy rains had subsided. This situation resulted from overlooking the drainage system for the 'Region'. Planning Region should be defined primarily on watershed basis, rather than administrative boundaries. The Regional and Local Planning Authorities should collaboratively work out a framework for smooth flow of the storm water. Informal settlements on the embankments of the water bodies should be relocated, rather than redeveloped. Success stories of many cities show that sustainable drainage management is achievable.

Key words: *Planning Region, Drainage system, Multiplicity of agencies, Informal Settlements, Rainwater Harvesting, Awareness among people, Land value enhancement*

1. Introduction

Cities gets parched and yearn for water during summers. Paradoxically, the same cities face flooding of the roads and drains during even moderately heavy rains. Usually, the flooding of cities is confined to few pockets and lasts for a few days. This situation has become so very common that the government authorities at various levels have stopped undertaking a root cause analysis and people too have largely reconciled to their fate. Flooding of cities has come to the level of a news of the day only. In the process, the impact on the quality of life of the people has relegated to the background. Yet, it has been working on the psyche of the people, and could be one of the reasons behind the near-bottom ranking of India in the World Happiness Index over successive years. Municipalities have been struggling to handle the deteriorating quality of roads and drainages, as frequent flooding has been weakening the city infrastructure to the core.

The Delhi Disaster Management Authority has analysed the history of flooding of the National Capital Territory of Delhi (NCT) and reported that the NCT has

been experiencing floods of various magnitudes in the past due to floods in the Yamuna and the Najafgarh Drain system. The Yamuna crossed its danger level (fixed at 204.83 metres, elsewhere reported as 205.33 metres) twenty-five times during the last 33 years. Since 1900, Delhi has experienced six major floods in the years 1924, 1947, 1976, 1978, 1988 and 1995 when peak level of Yamuna river was one meter or more above danger level of 204.49 metres at old rail bridge (2.66 metres above the danger level) occurred on sixth September 1978. The second record peak of 206.92 metres was on twenty-seventh September 1988. Another major flooding of Yamuna in Delhi happened in September 19915, but, luckily, the flood did not coincide with heavy rains in Delhi, and could be contained within the embankments, causing damages only to the hutments on the embankments (DDMA: 2023).

While certain amount of flooding every year has brought in a degree of complacence among the city managers, the impact of the torrential rains in the initial weeks of July of this year presented the NCT with such challenges that were unprecedented by any yardstick and have become a real eye-opener. The Yamuna water level crossed the 208 metres mark on July 12, way higher than the Danger Mark of 205.33 metres, and smashing the all-time record of 207.49 metres set 45 years ago, in 1978. Pursuantly, several key areas in Delhi, including the Secretariat, which houses the offices of the Chief Minister, other Ministers and senior bureaucrats, were flooded. Videos of waterlogged streets in the NCT showed areas like Supreme Court, Rajghat, ITO, Red Fort, among others, being impacted seriously with flooding were displayed on the national and local media, causing widespread concerns. For a change, the affluent areas were also impacted, though the weak suffered far more extensively. Similar situation has been occurring in the other mega cities of Mumbai and Chennai too, but the latest episode of flooding in Delhi was far more startling.

The curious situation of the NCT during this episode was that though it got flooded during the torrential rains that lasted for about a week, but the flooding of the city continued for well over a week even after the rains had subsided. Post cessation of the heavy rains, the major inflow of water into the NCT was from the River Yamuna. Though the Government of the NCT blamed the upper riparian state of Haryana for not diverting the Yamuna waters into the minor barrages and the canals on the upstream, but that argument did not get much support as the basic issue was the inadequate drainage system for the NCT as a whole, which did not allow the gathered water to exit the area soon. A closer analysis of the Delhi Floods of this period provides a set of lessons that need to be pursued soon, to prevent the recurrence of a similar predicament in the times to come not only for Delhi, but for other cities as well.

2. Regional Framework for Drainage

The first lesson from Delhi is that the planning for the drainage system for a city has be developed in the regional framework, with the watershed of the basin containing the city defining the boundaries for planning. This is essential, because a city receives water not only from the rains falling over it, but also from the various streams in the upper reaches of the watershed region. Therefore, if the upper regions outside the city get rains, the city would normally be obliged to receive the extra flow, subject to the availability of reservoirs and percolation en route. On the other hand, the water being discharged from a city has to follow the gradient and dimensions of the nallahs and other water bodies outside the city boundaries. Therefore, the surplus of the rain water falling in the city can flow out of the city only if the nallahs and reservoirs outside the city are capable of receiving it and letting it flow through. If the drains and the waterbodies of the basin region within and outside the city are choked, the city will continue to remain flooded for some more time even after the torrential rains subside[1].

This explains a major reason behind the unprecedented flooding of Delhi and would call for preparation of Regional Plan for sustainable management and development of the city and its surroundings. The Comprehensive Regional Plans would have multiple layers, of which the first and foremost would be the Drainage Plan, followed by Habitation Plan, Business Development Plan, Mobility Plan etc. The Regional Drainage Planning should be based on watershed approach and should adopt the objective of optimal harnessing of the water coming from various sources including the rain as well as the recycled water coming from industries, businesses, and households, after providing for subsoil percolation and smooth disposal of the remaining collection. The Drainage Plan should identify the major water bodies such as the lakes, ponds, rivers, and nallahs and map these in a logical framework, identifying their respective holding/carrying capacities. Satellite imagery, mapped in conjunction with the statutory cadastral revenue and forest maps, supported by ground truthing, would facilitate in this exercise.

The Regional Drainage Plan should determine the extent to which water could be made available for the development activities including for the human consumption, agriculture, industry, construction, businesses etc. It should also

1 A similar striking phenomenon was seen in the case of the flooding of the City of Derna in Libya in September 2023, when two dams around Derna collapsed following torrential rains in the wake of the landfall of the powerful Storm Daniel, and the dam water gushing into the city could not find quick exit as many of the rivers and rivulets in and around the city had become dry and choked. The result was a huge loss of life and property, with over 10,000 persons reportedly dead due to the floods.

determine the extent of used water that would become available for recycling and the net disposable water that would need to flow out of the respective habitats (cities, villages etc.) and finally leave the region. In doing so, the Regional Drainage Plan should also incorporate a sensitivity analysis, to provide for handling the vagaries of climate change ranging from drought to torrential rains.

3. Statutory Backing for the Regional Drainage Plans

The Regional Drainage Plans would need to be notified under appropriate legislation as the overriding Plan for the local area plans for the cities and villages coming in the region and for regulation of the development activities. As of now, some States have provided for a specific law for handling regional planning, the foremost being the National Capital Region Planning Board Act, 1985 , which covers the areas of the States of Haryana, Rajasthan, Uttar Pradesh, besides the NCT of Delhi. Another example is the Maharashtra Regional and Town Planning Act, 1966, which enables state government to notify metropolitan regions and prepare development plans for such notified regions. Some States have made laws for regional planning focussing on specific major cities. For instance, the Mumbai Metropolitan Region Development Authority Act, 1974, the Calcutta Metropolitan Development Authority Act, 1972 and the Bangalore Metropolitan Region Development Authority Act, 1985. In States where legislation for regional planning is not in existence, it could be introduced by way of amendments to the State Town & Country Planning Acts, as many States have done. However, a more specific law for regional planning, on the lines of the NCR Planning Board Act, 1985 or the Maharashtra Regional and Town Planning Act, 1966 seems more appropriate for achieving the objective of comprehensive regional planning.

4. Administrative Arrangements for the Regional Planning

The administrative arrangements to handle regional planning and monitoring its implementation too deserve emergent attention. It may be recalled that the 74th Amendment to the Constitution has made a provision for Metropolitan Planning Committees (MPCs) for the Metropolitan areas defined under article 243P(c) quoted below:

- 243P(c). "Metropolitan area" means an area having a population of ten lakhs or more, comprised in one or more districts and consisting of two or more Municipalities or Panchayats or other contiguous areas, specified by the Governor by public notification to be a Metropolitan area for the purposes of this Part;"

This approach would need a modification inasmuch as the boundaries of the MPC should be determined in terms of the contours of the watershed, while observing the population criterion as well. The MPC can be named as the Regional Planning Committee (RPC) or Regional Planning Authority (RPA), to highlight the regional approach to the area planning.

The NCR Planning Board has a two-tier administrative arrangement. At the apex level, the Board by statute comprises the Chief Ministers of the constituent States and Administrator of the NCT and experts nominated by the Governments of the Member-States/NCT. An officer of the level of (or above) Joint Secretary to the GOI is the Member Secretary of the Board. The secretariat of the Board has subject matter experts.

The next management tier in the NCR Planning Board is the Planning Committee, headed by the Member Secretary of the Board as the chairperson and Principal Secretaries in-charge of Urban Development and the Chief Town Planners of the Member States/NCT as members. All issues relating to preparation of the regional plans, its component functional plans and sub-regional plans, are examined and processed in detail by the Planning Committee and given approval in the Board chaired by the Union Minister.

The NCRPB Model in respect of the administrative arrangements can be improved upon. All the municipal bodies, panchayats and other similar bodies such as the Cantonment Boards, Industrial Area Authority etc., should be suitably represented on the RPC. This is desirable because the local governance bodies and the local planning authorities have got to be interacting with the Regional Planning Authority dynamically. Moreover, all such bodies have to interacting among themselves as well, for fomenting better coordination and cooperation on various aspects of the regional planning, be its waste management, pollution control, drainage planning and management, etc.

For the RPC to be effective, it should have adequate database and arrangements for data collection and its dissemination. It should also have adequate arrangements for receiving suggestions and complaints relating to the effectiveness or challenges to the different sectors, such as drainage, transportation, pollution, etc. For handing such responsibilities effectively and efficiently, the RPC would need to have specialised staff having expertise in land-use planning, cartography, digital mapping, geographical/geological disciplines, data analytics etc. The RPC should also conduct research on the environment, land use, and good governance, and advise the cities, communities, and public agencies from time to time.

5. Local Area Planning

The Planning Regions would need to define the Local Areas of Development, such as the villages, towns and the cities, as also specialised hubs such as the Industrial Areas/Townships, Military Zones, and Wildlife Sanctuaries etc. For each Local Area, a Local Planning Authority would have to be notified under appropriate legislation, such as the State Town & Country Planning Act, the Industrial Areas Development Act, Cantonment Areas Act, Wildlife Sanctuary Laws, Ports Act, etc. Each such Authority would need to prepare the Plan for its Area, which would have the same layers as for the Regional Plan, commencing with the Drainage Plan and followed by other sector plans. The Local Area Plans should be aligned with and subservient to the Regional Plan. The arrangement in the NCR Planning Board Act requires the Member States to prepare Sub-Regional Plans for the geographical areas falling in their respective domains and the Board is required to ensure that each Sub-Regional Plan conforms to the features and standards laid down for the Region as a whole in the Regional Plan including its Functional Plans.

As for the Regional Planning, the Local Area Planning should also have the Drainage Plan as the primary layer. The Drainage Plan for each city and other Local Areas should delineate more elaborate details for the water bodies, including the rivers, nallahs, lakes, ponds, including the minor ones and superimpose the spread of such bodies on the revenue survey maps and in the land records accounting for survey numbers. The status and spread of such water bodies should also be notified under the relevant State Laws such as the Land Revenue Act, Town & Country Planning Act, Municipal Acts, Panchayat Acts, Irrigation Act, Forest Act etc. Each such Notification should also make a reference to the notifications issued under the other laws, to ensure harmony of the notifications issued for each water body under different laws. Absence of cross-referencing could give rise to disputes and litigation.

The Local Area Plans should also identify and delineate the existing habitations and other developments that have already come up in the spread of the water bodies and declare these as undesirable developments. Such developments normally include the informal settlements such as the slums, though some of these could fall under the definition of 'regularisation of unauthorised developments' or even development by government agencies as well.

6. Existing Statutes

The NCR Planning Board Act 1985 provides for notification of a region comprising the NCT of Delhi and areas from the states surrounding the NCT, but

without prescribing any principles for determination of the region. It provides for defining sub-regions as the parts the respective States. It also prescribes for formulation of a Regional Plan and Sub-Regional Plans with the mandate that the sub-regional plans shall conform to the regional plan. However, the Act does not correlate the boundaries of the Region and the Sub-Regions with the concept of watershed. It also does not directly prescribe that the local area plans of the cities, towns etc. falling within the sub-region shall conform to the sub-regional plan or the regional plan of the NCR. However, it is safe to assume that the state governments shall ensure such conformity.

Other than the NCR, States have enacted laws for setting up arrangements for regional planning. Some States have amended their Town & Country Planning Act to introduce the core provisions for constitution and functioning of the MPCs, whereas some other States have enacted special laws for the MPCs. The former type include the Haryana Municipal Corporation Act, which was amended to in 1994 to introduce one section for the MPC. Of the latter category, a significant example is the Maharashtra Metropolitan Planning Committees Act 1999. This Act is very elaborate in describing the arrangements relating to the MPC and its functions. However, it has prescribed the primary function of the MPC as 'to prepare a draft development plan for the Metropolitan area having regard to the plans prepared by the Municipalities and Panchayats in the Metropolitan area'. This puts the regional planning in a secondary mode, as the primacy is given to the local area plans over the regional plan. Learning from the flooding experience of Delhi, as also many other cities, it would be desirable to reverse the arrangement by giving a leading position to the regional plan and declare the local area plans to be subservient to the regional plan. At the same time, the regional plan should itself be made dynamic and responsive to the features and requirements of the local areas and the statutory provisions for the MPCs need to ensure this.

7. Development Control Regulations

The development of habitats, including the construction and the economic activities, is regulated under various laws such as the Municipalities Acts, Development Authorities Act, the Industrial Areas Development Act, the Cantonments Act, the Panchayat Acts, etc., besides the laws mentioned before. The regulatory authorities under such laws should also make statutory notifications carefully regulating the development activities within and around the embankments of the rivers, rivulets, lakes, ponds and other water bodies areas, on the lines of the development control regulations that have already been applied for the coastal regions. In particular, the Development Controlling

Authorities should freeze the status of the developments that already exist in the prohibited areas and work on preparation of a time bound action plan for reclamation of the lands that host the developments in such areas, with a view to preparation of an effective drainage plan.

8. Multiplicity of agencies handing the drains

The drains in the cities usually are along the sides of roads and are owned and maintained by the agencies that own the adjoining roads. The road network in a city usually appears to be seamless, but in reality, different reaches are owned by different agencies. In the NCT of Delhi alone, there are nearly three dozen agencies/authorities that own different stretches of the city roads and the appurtenant roads. Each authority follows its own time plan for the periodical maintenance and special repairs to their roads and drains, depending upon their budget provisions and approval processes. Resultantly, However, the flow of rain water in the drains needs a seamless alignment not only within the city but even beyond, when it reaches panchayat roads and even 'no roads' areas, until it connects with the natural reservoirs like lakes or a bigger river. Poorly maintained stretches of the drains act like a bottleneck, which leads to flooding like the backwaters.

The issue of management of the drainage system requires a strong administrative arrangements based on the functional cooperation and coordination among the various agencies that own and maintain the drainage system in the region. The Regional and the Local Planning Authorities (LPAs) should have a Drainage Management Department, with the Regional Authority providing the coordinating and leadership role for the 'Regional Drainage Management Group' comprising all the LPAs. With the aid and support of satellite imagery and cadastral maps, this Group should monitor the flow of storm water on a regular basis with special reviews at the onset of rains and during the rainy season. Such close monitoring should lead to ensuring free flow of the water that reaches the drain. In addition, such monitoring would lead to identification of the locations where obstruction is being caused by dumping of solid waste including the construction & demolition waste, plastic waste etc., and ensure the remedial measures through the agencies concerned.

9. Relocation of Informal Settlements

In a large number of instances, the unauthorised informal settlements such as the slums have come up on the embankments of water bodies like the rivers and the lakes and low lying areas that have been excluded from construction activities under the Master Plans. In many cases, the occupants of the slums

are the weaker sections of the society including migrants from other places and the housing shelters developed by them, usually unauthorizedly, are environmentally unsustainable. The general refrain of the governments is either to support in situ improvements to such informal settlements or to develop relocation housing projects in close vicinity. In either case, there hardly are many instances where the settlements in the prohibited areas could be finally cleared, and the final results are only proliferation of the slums and continuation of the flooding hazards.

There are, however, some notable successful instances of relocation of the slums from the embankments of a water body, though very few. One such example is the relocation of a slum of around 5,000 families from the embankments of River Sabarmati in Ahmadabad. The relocation was achieved through the adoption of the Basic Services for the Urban Poor (BSUP) and other components of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), besides the schemes and programmes of different agencies. This resettlement project was implemented during 2008-2012 and was fairly successful, even though it did offer lessons for better handling for future cases. Over the years, many more programmes for urban development have come up, including the expanded framework of the Pradhan Mantri Awaas Yojana (PMAY), which provide the opportunity for a more effective and comprehensive relocation of the informal settlements.

10. Rainwater Harvesting

The challenge of flooding of the cities can be contained to some extent through adaptation of rainwater harvesting as a part of development control regulations. This would give the added benefit of subsoil aquifer recharging, which is a great boon by itself for the cities and the regions and deserves to be given the status of 'a way of life'. In fact, if and as the regional and the local area plans strengthen the water bodies and protect their embankments, the objective of rainwater harvesting gets achieved automatically and concomitantly, to a good extent. In addition, suitable designing of the buildings, pavements, footpaths, and the storm water drainage channels would further augment the extent of percolation. The Building Byelaws of the Municipal Bodies should also ensure an in-built provision for the rainwater harvesting. Periodic verification and rectification of the continued effectiveness of the rainwater harvesting structures is also necessary.

11. Financing the Implementation of the Drainage Plans

The Regional and Local Area Drainage Plans have two broad components: one for restoring the water bodies and their embankments and the other, for

preventing future damages. The second part would require negligible cost, as it would be achieved though preparation of drainage plans and enforcement through regulations, requiring the violators to pay for the cost of enforcement by way of imposition of fines. The task of restoration would, however, have significant financial implications, as considerable damages to the embankments have already occurred. Part of such expenditure could be secured through resources from the programmes like PMAY, Swachh Bharat Mission, National Urban Livelihood Mission, National Health Mission, Sarv Shiksha Abhiyan, Solar Mission etc.

Reclamation and restoration of the embankments enhances the values of the surrounding lands greatly. This is supported by numerous examples such as the Kankaria Lake and Sabarmati River Front in Ahmedabad, restoration and rejuvenation of the numerous lakes and step-wells in Indore, the Bhopal lake, the Gomti Riverfront in Lucknow, Promenade on Kochi Sea-front and so on. A typical example is the Chinhat Lake on the outskirts of Lucknow. The lake had completely vanished and turned into a garbage dump. Its restoration and renovation under the JNNURM in early 2010s led to the rebirth of the great water body and the surrounding areas saw the coming up of numerous lots of 'Lake View Apartments'. All such developments not only provided great catchments for holding the rainwater, allowing for its free flow, and improvement of the subsoil recharge. However, equally significant was the massive rise in the land values of the areas in the surroundings. Such land values need to be captured in terms of revision of the 'circle rates' for the land and buildings and conversion of land use to match with the growth potential for economic and commercial activities, which all provide enhanced revenues to the government, including the panchayats and the municipalities, as also the citizens including the entrepreneurs for activities such as hospitality, real estate etc.

It should also be appreciated that violation of Drainage Plans leads to flooding of the cities, which in turn, leads to damages to the road surfaces and other infrastructure, besides to the life and properties of the citizens, which all lead to heavy costs for the government as well as for the citizens. Therefore, in all fairness, the Drainage Plans should be financed by the Government from its budgetary resources, while some part of the cost could be recovered by way of imposition of a fee on the development charges on the construction projects/ works.

12. Creating Awareness among the People

The entire concept of drainage planning, the benefits of its proper implementation, and the fallout of violating it, needs to be brought home to

the local governments and authorities, as also to the people, effectively. While drainage planning is mentioned in the school text books for geography, but it needs to be made more informative and interesting for the children. Instances of poor drainage planning and the resultant flooding in live cases such as the Delhi Floods, as also the success stories of good drainage planning in different cities across the world should be included in the school text books and also shared with the people through mass media and social media.

Involvement of the people in a key factor in making the Regional Drainage Plan getting acceptance as an effective tool for the benefit of the people themselves. Indeed, the existing laws usually provide that the Drainage Plan, ahead of final notification, should be published in Draft Form, to invite suggestions and comments through wide publicity. However, such publication should not become a routine 'Gazette notification' exercise. Besides publication the intimation about the Draft Plan in the newspapers, it should also be placed for Town Hall Discussions and debate on the media such as radio and television, besides the social media. A wider-scale debate on the Draft Drainage Plans would help in better fine-tuning of the plans, and in turn, to lesser disputes and higher acceptability among all segments of the society.

13. Conclusion

A good drainage plan for a city, adequately designed and implemented, would not only enhance the land values all around significantly, but would also improve the quality of living for the rich and the poor alike. This would lead to providing healthier life and environment to the citizens, besides higher revenues for the government including for the municipalities and the panchayats. While we have already seen numerous instances of the damages caused by not putting in place a good drainage plan for the cities and the regions, the good news is that it is not only highly desirable, but is also eminently doable and a Win-All situation, as is shown by the success cases strewn in different parts of the country.

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2. The various State Town & Country Planning Acts and the Regional and Metropolitan Planning Acts cited in this paper are accessed on the respective web portals and accessible conveniently.

Bahanaga Train Tragedy: Lesson on Disaster Management

Dattatraya Bhausaheb Shinde, IAS

Abstract

Preparedness is the key to effective and efficient handling of emergency/disaster. This has once again been proved in tragic and very rare multi train accident near Bahagana Railway station in Balasore district, Odisha. Notwithstanding the severity of the incident, the overall preparedness of response mechanism at the District and state level and their well-rehearsed procedures and drills helped Balasore District Administration to minimise losses and resume essential services within 72 hours. Once again ODISHA demonstrated their preparedness not only for recurring natural disasters bot also sudden man made emergency.

Key words: *Rescue Operation, Zero casualty*

1. Introduction

The Balasore train tragedy was one of the most terrible incidents in the history of India. It was the biggest and worst train accident in India and the third biggest in the world in terms of scale and severity. Three trains colliding with each other were never heard before in the history of the world.

NDMA guidelines consider accidents as disasters hence, invoking the IRS (Incident Response System) for disaster response. In the instant case, the scale and intensity was of such a scale that it was a challenge before District Administration. Team Balasore led by the district administration adopted a participative, coordinated and swift efficient response mechanism which could save many lives.

2. Bahanaga at a glance

The Bahanaga Bazar Railway Station is located on the Kharagpur-Puri railway line. It is a part of the Howrah–Chennai main line under the Kharagpur Railway Division of the South Eastern Railway Zone. It is located in Balasore district of Odisha State and 25.7 Km. away from District head quarter. The coast line is 14 km away and the National Highway 16 is one km away (Latitude is 21°20'10" N &Longitude is 86°45'41" E.).

3. Bahanaga Train Accident

On a gloomy evening of 2nd June, 2023 at about 6.52 pm the localities around Bahanaga Station heard a devastating sound, considering nearness to railway station everyone realised that was a train accident at Bahanaga Station. On reaching the site of location it was realised that there was multiple train collision and the site was a scene of devastation. The well prepared District administration sprang into action and under the able leadership of the District Collector and his team and with the help of NGOs and CBOs were able to undertake timely rescue, relief and recovery action. Within the Golden period of four hours 95% of injured were evacuated to hospital/shelters and within 48 hours most of the recovery activities were nearly completed. The accident involved three trains in which total casualties were 193 and more than 1200 injured

4. The Odisha Way

Odisha is one of the most hazard prone state notwithstanding after 1999 Super Cyclone Odisha has changed its approach from relief and recovery to preparedness and temperament to tackle any disaster and has been successful in dealing with these disasters in all these years. Odisha has been recognized as a role model in the country for its excellent disaster management techniques to deal with different types of natural calamities and disasters due to human errors.

Hon'ble Chief Minister, Odisha has always emphasized on the principal of "Zero Causality all across the state and for all disasters". Considering the National disaster Management authority vision to tackle any disasters two themes have been prioritized.

a) Disaster Preparedness

b) Disaster Response

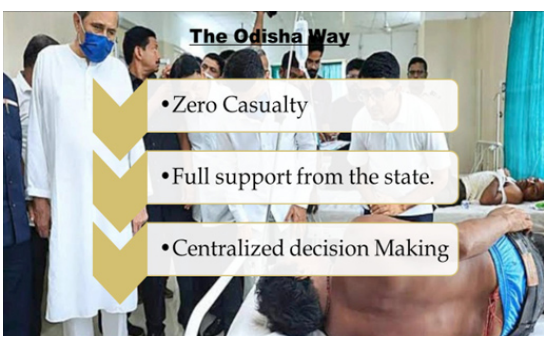


Fig.1: The Odisha Way: Mission Zero Causality

5. Sequence of Events

- On 2nd June, 2023 at about 6.52 pm three trains collided with each other near Bahanaga Station.
    - Shalimar Chennai Coromandal Express
    - Bengaluru- Howrah Superfast Express
    - A Stationary Goods Train
- At 6.52 PM sharp, District Collector, Balasore received a phone call in his mobile from Bahanaga locality regarding the Mishap.
- Instantly Emergency Operation Centre was activated and response forces under Tehsildar and Executive Magistrate, Bahanaga, were ordered to mobilise and report to accident site.
- District Collector, Balasore, assumed the control of operations t to expedite the process of rescue operation. Considering the severity of the accident, Collector apprised the Chief Secretary of the state and requested him to immediately provide 500 ambulances for rescue operation.
- Nearby hospitals and all their staffs were alerted and immediately made available for treatment of the injured persons & rescue operation. 108 Ambulance services were mobilized with the help of locals of Bahanaga.
- After field triaging segregation of victims was done i.e. critically injured requiring lifesaving treatment, severely injured and persons with minor injury and by 11PM in that night, 95% of the injured were shifted to various hospitals.
- Considering number of death, Collector immediately declared Bahanaga High School and NOCCI as Temporary Mortuary and ordered to execute Night Autopsy of dead bodies.
- Being a costal district, Balasore have its advantage of having marine industries. Hence around 1500 Ice Beds were arranged within 3 hours for establishing Temporary Mortuaries.
- In the meantime, all line departments and industrial houses were mobilized for rescue operation and to provide manpower and rescue machineries available with them.
- The Volunteers, NGOs, Apada Mitras, Blood Donors, Industrial Houses contributed their best towards the primary rescue operation.
- The masses including the passerby, auto drivers, medical store keepers and many unnamed heroes played crucial role in this tragic rescue operation.

- By late night Ministers, Senior Officers from state reached the spot and shouldered various responsibilities.
- With the advancement of night, rescue operation became tougher as everyone was working relentlessly without having minimum food and drinking water.
- Another issue which created a lot of trouble was network congestion, for which communication with staff as well as state level officers become difficult.
- Finally, at around 4.00AM on 03.06.2023 cooked food (Rice, Dalma, Roti) reached the spot from a nearest Aahara Kendra. Collector himself with other staffs had their meal near the accident spot.
- Thereafter, Relief food packets and drinking water started reaching the spot from other blocks of the district by the morning.
- Hon'ble Chief Minister of the state arrived on the spot by 7.00AM. Hon'ble Chief Minister West Bengal arrived on the spot at about 10 am. Hon'ble Prime Minister of India, Hon'ble Minister of Railways Shri Aswini Bainshav and Union Minister of Education Shri Dharmendra Pradhan arrived at 4 PM. Other State Guests from neighboring states and VVIPs started arriving at the accident spot throughout the day.
- Proper protocol was ensured for everyone. Helipads and landing permissions were also taken care of.
- By 11.00 AM all dead bodies were shifted to NOCCI and the identified dead bodies were immediately handed over to their families with the ex- gratia amount cheque.
- At around 5.00PM, it was decided to shift the unidentified dead bodies to selected mortuaries in Bhubaneswar and by 9.00PM the shifting process started.
- By 11.00 AM next day (04/06/202023) remaining dead bodies were shifted to Bhubaneswar in a dignified manner (covered by body bags, maximum two bodies in one ambulance).
- Death certificates were issued to the family members of deceased within a week's time at their door step both inside and outside the state.

6. Complexities during the Rescue Operation

The incident occurred in evening time in such an area, which was devoid of street lights/ other source of light. The bogies which were affected the most were the general ones.

- Bogies were flown away from the track and got capsized; as such rescue operation became tougher.
- Lack of light.
- Timing of the accident.
- General bogies were affected the most, for which the injured list and the death toll was rising exponentially.
- Location of the accident was nearer to the NH & this attracted the inflow of crowd to see the accident spot, which resulted in huge crowd gathering & the rescue operation was affected like moment of vehicles, Medical Teams, Ambulances, the family member of the accident victims etc.
- Three trains at a single location in a single frame.
- Arranging huge number of ambulances, dead body carriers, medical teams, Rescuers.
- Managing the families of victims.
- Crowd Control.
- Saving the lives of injured.

7. The System

If we consider the whole disaster management as a system, it contains several wings i.e.

A. Rescue force
B. Health infrastructure
C. Civil Society Organization
D. Vehicle mobilization
E. Media Management
F. VIP management
G. Coordination

The pro-active approach and principle of 24x7 Disaster Preparedness helped to a great extent management of such a major Disaster. The preparedness helped in quick mobilisation and deployment of rescue and relief forces and set procedures gave line of action to staff in the field to take decisions. The major activities undertaken by Line Department as Emergency Support Function are as under:

A. Rescue forces deployed for operations

- NDRF Team -302 Personnel's

- ODRAF Team -117 Personnel's
- Fire Team -200 Personnel's
- Police Administration
- Indian Army -170
- Officer & Filed Staffs of District Administration
- GRPS

B. Health infrastructure

- All the PHCs, CHCs as well as the DHH were kept ready to receive the injured for speedy treatment.
- A separate green corridor was set up for movement of ambulances.
- Doctor Teams under the CDMO were sent immediately to the accident spot and temporary camp was setup.
- The team of paramedics played their crucial role in treatment of the injured.
- Autopsy team have done their work with utmost sincerity and promptitude.
- Availability of Medicines / Blood / Food were ensured in the rescue operation through Janaousadhi Kendra, Aahar Kendra and Mission Shakti groups.

C. Civil Society Organization

- The response from various Civil Society Organizations was overwhelming.
- The response of Industrial houses was quick in mobilising their teams / equipment's/ consumables to the accident spot.
- Thanks to Blood donors who were standing in queues for blood donation, for which there was no short fall of blood in the hospitals
- The response from various Civil Society Organizations was overwhelming.
- The response of Industrial houses was quick in mobilising their teams / equipment's/ consumables to the accident spot.
- Thanks to Blood donors who were standing in queues for blood donation, for which there was no short fall of blood in the hospitals.
- The locals, the pavers, the shopkeepers all turned out to be volunteers and gave their 100% towards the rescue operation.

D. Vehicle Mobilization

- Cutting and lifting the train compartments was a herculean task, which was ensured using Hydras and cranes.
- Immediate arrangement of Dead Body carriers, Busses, Trucks was ensured by Roads & Transport functionaries.
- The safe passengers and minor injured passengers were immediately sent to their destination/ villages after First Aid and their checkup through Buses with Govt. staffs.
- For transportation of dead bodies, Mohaprayana Service was made free of cost.

E. VIP Management

- It was expected that many VIPs may come to the spot on the nest morning and accordingly all preparatory arrangement was started in the night itself.
- Construction of temporary helipads, sharing the landing locations and visit timing were decided on spot.
- Vehicles were immediately arranged for movement of VIPs and VVIPs.
- Proper arrangement of food and resting facility was ensured at the circuit house, local hotels and NOCCI.

F. Media Management

- Rumors and fabricated information was on air during the first few hours across the nation, tracking and countering of fake news was a great challenge.
- With proper documentation, centralized monitoring of Data from every department, dealing of fake news could be possible, e.g- one of the fake news got spread "one person was declared dead in night was found alive next morning." This could be countered only because of documentation of his referral certificate from Balasore to Bhadrak.
- Discharge certificates/ Clicking photographs of bodies/ Displaying outside the mortuary / Centralized data monitoring and disseminating helped in proper management of media data and figures

G. Coordination

- Rescue operation has never been a single man's task, for this coordination between,
  a) Departments,
  b) District and State,

Fig.2: Glimpses of various events during Bahanaga Train Tragedy

c) DEOC & SEOC,

d) Administration & NGOs,

e) Administration & CSOs

Co-ordination among above stakeholders played a crucial role and timely completion of rescue process was ensured.

H. Providing Psycho Socio Care

- The Tragedy not only gave injuries, but also a mental trauma to the victims, their families and to the society.
- To deal the mental trauma of the victims, Psycho Social Care Units were immediately mobilized by SRC Office and BMC to the Hospitals and to the villages of victims.
- Many industrial houses contributed to this by inviting psychologists and taking them to villages of affected ones for counselling
- The locals of the accident spot were also provided with the psychosocial care as they were exposed to this tragedy for the first time.

I. Role of Mission Shakti Groups- special mention

- The MSG members played a much needed cameo in the whole rescue process. Starting from blood donation, treatment of injured, serving food to the injured, passenger and the rescue teams they have proved that their importance is not less than others and their service can be used during emergency situation.
- Some groups have overwhelming served at the temporary mortuary established at NOSSI.

8. Best Practices/ Positive Outcomes

- Free transportation of injured, dead bodies and other passengers.
- **Smooth movement of 193 dead bodies** from NOCCI, Balasore to different mortuaries in Bhubaneswar completed in the next night on 03.06.2023.
- **185 critical surgeries** were made at D.H.H., Balasore overnight.
- **1100 dressings** were made at DHH, Balasore with the help of Medical teams.
- **94 autopsies** were carried out overnight by autopsies teams and handed over to their families.
- **Recognition**
  - Hon'ble Prime Minister of INDIA has hailed the noble efforts and quick response of district administration for the rescue operation at Bahanaga.
  - Hon'ble Chief Minister, Odisha has personally visited the spot and

praised the efforts of Team Balasore.

- Hon'ble Minister Railways had organized a thanks giving ceremony.
- Hon'ble Chief Minister West Bengal has attended and praised the efforts of Team Balasore.
- Ministers from Tamilnadu and Andhra Pradesh visited the accident site and discussed with District Administration and praised the efforts.
- SRC, Chief Secretary has personally praised the efforts of District Administration.
- Senior Officials from West Bengal, Bihar & Other States have visited and praised the rescue operation.

9. Lessons Learnt

- Attending to each call (Response) is very- very important as which is proved in this tragedy.
- Documentation of events/actions / dates must be ensured to tackle any future controversy / confusions.
- As a human being, ego should not be a constraint during the time of rescue on response. In general, we should shed our ego and have faith in humanity.
- We must check and verify all our data, process, evidence thoroughly as we will be held accountable in future.
- Our communication channel must be functional as without communication a small problem might turn into a gigantic one.
- We must be aware of our strengths and challenges in our working locations, so that we could use the advantages available there and counter challenges properly.
- Individual difference is a human tendency and hence we should be careful while deploying officers/assigning duties according to their strengths.
- We must not undermine anyone and everyone can be useful at a certain point of time.

10. Conclusion

Bahanaga train tragedy was an unprecedented and unbelievable disaster and response to it was also unbelievably Swift and efficient. What happened during those 56 hours can best be described in three sentences said by the Hon'ble Chief Minister to us when he visited Bahanaga:

- It was indeed a terrible tragedy.
- The team has done an outstanding job in the rescue operation.
- Any support needed from field will be ensured.

Chamoli Disaster Management, 2021 - A Case Study

Swati S. Bhadauria, IAS

Abstract

The case demonstrates the dilemmas faced by the district magistrate in the wake of a tragic disaster wherein 204 people went missing.

Key words: *Avalanche, GLOFs, National Thermal Power Corporation (NTPC), National Disaster response Force (NDRF), State Disaster Response Force (SDRF), Indo Tibetan Border Police (ITBP), Head Race Tunnel (HRT), Silt Flushing Tunnel (SFT), Community Health Centre (CHC), Standard Operating Procedure (SOP)*

1. Introduction

Chamoli is a Himalayan district spread over an area of 8000 square kilometres, with the altitude ranging from 800 metres to 7800 metres, falls in the zone-V of seismic activity risk. The district is home to the highest peak completely within India, Nanda Devi as well as the pilgrim towns of Badrinath and Hemkund. Its higher reaches are snow-clad for most of the year. There are several glaciers from which several perennial streams originate feeding the large populace of the Gangetic plains. Due to its fast-flowing perennial rivers, the district also has quite a few hydroelectric power projects within its boundaries.

It was a cold but sunny Sunday morning in February when the district magistrate was informed by the SDM Joshimath that there was a big disaster near Tapovan. Just as she disconnected, another call from a local resident of Joshimath informed her the same. Upon further enquiry, she realized that it was a glacial burst and avalanche which seemed to have caused massive damage. She immediately left for the spot along with the Superintendent of Police and informed the Disaster Control Room to alert those staying near the river banks on the downstream. On the way, she spoke to various agencies and departments of the district to immediately mobilize them for rescue works.

On reaching the spot, there was a sight of utter destruction. The under-construction hydro-electric power plant of NTPC and the commissioned hydro-project of Rishiganga Power Plant had been washed away and there were several sites where people were suspected to be trapped. The trail of destruction has

been shown in figure -1, the comparison of satellite images before and after the disaster can be seen in figure -2. In view of the scale of the disaster, further decisions had to be quick as these critical decisions would make the difference between life and death for a lot of people in figure-3.

2. Where to start the rescue and which agencies to involve?

The district magistrate spoke with the NTPC officials and the local people, studied the map of the tunnel and barrage to narrow down on the geographical points where people can be saved. The district administration immediately requisitioned the ITBP, the army and the SDRF for the job and they readily reached the spot. There was a risk of mis-coordination in involving too many agencies, but the impact of the disaster was huge and there were multiple sites where simultaneous rescue operations were needed. Therefore, it was decided that all the available agencies be utilized and their scope of work and the rescue sites be clearly demarcated to avoid any confusion. ITBP was given the responsibility of the rescue from the SFT; the army was designated to clear the main entrance to Head Race Tunnel and the SDRF was sent to the Rishiganga site for rescue work. Local revenue officials were directed to assist the agencies in mobilization of the necessary resources and the local police initiated the combing of the area to see if any more people were trapped at any other point. As the rescue started, helicopters, medical teams and NDRF teams were requisitioned. The first batch of 12 people were rescued alive from the SFT within 4 hours of the incident and were immediately admitted to the hospital. Apart from it, 13 people were further rescued from the Rishiganga site. Such successful operations gave more hope and courage to everyone involved and the search operation continued with full gusto.

3. How to reach out to the families of the workers working on those sites?

Now that the rescue work was on track, the next challenge for the district administration was to calm down the anxious family members of the workers who belonged to different parts of the country by informing them about the exact status of their loved ones. For this, first they needed to assess the numbers as well as personal details of those who were still missing. Also, this listing would be helpful in directing more resources to the site that had maximum people missing, thus helping them deploy more man power in those sites. Based on the feedbacks from the locals and NTPC officials, the number of missing was estimated to have crossed 150. Listing the exact details of everyone was a daunting task, for which the District Magistrate made a team of a few district level officials to be assisted by the NTPC and contractors working on the Rishiganga project. The team was directed to complete the task by midnight of the day the

disaster had struck. Attendance registers of all the sites were collected but this was not sufficient as several of those working on the site had escaped. Thus, the neighbouring gram panchayats were involved and feedbacks were taken from them about people who had come back after the glacial burst had taken place. In the above manner, this list was constantly refined as information from gram panchayats started reaching the team deployed. The list was again vetted by local revenue officials 'patwaris', to ensure that the doubly checked list was fool-proof to avoid unnecessary panic to anyone once it is circulated. This list was also important as it would become the basis for the relief distribution by the government later. The team worked through the night and the by the early morning of the next day, the list was prepared which listed 204 people!

The personal details of the people on the list were immediately sent to the district magistrates of the concerned districts, to which the missing people belonged to. The details were also circulated widely through media along with the Helpline numbers to provide assistance to the concerned family members of those missing. Help desks were set up at the sites to brief about the progress of the rescue operation, the exact ground situation and facilitate the families, who came to enquire about the well-being of the workers. These help desks were also tasked with arranging for the accommodation and food for these relatives as well.

4. How to excavate the tunnel?

Here, the most difficult rescue site was the Head Race Tunnel (HRT) where 34 people were feared to be trapped. The mouth of the tunnel was completely plugged by semi-liquid slush. Big earth movers could not enter the HRT as the width of the tunnel was narrow while the capacity of the JCBs to remove the buckets of slush was very limited, causing the process to be slow and cumbersome. The situation was worsened by the fact that the debris was neither fully solid nor completely liquid, but a semi-solid slush. Though the rescue continued the entire night, the progress was slow. The intake adit to Head Race Tunnel (HRT) was 242 metres long, which had to be excavated completely, before the spot where NTPC officials expected the missing workers to be working, could be reached. The specialist engineers of NTPC suggested to drill a hole from the top and inserting a camera inside to locate the exact position of the workers. The drilling equipment were brought and this operation continued for 3 hours. However, the tunnel being fully plugged with slush, the camera could not get inside. Thereafter the JCBs continued their day-night slush removal job, without any breaks. The task was made tougher on the far end, by the undulating slope of the tunnel-bed, which had given way to the waters of the changed course of

the river Rishiganga, now flowing through the far end of the tunnel. Dewatering equipment were thereby brought in to enable easy removal of the slush. Finally, after five days of rigorous work, the first two bodies were recovered from the tunnel. With that, the last ray of hope of saving those trapped inside was lost!

5. Should we wait for body identification or cremate the recovered bodies?

Bodies were being recovered from both the disaster sites as well as the banks of the river Alaknanda downstream, even as far as 200 kilometres away from the disaster site. A temporary post mortem centre was made near the site with teams of doctors deployed there, round the clock. Different Community Health Centres across the district were also designated for post mortem of the bodies, if they were found away from the disaster site. The existent Standard Operating Procedures in place directed that the unclaimed bodies, could be cremated 72 hours after they were recovered. However, the identification of the bodies was important for the families of those deceased as they wanted to perform the last rites for their loved ones. Further, the body identification was an important key for the provision of compensation to the families of those deceased or any disputes relating to the identity of the bodies.

While the above factors weighed in, it was also not possible to wait for the families indefinitely. Therefore, it was decided to photograph each body and collect their DNA samples so that any future disputes can be avoided. Executive Officers of the respective municipal bodies, magistrates and police officials were made in-charge for respectful cremation of bodies and completion of death related documentary formalities. To facilitate information dissemination, the help desks were given the list of the details of those cremated and those, which were kept in the mortuary. This facilitated in the easy identification of the recovered bodies and their handover to their families.

6. How to prioritize reconstruction and relief simultaneously?

In a disaster, rescue is the most critical activity. There is an apprehension that if relief and reconstruction are focussed, the limited resources may get divided and thereby, delay the rescue operations. However, after comprehensive analysis, it was found that several critical pieces of infrastructure were damaged. For instance, the motor bridge at Raini was washed away, leaving 13 villages in Niti Valley cut off from the road network. Similarly, three suspension bridges, water pipelines, electricity lines, electric poles and mobile network were damaged in the area, leaving the area crippled. Further, it was assessed that since the departments responsible for the repair and restoration will have no

role in rescue, it was decided that once the immediate rescue was tied up, these concerned departments would immediately focus on reconstruction works and restoring connectivity to ensure that the cut-off area is brought out of the disaster-distress.

These restoration works are largely independent of the rescue efforts and on the contrary, will facilitate the rescue workers as restoration of electricity, mobile networks, road networks etc. are very crucial for effective rescue operations. Within three days, all the services except for the bridge connectivity were restored. As an immediate substitute for the collapsed bridges, manual trolleys were made functional by 13th February and the bailey bridge as replacement to the motor bridge was made operational in a record time by 5th March.

Immediate relief support materials like tents, ration, medicines and medical teams were sent to the cut-off villages by requisitioning a helicopter. Those who were seriously ill were also brought to the district hospital using these helicopters. While compensations are no substitute for the lives lost, the district magistrate and her team decided to immediately start with the distribution of the relief compensation to the families of the deceased. Once the bodies were identified, their families were distributed compensation within three days.

7. What should the administration do about the glacial lake which was unofficially reported to be formed below the Raunthi glacier?

Some of the locals had informed about a lake being formed due to the accumulated debris, which was a cause of further worry. This could turn into a serious issue as the lake could have been breached, which may lead to another disaster of similar scale.

As soon as the district administration came to know about the formation of lake, they informed the State Disaster department of the lake formation, requesting for a quick initial study by geologists and scientists. However, the visit of scientists could have taken sometime as the trek route to the lake was treacherous. Therefore, the district magistrate decided to collect the latest satellite images and it was soon verified, that there indeed, existed a lake. Since, she did not want to lose any precious time, a group of mountain-trained SDRF men were sent, who brought back videos of the lake for study by the scientists. Additionally, the SDRF removed the obstacles to the smooth outflow of the lake water so that none of the sides of lake were suddenly breached. After consultations with scientists, it was assessed that there was no imminent danger and hence, the evacuation of the villages located in the immediate downstream, was not required.

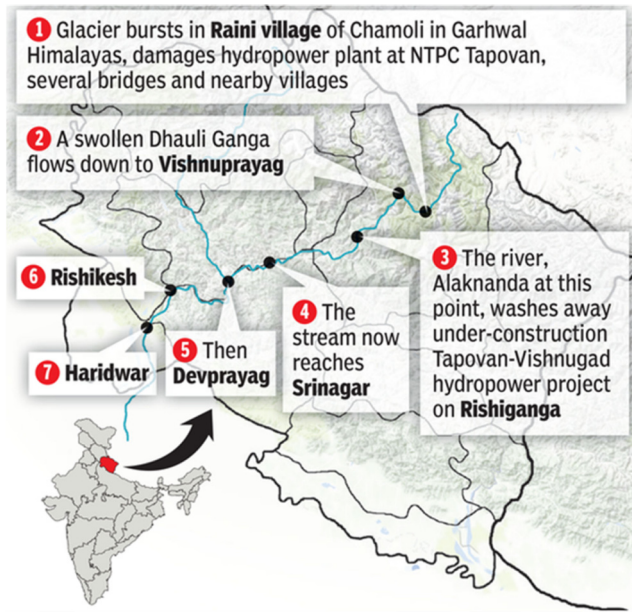


Figure 1: Trail of Destruction

(Source: https://timesofindia.indiatimes.com/india/uttarakhand-glacier-burst-in-chamoli-damages-hydropower-plant-rescue-operations-underway/articleshow/80732809.cms)

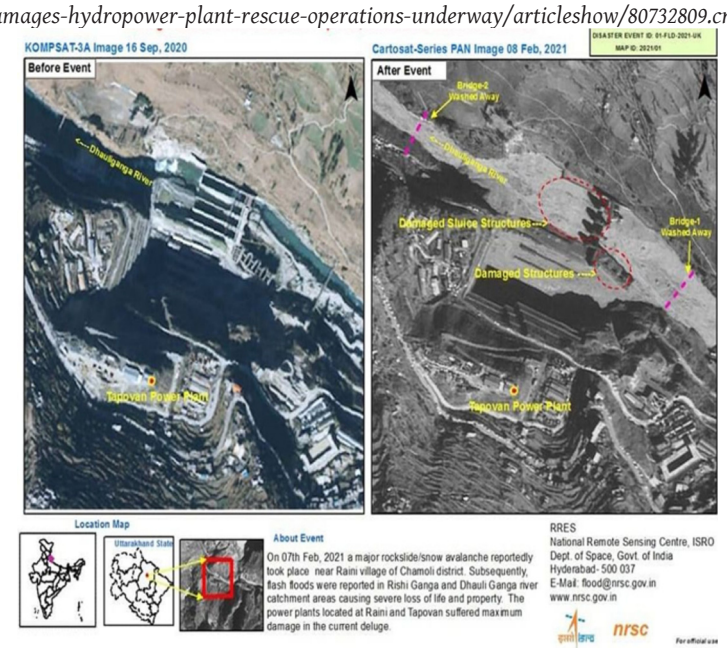


Figure 2: Damages to Dam infrastructure at Tapovan, Uttarakhand due to flash flood (Source: NRSC, ISRO)

Figure 3: District Team leading the Rescue, Relief and Rehabilitation Efforts

8. Conclusion

The case demonstrates the occurrence of a series of unforeseen situations and the inability and unreliability of conventional SOPs to always serve as the guiding force for an administrator in case of natural disasters. The case also reveals that the simultaneous management on various fronts through effective task-distribution can play an instrumental role in dealing with unforeseen administrative situations.

Resilience in the Face of Tragedy: The Harda Blast Experience and its Remarkable Management

Dr. Nagarjun.B.Gowda, IAS

1. Introduction

It was a regular Tuesday morning in the month of February, and as it was still pretty cold in the morning hours, my day started a bit late. I somehow managed to have a good workout session that day. I was a bit tired, but made it to Jansunwai at around 11:00 a.m. I was casually scrolling through my cell phones for the pending messages of the day while waiting for the crowd of Jansunwai to gather in the hall. All of a sudden, around 11:30 AM we encountered strong tremors that rocked the windows of the hall. Totally unaware of the reason for the tremor, we got back to our Jansunwai. Again, within a couple of minutes, there was a much bigger and stronger tremor, which planted the thought of an earthquake at Harda. Some of my colleagues tried to brush it off by saying it must be a blast of transistors nearby and some said it must be an act of monkeys, but little did we know at that point of time that it was an act of human error. An error that took multiple lives, an error that displaced hundreds around the blast site and an error that gave us many sleepless nights.

The doubt of an earthquake made us all come out of the building. Our CMO got a call that there was a blast in the firecracker factory, which is situated around 5 km away, within the town limits. SDM and I rushed to the site immediately. My heartbeat started racing, and thoughts got clouded as I was trying to imagine the intensity of the damage caused. This was because I had seen the factory from inside; I had walked through all the rooms; I had seen the number of people who work there and I had seen the number of firecrackers that were stored in the factory. I had reported the imminent danger as well.

For introduction, Harda is a medium-sized town situated around 180 km away to the south-west of the capital city of Bhopal. The mainstay economy of Harda is agriculture, with few industries. But for the people of Harda, the biggest industry chain in the city was firecrackers. There were a bunch of Sutli or Rassi bomb making industries in and around the town. They were known to generate multi-crore business every year and also employed thousands of unregulated manual labourers.

Fig. 1: Blast image as captured by the bystanders

2. Dreadful sight and quick response

As we were moving towards the blast site, we could witness a huge cloud of smoke rising at least up to a 1000 ft. We had to stop the car around 200m from the blast site. As soon as I got down, I saw an amputated arm lying on the road. It was a terrible sight. Being a doctor I have seen the worst injuries, but this was different; this was an indication or a metaphor for what had just happened in a sleeping town like Harda. The crackers were still bursting, and there was a huge fire at the site. We couldn't dare to go near the factory site. We were literally in a state of shock for a couple of minutes.

As soon as our senses took over, by around 11:40 AM, the rescue work started. I picked up my mobile phone and made several calls. Our immediate priority was to shift the injured to the hospitals and start dousing the fire. We informed the CMHO to call for all the ambulances in the district, except a few stationed for other emergencies, and also send a message to the private hospitals to be ready to receive patients in case the government hospital fills up. Within no time, separate wards were set up in the district hospital, and we sent a Naib Tehsildar to manage things at the hospital. My medical knowledge of the Triage system of managing disasters came to use in guiding the district surgeon in preparedness. We also called for all the fire brigades from the district to the site. Homeguards and the district SDRF team immediately arrived at the site, and with the help of volunteers, they started shifting the injured and dead in the ambulances. All the available resources with the emergency response team like helmets, jackets, firefighting equipment, suits etc., were called for.

By that time, Collector Rishi Garg sir and ZP CEO Rohit Sissoniya sir had arrived at the site. We had a brief discussion about further management. Me and CEO Sir then started calling the neighbouring districts and subdivisions for more ambulances and fire brigades. CEO Sir had by then informed the nursing colleges to prepare a makeshift hospital, which was also ready within a brief time to receive around 100 patients. CEO Sir called for nearly 20 water tankers from the nearby panchayats for fire management. We immediately spoke to the CM Office for more ambulances from the headquarters, fire brigades from neighbouring districts, a specialised medical team to assist in complicated cases, NDRF and SDRF personnel, medical kits, air ambulances if required and also the option of fogging from the air if the fire threatens to spread to nearby colonies. So positive and immediate was the response from the CM office that all the required assistance reached the site in the next few hours. One has to give a lot of appreciation to all the volunteers involved in the rescue operation. The whole city was barricaded by volunteers for the fast and easy movement of ambulances and fire brigades, right from the time of the blast until late in the evening. Hundreds gathered in no time to help at the hospital and the blast site. This made the rescue work quicker. CEO Sir also called for drone cameras to capture and monitor the spread of fire in and around the factory.

Fig.2: Drone image showing the blast site at 4 PM

3. Panicked yet resolute

There was a lot of panic in the whole team regarding the possibility of a death count. The said factory, according to intelligence officials, used to employ at least 1000 employees, working around 300 per shift. This number rang bells even in the ongoing parliament session and government of India. I started

getting calls from MHA asking for the preliminary report of the incident. But everybody was just curious about the death count. In the next few hours, I had conversations with the DGP, ADG, principal secretaries and many other senior officials. I had a possibility of around 30 to 40 deaths in my mind. Till 1 PM, there was a continuous blast of crackers in the factory. And we had already found around 7 deaths and 65 injuries among the bystanders by then. We all knew somewhere that the truth remains to be seen in the debris.

The blast was so intense that we found almost four dead bodies flown away into the nearby farm. Concrete pillars had fallen 200 metres away, trucks parked 500 metres away were completely damaged, many bikes and cars nearby were crushed, and there were reports of bricks falling on the rooftops of homes situated around 500 metres away. To my surprise, my office door had a crack, which is situated 5 km away from the site.

Also, there was a rumour that gave chills to the rescue team and the administration. There was a belief among the public that there exists an underground storage system, and the number of crackers stored there is much larger than the ones that exploded. I was sure that there are no such underground rooms, as I had searched the whole setup a few months ago and found nothing as such. Still, the higher-ups were worried. And also, information about the storage of more than 1000 litres of diesel in the godown adjacent to the factory made us more worried. Though the diesel storage turned out to be false after the search, the underground system news bothered us for a couple of days more.

Despite all these rumours and fearsome situations, the rescue work continued with full vigour. We finally got access to the factory to douse fire from one of the sides by around 2 PM, and the firefighting thus started after two and a half long hours. Slowly yet steadily, we progressed and we started to get in control of the situation, thus stopping the spread of the fire to the surroundings.

In the meantime, our Divisional Commissioner Pawan Sharma sir and IG Irshad Wali sir arrived at the site and took over the whole operation. Commissioner Sir had already managed a couple of big tragedies himself, and this gave speed, clarity, and a definitive approach to the operation. Sir sent CEO sir to the hospital to manage everything there and also to be in charge of the many VIP visits to come. And I was asked to stay at the site and handle the situation and operation.

4. Getting ready for a long operation amidst unanswered questions

As soon as we got control of the fire spread, we started preparing for a long and temporary action plan at the site. A temporary camp and a control room were

set up for the administration to operate in the vicinity, where the whole site was visible. A separate barricaded section for the media was prepared. A space was identified for the food and water supply for the rescue team and also for the volunteers to assist these teams. All the roads leading to the site were cut off for the general public. Four help desks were set up to report missing people and for other assistance; one near the blast site, one at the hospital, one at the collectorate and one at the tehsil office. All the district staff were mobilised, and the executive magistrates of the district were assigned respective duties.

Fig.3: Help desk setup at tehsil office to file missing reports

We had a couple of ministers and senior officials' visits lined up at 4 PM. By that time, we had prepared the helipad and route map for VIP visits. Honourable CM sir had already set up a high-level committee to investigate the matter and CM Video Conference with all the collectors, was scheduled for 7 PM to take stock of the situation and prevent any such incidence in the whole state and we were told that he expressed great displeasure and grief as well.

Bomb squads, forensic teams, pollution control board officials, PESO officials and other such departments arrived at the site to evaluate their respective matters and also to provide assistance to the team. By 4 PM, we had at least 100 ambulances operating in rescue operations and around 33 fire brigades employed to douse fire. All of them had responded; the CM office, neighbouring districts and other departments. All the promised assistance had arrived by 5 PM. It was a massive coordination exercise happening simultaneously with the firefight. We then realised this was what we were trained for in the academy and by the fraternity, to manage any kind of tough situation with composure.

Though the local media had started reporting the incident right after the blast, the national media arrived at the scene by around 5 PM. The faces that we used to watch over TV reporting for reputed media houses had all come to the site. Commissioner Sir assigned me the responsibility of interacting with the media as well. It was a tricky thing, as so many questions were unanswered and only the detailed investigation could answer most of them. And also, in these kinds of situations the media will come down heavily on administration, and a word here and there could create a lot of confusion. Yet I could navigate them one by one satisfactorily.

We had finally started to get access to the main site and started the search and rescue by around 6 PM. And at 6:15 PM itself, we found a charred body at the factory site. This created many doubts about the number of workers who might be stuck inside the actual building. All along, we had given clear visual access to the media; this helped largely to alleviate fears that the administration was hiding the actual death count. But still, people had their doubts based on rumours. We had also called for large Poclain machines and JCB by then. A total of 10 Poclain machines from in and around the district and 10 JCBs were at work the whole time. They started clearing the way for fire brigades to douse fire and also gave us access from all sides and to the core of the fire site by around 9:30 PM. The death count had reached 11 by then, with two unidentified bodies among them.

5. Let's get cracking!

We got confirmation in the night that CM sir will be visiting by 2:30 PM the next day to assess the damage and meet the victims. Our rescue team received a target of extinguishing the fire completely and breaking down all the concrete structures by 3 AM and no smoke was to be visible by the morning. The SDRF team and NDRF team were doubtful about the possibility. At 9:30 PM there were still blasts here and there around the site.

The main challenge was the three-story building which had collapsed on itself, was difficult to access, and spitting continuous fire and also the fear of an underground storage system. By this time, the accused were arrested, and they had confessed that no such underground floor existed, and the architect of the building seconded the same. But the belief of the people around us and the media made us confirm it ourselves. What made dousing fire difficult were the ropes (rassi) and packaging materials which used to catch fire due to a small spark repeatedly, and there were a lot of them at the site.

We took up the challenge!!! The whole team, including Commissioner sir and IG sir decided to camp at the site until we saw the last fire doused. Immediately,

all fire brigades were given tasks to run continuously throughout the night, and the Poclain and JCB machines were put to work. We stood there with the team, guiding them throughout the night. We broke the slabs metre by metre from three sides while fire brigades worked simultaneously with the machines to put out the fire. One side was deliberately kept free so that we would be left with a side to approach if other sides' access were cut off. The machines dug deep and searched inch by inch for any more bodies or remains in the debris, as well as for any structure underground. Only after digging at least 5 feet deep into the mud, we concluded that there was no such structure underground.

Fig.4: Fire dousing operation image captured at Midnight

It was a cold winter night, but the fire and smoke made it warm. We stood there throughout. My formal shoes were completely soiled in muddy water mixed with chemicals from the factory. Such poisonous was the air there that even with a mask on throughout, I got a severe headache by the night. We had barely eaten anything or drunk water since morning. And this was the case with the whole team as well. But still we stood there without a break with a firm resolve to get over the fire. And finally, by around 5:30 AM we had completely doused the fire. But the fire extinguishers worked continuously until noon the next day and made sure no smoke was left behind, as promised. The NDRF and SDRF teams of around 200 frisked the whole site for any remains or bodies in the morning for a couple of hours and found none. I finally got a break at 9:30 AM after 22 hours of continuous standing to freshen up for a while and had to be back on the ground by 11 AM.

Fig.5: SDRF teams with fire brigade, getting ready for the frisking operation at 9AM on the second day

6. Hospital Management and the satisfying news

While we were fighting fire here at the site, there was another team working tirelessly at the hospital, a dedicated team of doctors and nursing staff. Soon after the blast, separate hospital wards were set up to receive patients according to the seriousness of the injury. The Triage system of emergency management was followed with different wards according to the level of injury. Patients were sorted into three categories: brought-dead, grievous injury, and simple injury, which needs admission and observation. OPDs were busy handling simpler injuries like abrasions. All the doctors and hospital staff had gathered in no time after the blast. The plan was to leave no patient unattended. The Security team led by the police made sure the crowd was managed without any major incidents and only the patients were allowed into the wards. As requested, a specialist team of doctors also arrived by evening to handle serious cases. The whole hospital system was managed by the CEO sir. A data collection system was also put in place, which was to help us later in relief and rehabilitation. Postmortems were conducted without any delay. A total of 184 people were injured and 11 were declared dead by the end of the first day. A total of 39 patients were referred to different tertiary centres in Bhopal, Indore and Narmadapuram The role of volunteers was also immense in shifting and handling injuries at the hospital. More than 100 of them had lined up for blood donations as well.

What was most relieving (though it was a huge tragedy) against the popular belief was the death count. It had stopped at 11 even after many thorough rounds of search were conducted by the teams. Much to our surprise only four were reported missing by the next day as well. Later on, 2 unidentified bodies DNA matched with 2 missing persons, bringing the missing count to only 2. The reasons for this were found out later in the evening. The first one was Tuesday being payday for the employees, very few of them work on payday, and also one of the employees was getting married on the same day which many workers attended as well. The biggest reason for such a low death count was a small blast in the chemical mixing room around 10 minutes prior to the main blast. This allowed all the workers from inside to run far away. Most of the deaths that had happened were bystanders who were watching the blast scene and recording videos on their phones. I still believe that the small blast was a God-sent signal, which saved at least 100 lives that day.

7. CM visit and the relief work begins

As planned, the honourable CM visited the blast site, hospital and house of a victim. By the time CM sir arrived, all the kin of identified dead victims had received 4 lakh rupees in the accounts, as announced by the honourable CM a day earlier. The blast site was free of fire and smoke by then and properly barricaded. Protests were managed according to the set protocols. CM sir spent considerable time with patients at the hospital and gave certain instructions to be followed. The dead victims' families were to receive 2 lakh rupees from PM Ex Gratia as well. Over and above this Rogi Kalyan Samiti funds and Red Cross funds were also distributed to the injured victims to the tune of 50 and 25 thousand rupees respectively.

After the CM visit, we arrived back at the site to address the displaced people and relatives of the victims. We could satisfactorily explain to them the further plan of action for their temporary settlement. Temporary shelters were set up immediately nearby at the Gaushala and ITI college for around 250 people reportedly displaced from the surrounding houses. A plan was made to manage their basic amenities for the coming days, mainly from the government side and also from some of the donations received.

The high-level investigation committee had arrived at the site for inspections and started collecting evidence and related files. The accused were in custody and the police also made progress in the investigation with more arrests. The whole process went on until late in the night. Finally, I could come back home that day by around 2 AM and lie down for the first time in two days !!!

Fig.6: Honourable Chief Minister of Madhya Pradesh visiting patients at the District Hospital, Harda

8. Final mop-up exercise of the blast area and other factories

The next day our first priority was to do a thorough video recorded search of all 37 houses that were damaged in the vicinity of the blast site. 10 teams of SDRF men were formed for the same. Right at the entrance of the second house, around 50 metres away from our campsite, we found the dead body of a middle-aged woman covered in debris. This was a shocker and made us more vigilant during the search process. Meanwhile, IG sir instructed us to make one large mound out of the whole debris to prevent blast site tourism for the general public and also to effectively monitor the debris from intruders and rag pickers in the coming times. This was done by the night using poclain machines and the mound was completely barricaded with 360-degree CCTV monitoring of the same.

During the search operation, the team found one house completely filled with finished crackers and some raw materials. This building was completely seized, and a report was prepared. There was also news that some unknown people had disposed of 73 gunny bags of crackers near the railway track. A team was sent to seize that as well. There were six other fireworks factories active in the district. All of them were immediately investigated and sealed to prevent any further incidents. The same night, by around 1 AM there was a news report that some unknown person had disposed of firecrackers in the naala (canal) in the nearby village. I immediately rushed to the location with a team on the same night and got everything cleared out of the water.

9. Rebuilding after the disaster

Fig.7: Loss and Damage assessment survey being conducted by the technical team

On the third day, simultaneously with the mop-up exercise, relief and rehabilitation work had started in full swing. A relief camp was set up at the site for the people to report the injuries, damages, and losses. Individual teams were set up to do a detailed loss and damage assessment survey of different zones, like structures within the radius of 100m, 500m, and 1000m. We had created an exhaustive data collection format for the same, which would later serve as a primary document for relief assessment. By the end of the third day, we had completed surveying all the structures within a 100m and 500m radius. A technical team was formed to assess the building strength of the structures in the blast vicinity, and a list of unfit structures was made ready. We also prepared on the same day a calculation of damage to the movable and immovable properties and the compensations payable under existing RBC (Revenue Book Circular) laws for relief payments. The same night, we got a new collector Aditya Singh sir and SP Abhinav Chouksey sir posted to the district. They reached the district the same night, and we had a short debriefing session at 3 AM.

The new collector was known for his dynamism and quick-decision making capabilities. With a young team in place and new-found energy we started the day at 7 AM and visited the blast site, met the victims, and sir took stock of all the work done and pending work in a general meeting. Our first priority was to demolish the unfit structures near the blast site so that people wouldn't start living there. The displaced created a huge uproar for the same so the plan was called off temporarily. A security system to prevent entry by anyone near

these buildings was put in place. The next immediate priority was to assess, seize, and dispose of the remaining firecrackers and the raw materials in other factories. Teams led by magistrates were formed for the same, and it took nearly two days to do the estimation. And in a couple of days, a series of high profile visits by opposition parties including Ex CM were scheduled. There were false allegations levelled that the administration was hiding the actual number of deaths. Under the leadership of Collector sir a plan was prepared to manage and avoid any political drama, and we succeeded as well.

10. The Endless Cycle: Report Submissions and Fatigue

What was most laborious in the whole blast management was the report submission and the paperwork. At the end of the first week, there were around 23 reports to be made and submitted to various courts, commissions, and departments. These included the CM Office, MHA, National Green Tribunal, Pollution Control Board, Labour Department, Home Department, Environmental Departments, NHRC, PESO (Petroleum and Explosives Safety Organisation), and Labour Commission etc. These reports were assigned to different officers to prepare and submit on time. A separate task force was also constituted to plan and coordinate the whole rehabilitation process and report submissions. It is to be appreciated by our office staff that all the reports were submitted on time and in full. For the first few days, report making used to go on until morning. I used to stay with the office staff until sunrise on multiple occasions to keep them motivated and also to monitor their progress.

Simultaneously with report submissions, the process of suspension and cancellation of already issued manufacturing and storage licences for factories was taking place. To add on to this, Rajasva Vasuli Abhiyan, Girdawari and Patwari recruitment was in full swing, and board exams were also scheduled during the same time, which involved our magistrates' time and energy considerably. With limited human resources available in the district, these few hard-working and efficient employees were overburdened and drained out, some of them started having family issues as well. But the resoluteness of these employees served as a motivation for us as well.

11. Displaced and Displeased

The administration had completed all the legally possible disbursement of the relief funds for deaths, injuries, displacements, animal deaths, loss of property etc., within a week. There were in total 201 displaced individuals from the blast incident who were sheltered at the ITI college campus by the government. A total of more than 2 crore rupees was distributed under different categories from different funds and provisions like RBC 6(4), Red Cross Funds, Rogi Kalyan

Samiti funds, PM Ex Gratia, Sambal Yojana etc. But the losses calculated were greater. In addition to this, NGT had taken suo-motu cognisance of the matter and ordered compensation under different categories. The calculation under this compensation mechanism ran up to 18.23 crore rupees. The affected and displaced being aware of this, were demanding immediate and complete payment of all the losses. Initially, we were not allowed to demolish unsafe structures, later on there were demonstrations and protests for compensation. They were not ready for temporary resettlement into other buildings with better facilities. Certain political outfits tried to make use of the opportunity and planned a hunger strike. As we had regular, direct, transparent and open communication with the displaced throughout, we were able to convince them not to sit on hunger strike. Except for a couple of individuals, most of them agreed not to proceed on strike and to trust the administration. This was possible only because the administration including Collector sir, SP sir were accessible and patient enough to listen to the affected individuals multiple times, and we were also honest in our efforts.

Fig.8: Collector and SP celebrating Holi with the displaced families as a symbol of solidarity

Apart from regular interactions with the affected individuals, the administration had taken care of all their necessities. The task force was made responsible for addressing the demands and needs of the affected individuals. All the departments had set up a camp to provide possible benefits and saturation under available schemes for the displaced. A livelihood survey was done and the affected are being skilled for different occupations under government schemes. We got them to reissue all the lost or burned documents from the concerned departments. Regular medical checkups were organised,

vaccinations for children and antenatal checkup visits for pregnant women were also conducted regularly. The kids taking exams were shifted to hostels to provide a better environment to study in. A girl who had lost both parents in the tragedy and had siblings to take care of was provided with a job. Collector sir and SP sir celebrated Holi with them as a show of solidarity with the affected individuals.

12. Harda: A Pocket Dynamite

If I had told someone that such a huge blast was possible in a small town like Harda, hardly anybody would have believed me. The firecracker manufacturing industry in Harda was big and dangerous. It was so scary that a few months ago when I conducted a surprise raid on all the factories in the district at once, even we were surprised and taken aback. During inspection, while I was walking inside these factories I was so scared that a small spark here could create havoc, and it did create one later. After the blast, we sealed all the factories in the district for violations, including three other factories of the accused in the blast case. And after two days of weighing and counting, we found a storage of around 78000 kg or 78 MT, of firecrackers and raw materials combined in six factories of the district. One of the factory sites that was under seizure for two years had around 70 lakh Sutli bombs stored, both finished and unfinished. That was the magnanimity of these factories functioning with individual licences for a maximum of 1500 kg finished crackers to be stored at a time on the premises.

As per the procedure mentioned in the law, after the seizure the court gave an order to destroy the firecrackers and raw materials in accordance with explosive rules. PESO is the authority empowered to oversee the destruction activity according to the explosives rules, so we contacted them, and after discussion with PESO, it was decided that such quantities of the fire crackers could be destroyed at an incinerator facility situated in the Pithampur industrial area. The company was then contacted, and they started shifting the fire crackers to Pithampur in specialised vehicles. Once everything was shifted, it took a total of 7 days to destroy the whole quantity which was done under the observation of PESO and district administration. And finally, the collector sir's vow of cracker storage-free Harda was achieved.

13. NGT Order and the auctions

As mentioned earlier, NGT had given a compensation order taking suo motu cognisance of the blast. As per the order, Rs. 15 lakh was to be given for deaths, Rs. 5 lakh for damaged houses, Rs. 5 lakh for grievous injuries, Rs. 3 lakh for simple injuries, and Rs. 2 lakh for every person displaced. We had prepared an

elaborate list of claims in accordance with the order. The compensation thus calculated came up to 18.23 crore rupees. According to the order, the amount was supposed to be paid by the owners of the factory, and if it was not paid in 10 days the administration was supposed to recover it by means of confiscation and auction of properties.

In pursuance of the order, as the owners didn't pay up the compensation, we proceeded by confiscating all the movable and immovable properties of the owners. And as per the guidelines, the first phase was planned for April 2nd after giving a mandatory 30 day notice period post-publication. As the elections were announced and the model code of conduct was in place we had to get permission from the Election Commission of India to proceed and we received the approval at the N^{th} minute on the previous day of the auction. In the first round of auctions, there was good participation from the buyers, and to our surprise we generated 2.65 crore rupees out of auction against the guideline rate of 69 lakh rupees, more than three times the guideline value.

When the final numbers collected from the auction broke out in the news, there was an atmosphere of confidence and celebration among the affected families. They had lost everything - their lifetime earnings, families, livelihood and in the end, they had a sense of hope and a sense of trust in the administration and our efforts. But our feeling was of relief and satisfaction- satisfied to see the fruits of all the efforts we had put in within a short span of less than two months and satisfied to see smiles and gratitude on the faces of those affected.

During our academy days, a speaker once said that leading a team of hundreds with differential capabilities in difficult circumstances and under tremendous pressure is what makes our service special. And we realised today that it's actually true. None of the other services or jobs can provide this opportunity. It also put an end to the debate in our minds that a generalist civil servant with multiple skills (jack of all trades) serves the requirements of a developing country's bureaucracy much better than multiple specialists.

Overall, it was an immense learning experience for us. It was a large, coordinated effort involving multiple departments, with us playing a small part in leading it. Another important learning or realisation was that our camaraderie and connections within and with different services and cadres help us get timely work done for a public cause. As of date, we know that we have just won a battle, and a long war is yet to be fought to completely rehabilitate the displaced. But as an honest and dedicated team, whatever and whomever we have fought for till now was the reason we joined this service, i.e., to serve the needy and to provide justice to the common man.

School Safety Initiative in Munnar, Kerala: Best Practices

Rahul Krishna Sharma, IAS

Abstract

This case study highlights the best practices in disaster prevention and mitigation in the context of school safety in Munnar, Kerala. It explores the innovative approaches taken to enhance the resilience of educational institutions and communities in a disaster-prone area.

Key words: *School safety, Disaster Mitigation*

1. Introduction

Munnar, a picturesque hill station in the Idukki district of Kerala, boasts a unique but challenging location between the Western Ghats and the Arabian Sea. The region's beauty and tranquillity are juxtaposed with its susceptibility to various natural hazards. In 2018 and 2019, devastating floods wreaked havoc on Munnar and the wider Idukki district. These floods not only damaged homes and farms but also took a toll on education.

According to the Post-Disaster Needs Assessment (PDNA) report, the education sector in Munnar and Idukki suffered losses of INR 179.48 crore. To recover and rebuild this sector, it's estimated that around INR 214 crore will be needed over the next 3-5 years (PDNA Report October 2018, Government of Kerala, Reference (1). The recurrent floods and landslides in Idukki called for innovative measures to ensure the safety and resilience of the education system, aligning with the Sendai Framework on Disaster Risk Reduction and SDG Goal 11.

The national disaster management guidelines emphasize several critical aspects of school safety, including capacity building of children, teachers, and school personnel on disaster preparedness, anchoring child-centered community-based disaster risk reduction, mainstreaming risk and safety education in the school curriculum, and strengthening coordination among institutional structures at the district and state levels. It is crucial to prepare schools and the education sector to minimize losses and ensure the safety of students, as children have not just a right to education but a right to a safe education. Preparedness can be instilled in students, teachers, and other stakeholders through grassroots-level capacity building in schools and colleges.

As per Sendai framework on disaster risk reduction guiding principle, which is as follows:

"To develop effective global and regional campaigns as instruments for public awareness and education, building on the existing ones (for example, the "One million safe schools and hospitals" initiative; the "Making Cities Resilient: My city is getting ready" campaign; the United Nations Sasakawa Award for Disaster Risk Reduction; and the annual United Nations International Day for Disaster Reduction), to promote a culture of disaster prevention, resilience and responsible citizenship, generate understanding of disaster risk, support mutual learning and share experiences; and encourage public and private stakeholders to actively engage in such initiatives and to develop new ones at the local, national, regional and global levels;"

Aligning this initiative with Sendai framework, SDG goals and National Disaster Management Guidelines, District administration, Idukki initiated this programme for school safety in Munnar.

2. Disaster Risk Reduction Strategy

The Disaster Preparedness and Safety Training Project for Educational Institutions in Munnar aimed to enhance the resilience of schools and colleges. The project had clear objectives:

(a) Providing physical disaster safety training.
(b) Raising basic disaster awareness.
(c) Conducting group exercises such as hazard hunts and evacuation planning.
(d) Developing disaster management plans for educational institutions.

This comprehensive approach was in line with the concept of "safe schools" as an indicator of quality education. It aimed to fortify existing provisions to make educational institutions safer.

3. Outcome and Impact

The training program yielded several significant outcomes, including the development of disaster management plans for 13 educational institutions, successful evacuation drills involving thousands of school and college students and staff, with a total of 4151 students, 298 teachers, and 68 non-teaching staff participating and the capacity building of 106 teachers, students, and Block Resource Centre (BRC) teams in School Disaster Risk Management. Further, Customized Information, Education, and Communication (IEC) materials were created in Tamil, Malayalam, and English languages and the BRC teams were equipped to disseminate knowledge and practices to other schools in the district. (Reference: https://idukki.nic.in/en/disaster-preparedness-modules/).

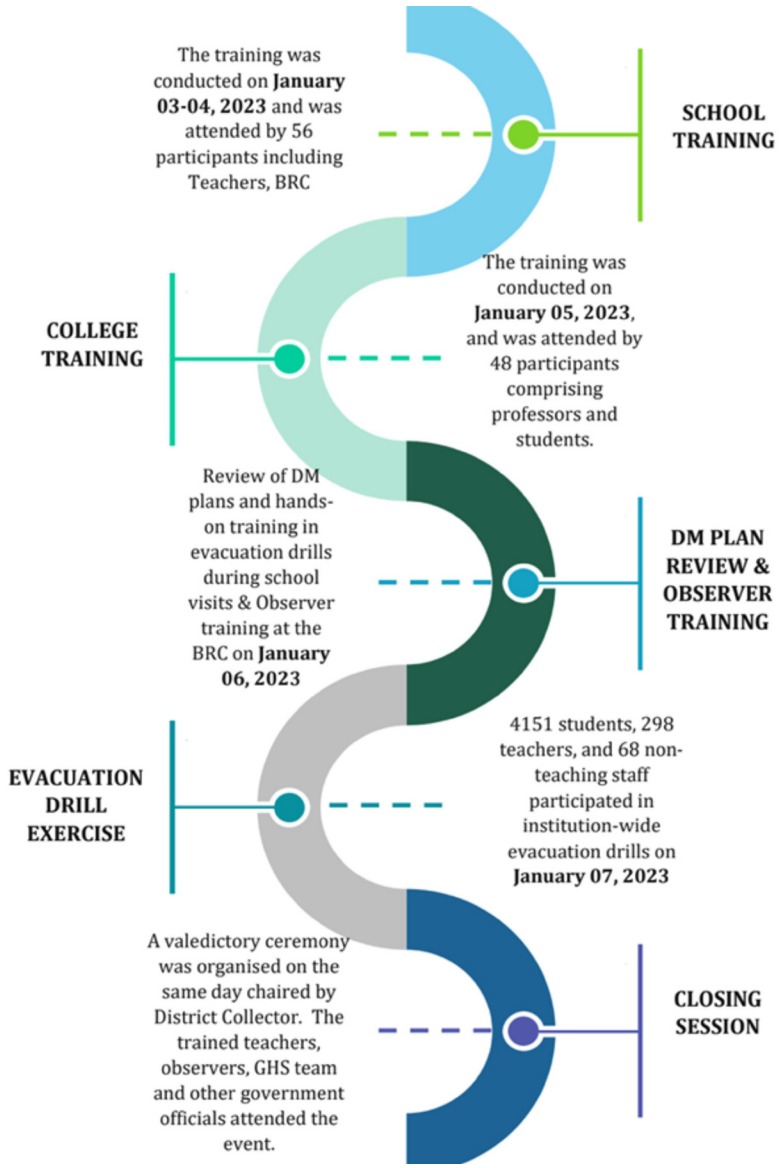


Fig.1: School Safety Initiative Timeline

4. Key Highlights of the Project

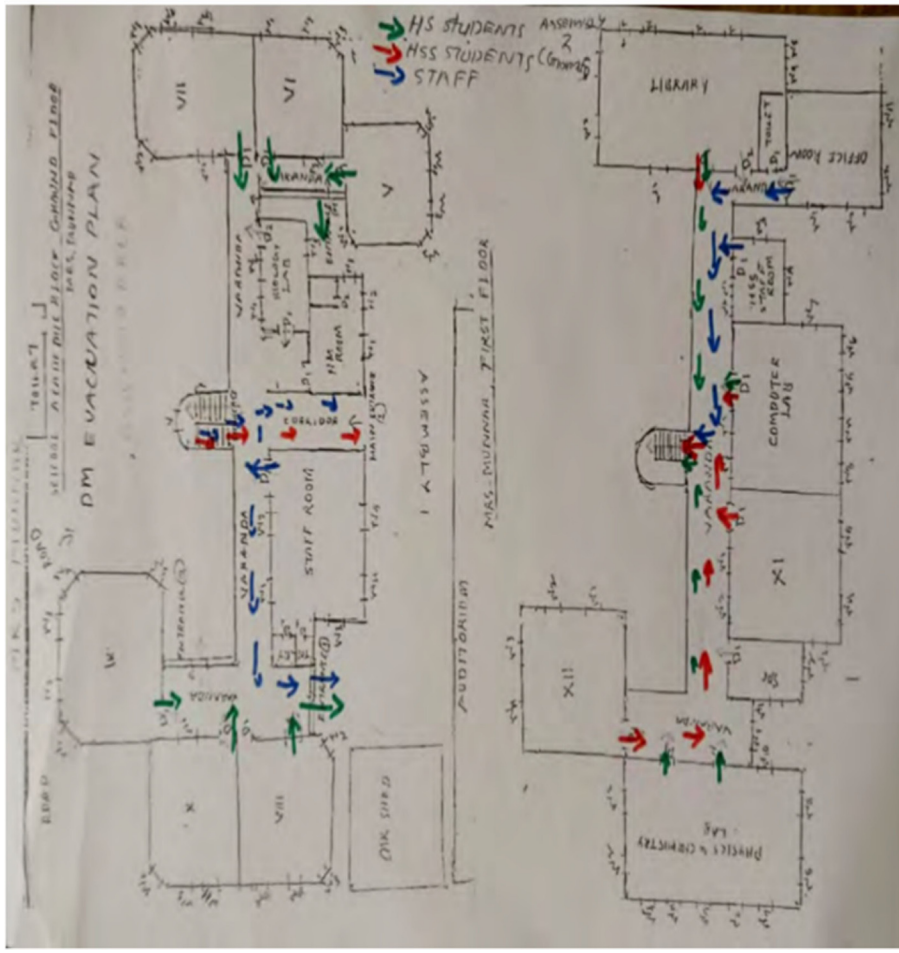
Our program aims to establish model schools for disaster management, focusing on sustainability and inclusivity, based on the following pillars:

(a) Sustainability and Inclusivity: To expand the reach of our disaster risk management efforts, we will involve coordinators from the Block Resource

Centre (BRC) and Special Educators in school training. This approach ensures that disaster risk management activities are not limited to a few schools but are carried out and maintained in all selected schools. Furthermore, these coordinators can spread the message of disaster safety to all other schools in their respective sub-districts and even to other BRCs in Idukki. The trained BRC team will play a pivotal role in sustaining these efforts and making them more widespread.

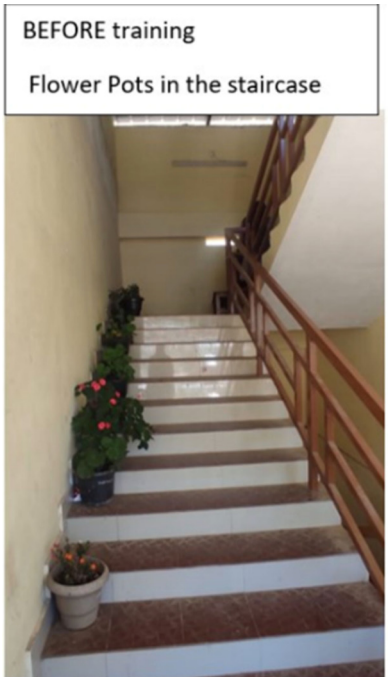
(b) Evacuation Planning and School Touring (Physical and Online): The intensive disaster safety training conducted within a week's time was made possible due to careful preparatory activities. Each school's Headmaster (HM) or Principal played a crucial role by sharing their floor plans and taking the time to virtually show the entire school premises to the resource persons from the Government High School (GHS) through video calls. This exercise served a dual purpose. It helped the GHS resource persons sketch out safe evacuation maps for each school and, in the process, raised awareness among school authorities about the importance of swift evacuation planning and the identification of safe assembly points well in advance.

(c) Hazard Hunt Exercise in All Schools/Colleges: The hazard hunt exercise conducted in the host school served as practical learning for the teachers. After completing their training, these teachers carried out similar exercises in their own schools or colleges immediately. During these assessments, they identified and eliminated various risks that could potentially harm



students or staff. The resource persons were able to observe the positive changes brought about in each school during their visits. For instance, they noticed that cupboards and shelves were securely tied to window sills to prevent potential falls and damages.

(d) ***Basic Disaster Awareness Classes for Parents:*** Following the training week, many schools promptly organized Parent-Teacher Association (PTA) meetings and took proactive steps to communicate risk information and lessons learned to parents. The trained teachers, who had now become trainers themselves, educated not only other staff and students in their schools but also their families. This initiative included providing awareness on family preparedness. In addition, Information, Education, and Communication (IEC) materials such as posters and videos in both Tamil and Malayalam languages were used to educate the gathering. These efforts



are expected to significantly boost the preparedness of school authorities and other stakeholders related to the educational institutions.

By implementing these strategies, we aim to create a safer and more resilient educational system in Munnar, where disaster preparedness becomes an integral part of the educational landscape. Our commitment to ensuring that children not only have the right to education but also the right to a safe education remains steadfast. Preparedness, capacity building, and community involvement are the cornerstones of our comprehensive strategy to enhance school safety. Through continued efforts, we are not only recovering but also building a stronger and safer future for education in Munnar and beyond.

5. Key Takeaways

The training sessions and hands-on experiences in conducting hazard hunts, resource mapping and evacuation planning have empowered every participating teacher. After returning to their respective schools and colleges, these teachers shared their newfound knowledge and skills with their colleagues and students.

They successfully conducted hazard hunts within their own premises, leading to a thorough analysis of safety gaps. Each institution identified areas for improvement and implemented the following safety measures:

a) **Redesigning of the Retaining** Wall at GLPS Devikulam (Landslide-affected Area): During a school visit, the members of the GHS team observed that the soil above the retaining wall, located beside the classroom block affected by a landslide, had a near-vertical slope. This slope could potentially slide down again, especially if heavy rains increased the moisture content of the soil. To address this issue, solutions were suggested, and the matter was promptly brought to the attention of the school authorities and the Sub Collector. Recognizing the urgency of the situation, the Sub Collector prioritized the matter and issued orders to rectify the slope-cutting. Additionally, a drainage system was planned and constructed atop the slope to prevent rainwater from seeping into the soil, thereby mitigating the risk.

Side wall for protection built with the help of Panchayat

Before January 2023 After July 2023

b) ***Emptying the Fertilizer Shed at ALPS Periavarai:*** During an inspection of the school, a member of the GHS team noticed a fertilizer shed that separated the primary and pre-primary sections at ALPS Periavarai. The school's evacuation plan required pre-primary children to move out to the road and pass by this Dolomite fertilizer shed to reach the assembly point in the primary section. Storing harmful chemicals and fertilizers within a school compound posed a significant obstruction and health hazard, particularly during the rainy season. This observation was meticulously recorded in the visitors' diary, and it was also brought to the attention of the Sub Collector. In response to this concern, the Headmaster (HM) of the school took prompt action by bringing the issue to the attention of the company manager. As a result, the fertilizer shed was promptly emptied and will no longer be used for storing fertilizers, thereby eliminating the associated risks. These actions exemplify the proactive approach taken by the educational institutions in response to the training, emphasizing their commitment to the safety and well-being of students and staff.

c) **Weather gauge installation-** an initiative was undertaken on iDDDR day 13 Oct 2023 to install rain gaugues in all the 11 schools and 2 college in order to develop sustainable and scientific awareness among students about the disaster management and prevention.

എല്ലാ വിദ്യാഭ്യാസ സ്ഥാപനങ്ങളിലും റെയ്ൻ ഗേജ്: പദ്ധതിക്ക് തുടക്കം

മൂന്നാർ • ദേവികുളം റവന്യൂ ഡിവിഷനിലെ സ്കൂൾ സുരക്ഷാ പദ്ധതിയുടെ ഭാഗമായി എല്ലാ വിദ്യാഭ്യാസ സ്ഥാപനങ്ങളിലും റെയ്ൻ ഗേജുകൾ സ്ഥാപിക്കുന്നതിന്റെ ഉദ്ഘാടനം ദേവികുളം സബ് കലക്ടർ രാഹുൽ കൃഷ്ണ ശർമ നിർവഹിച്ചു.

അപ്രതീക്ഷിതമായി അതിതീവ്ര മഴ പെയ്യുന്ന സാഹചര്യത്തിൽ വിദ്യാലയങ്ങളുടെ സുരക്ഷയ്ക്കായി മുൻകൂട്ടി തയാറെടുപ്പുകൾ നടത്തുന്നതിനും കുട്ടികളിൽ ശാസ്ത്രീയമായ അവബോധം വളർത്തുന്നതിനുമാണ് പദ്ധതി നടപ്പാക്കുന്നത്. മൂന്നാർ ഗവ. കോളജിലെ ഇന്നവേഷൻ ആൻഡ് ഒട്ടപ്രണർഷിപ് ഡവലപ്മെന്റ് സെന്ററിൽ ഡിസൈൻ ചെയ്ത റെയ്ൻ ഗേജ്, മീറ്റിയോറോളജി ടെക്നോളജീസ് എന്ന സ്റ്റാർട്ടപ് കമ്പനിയുടെ നേതൃത്വത്തിൽ സൗജന്യമായാണു സ്ഥാപിക്കുന്നത്.

ഉപകരണത്തിലെ നീഡിലുകളും കളർ കോഡിങ്ങുകളും ഉപയോഗപ്പെടുത്തി അതതു സ്ഥാപനങ്ങൾക്കു മഴയുടെ അളവ് കൃത്യമായി രേഖപ്പെടുത്താൻ കഴിയും. ദേവികുളം ഹയർ സെക്കൻഡറി സ്കൂളിൽ നടന്ന പരിപാടിൽ ഉപകരണം വികസിപ്പിച്ച എൻജിനീയറിങ് കോളജ് വിദ്യാർഥികളായ അതിഥനാഥ്, രാഹിത്ത് കേരള സ്റ്റാർട്ടപ് മിഷൻ നോഡൽ ഓഫിസർ രമേഷ്കുമാർ, സ്കൂൾ പ്രധാനാധ്യാപിക ഡോ. ജയലക്ഷ്മി, പ്രിൻസിപ്പൽ എൻ. എൽ. സജി, സ്കൂൾ പിടിഎ പ്രസിഡന്റ് ബാലു, സുനിത സു

സ്കൂൾ സുരക്ഷാ പദ്ധതിയുടെ ഭാഗമായി ദേവികുളം ഹയർ സെക്കൻഡറി സ്കൂളിൽ റെയ്ൻ ഗേജ് സ്ഥാപിക്കാൻ സബ് കലക്ടർ രാഹുൽ കൃഷ്ണശർമ നിർവഹിക്കുന്നു.

5. Conclusion

To ensure comprehensive disaster preparedness and safety in educational institutions, several key steps and initiatives have been outlined, focusing on both planning and practical measures.

a) ***Annual Update of Disaster Management (DM) Plans:*** DM plans should be prepared as part of the initial training and updated annually to reflect any changes or developments in the institution's preparedness and response strategies.

b) ***Hostel Blocks Preparedness and Evacuation Planning:*** Specific disaster management plans and evacuation procedures should be developed for hostel blocks within MRS School and the Government Engineering College in Munnar to ensure the safety of residents in these facilities.

c) ***Accessibility for Disabled Individuals:*** All schools and colleges should be made more accessible and disability-friendly. This includes assessing the presence of ramps and the availability of firefighting systems to ensure that individuals with disabilities can evacuate safely in case of a disaster.

d) ***Fire Safety Measures:*** To address the lack of fire safety measures, fire extinguishers should be procured for every school and college. Training on fire safety should be provided to nominated fire safety team members from the 11 schools and 2 colleges.

e) ***First Aid Training:*** The Health Department or District Hospital team should be invited to provide basic first aid training to first aid teams from all 11 schools and 2 colleges. This training will equip them to provide immediate assistance in case of injuries during emergencies.

f) ***Mitigating Falling Hazards:*** Falling hazards should be identified, and necessary actions taken to remove or relocate objects that pose a risk. Funds or manpower should be allocated to clamp or fasten shelves and cupboards securely to prevent accidents.

g) ***Decluttering Schools:*** Schools should conduct a thorough decluttering process to eliminate broken furniture and dispose of flammable waste materials stored on the premises. This will reduce potential fire hazards and improve overall safety.

h) ***Training for Block Resource Centre (BRC) Staff:*** The training program should be extended to all other BRC staff in the Idukki District. This expansion will enable them to train all schools in the district, spreading disaster preparedness knowledge and practices more widely.

i) ***Focus on Developing Model Schools:*** Efforts should be directed towards developing model schools that serve as examples of disaster preparedness and safety. Ground-level initiatives, such as installing rain gauges in all schools, should be undertaken to enhance monitoring and response capabilities.

j) ***Third-Party Surveys:*** Conducting third-party surveys can provide valuable insights into disaster preparedness and identify areas for improvement. The results of these surveys can inform future disaster management strategies and initiatives.

By implementing these measures and continuously improving disaster preparedness, educational institutions in Munnar can enhance their safety and resilience in the face of natural disasters and emergencies. The initative exemplifies a comprehensive approach to enhancing school safety through disaster risk reduction. This initiative aligns with global goals and guidelines, with a strong emphasis on building a culture of safety in educational institutions and ensuring the right to a safe education for all children.

The forward-looking strategy ensures that these efforts will continue to evolve, adapt, and contribute to a safer and more resilient educational system in Munnar. The aim is to make disaster preparedness an integral part of the educational landscape.

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The Brahmapuram Fire Incident-2023: A Study

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Abstract

At the waste dumping yard at Brahmapuram in Ernakulam district of Kerala state a fire broke out on 02.03.2023 and toxic smoke spread upto 10 km around Brahmapuram creating fog like conditions in Kochi. The situation became grave. The fire could be extinguished completely only by 13.03.2023. This is the largest waste dumping yard fire reported in Kerala. The Fire & Rescue Services Department named the entire Operation as `Mission Safe Breath'. Within 12 days a massive fire at the waste dumping yard situated at Brahmapuram, where most of the city waste of Kochi is dumped was extinguished by the Fire and Rescue Service Department of Kerala. This incident is one of the major Disaster Management Tasks carried out in Kerala. 'Lift, Turn and Wet' Methodology was used to extinguish the fire using water. Coordinated efforts by various Departments and especially the technical expertise and hard work of Fire Force personnel along with Civil Defence volunteers made it possible. The type of waste and nature of its combustibility may change. Hence improving the dumping yard and waste management technologies and segregation of waste and accessibility to each point in the plant are required to avoid major disasters in future. This study aims to explore the lessons learnt from the Brahmapuram fire incident to prevent future accidents.

Key words: *Disaster Management- Dumping Yard Fire- Waste Management*

1. Introduction

Kochi is the most populated and industrialized Metropolitan City in Kerala. It is a place of tourist attraction. The High Court of Kerala is situated in Kochi. A fire broke out at a waste dumping yard at Brahmapuram, Kochi on 02.03.2023 and toxic smoke spread upto 10 km around Brahmapuram creating fog like conditions in Kochi. The situation became grave. The fire could be extinguished completely only by 13.03.2023. This is the largest waste dumping yard fire reported in Kerala.

The waste dumping yard at a place called Brahmapuram, owned by the Cochin Municipal Corporation, is situated in a Grama Panchayat viz, Puthenkurisu; at a place called Vadavucode. It is around 9 km away from Thrikkakkara, Fire Station having jurisdiction. The yard extends to around 70 acres of land. This was established in the year 2008.

2. Literature Review

The newspapers from 3rd March to 11th March kept on reporting that a massive fire broke out at the Brahmapuram waste plant on March 2nd and thereafter, the air quality in Kochi City and neighboring areas worsened as they were engulfed in dense smoke. Local people in the region suffered problems including breathing difficulties, dry cough, irritation and dryness on the eyes. The District Administration declared holidays for children's in all Schools on March 5th. The Kerala High Court appointed a committee to monitor the situation. The committee comprises of the Ernakulam District Collector, Pollution Control Board officials and the Secretary of the Kerala State Legal Services Authority. The BBC reported on 6th March that Residents have been advised to remain indoors and use N95 mask if they step out. The Brahmapuram waste plant is known for the massive mounds of waste on its premises. Locals have protested earlier against the fires and the alleged health hazard caused by the burning of plastic here. The City Police has launched an investigation into the fire. The State Pollution Control Board has issued a notice to local authorities asking them to pay 2,20,000 as penalty for failing to follow waste management rules. The Times of India reported on 13th March that a division bench of the High Court is considering a PIL registered suo moto by the court on the basis of a letter written by Justice Devan Ramachandran to the Chief Justice. The Division Bench ordered the Kochi Corporation to produce all the files related to the awarding of the contract for the Brahmapuram solid waste management facility and details of the money spent for waste management in the past seven years. Arun Ramachandran[1] (The South First) reported that artistes in the Malayalam film fraternity expressed agony over the Brahmapuram fire mishap.

Shradha Panday[2] reported on 9th March 2023 that Brahmapuram waste plant fire turned Kochi into a gas chamber Brahmapuram waste treatment Plant carries out three major works, bio mining of legacy waste, windrow Composting of daily waste and plastic waste segregation. The fire outbreak has exposed deep rooted corruption and influence of political parties in quoting contracts. She also reported that Brahmapuram waste plant fire rocks Kerala Assembly. The Kerala Government in a damage control measure transferred Smt.Renu Raj IAS, The District Collector, Ernakulam and appointed NSK Umesh IAS as new Collector.

Reema Abraham[3] wrote that Brahmapuram is meant to process waste. However activists say that in the name of centralised waste management unscientific processes are being followed with towers of garbage piling up for years which could end up in major disasters. At night the smoke from the dump settles

low over the Kadambrayar, tributary of the Chithrapuzha river. The airborne poisonous gases and the toxic leachate from the melting plastic dump could get absorbed in the water, point out residents of the area.

Chippy Mohan and Gireesh Kumar[4] in their article, viz, 'Preventing Future Disasters: Lessons from the Brahmapuram Fire Incident in Kochi' recommend Firstly, waste management facilities should be designed to handle the expected waste volumes, and regular maintenance and inspections should be carried out to ensure that the facilities are in good condition. Secondly, waste should be sorted and segregated at the source to prevent the accumulation of large amounts of mixed waste. Thirdly, waste should be treated promptly to prevent the build-up of organic matter that can cause high temperatures and lead to fires. Fourthly, appropriate safety measures, such as fire alarms and sprinklers, should be installed in waste treatment plants to prevent the spread of fires. Furthermore, waste management practices should prioritize the reduction of waste generation through the promotion of recycling and reuse. This can be achieved by implementing policies that encourage the reduction of single-use plastic and promoting sustainable waste management practices such as composting and biogas production.

'Study report on the Emission of dioxins and furans during the fire break out at Brahmapuram Waste Treatment Plant - February 2020' by the Environmental Technology Division CSIR- National Institute For Interdisciplinary Science and Technology, Thiruvananthapuram[5] (Final Report December 2021) Summarises their major findings:

1. Dioxins were detected and quantified in ambient air and residual ash samples collected from the premises of waste dump yard during fire break out.
2. The average dioxin levels observed in ambient air was found to be 3.2 pg TEQ/m3. The observed levels are 16 and 2.5 times higher than reference and field blank data.

The study recommended that the legacy wastes in dump yard need to be disposed by 'bio-mining' to separate combustible and inert material in a phased manner. The contaminated ash separated during bio-mining should be removed to sanitary landfill. A road map for installing modern waste treatment plant and the phased reclamation of site may be laid down and implemented at the earliest.

The study by Dr.Antony Paul P 'Risk Perceptions And Quality of Life of Residents Near Brahmapuram Dump Yard, Kochi, Kerala'[6] for Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and

Technology, Thiruvananthapuram, September 2022 aimed to understand the risk perceptions of people living near the Brahmapuram dump yard and their self-rated health and quality of life. More than seventy percent of the participants of the current study perceived the proximity of the dump yard to their households to be unfair and almost two-thirds of them felt that the dumping of waste from other municipalities at Brahmapuram dump yard was unfair. Most commonly, negative attitudes towards such infrastructure are thought to be driven by NIMBY (Not in My Back Yard) syndrome which in turn are driven by personal concerns alone. (Johnson and Scicchitano, 2012)[7]. The study demonstrates the associations among geospatial factors such as distance and direction and how it affects risk perception and quality of life around landfills and dump yards and that it must be considered during designs to manage the dump yard. The findings of the study show that a proper scientific waste dump yard management is urgently needed at Brahmapuram with more transparency and people's participation.

'Comparative Analyses of Municipal Solid Waste Management in Kochi and Indore' study by B. Paul and D. Paul[8] concludes, the MSW management in Kochi is a ticking time bomb and if the present trends of management are to be followed, by 2050 the city will be requiring an area equivalent to its corporation size to treat the waste generated by the city households. The unsustainability dilemma in the minds of residents towards waste treatment and disposal has been pointed out especially through their behavioral aspects of street discards and burning. Landfilling is not an option of Kochi city given its geographical nature and polity. The government and authorities must focus on creating technical and engineering innovations to reclaim the existing landfill. The Brahmapuram plant needs a complete revamp by redesigning the entire structure with strong foundations to optimize the windrow compositing and mechanized compositing which results in the reclamation of landfills.

'Untapped Potential: Securing livelihoods dependant on 'Waste', A Review of Law and Policy in India' study by Roopa Madhav[9] includes, Article 51(A) of the Indian Constitution obliges every citizen to protect and improve the environment. This duty of the citizen has been reiterated in Municipal Solid Waste Management Rules, 2000 wherein citizens are required to segregate and dispose waste in the manner prescribed under the Rules. The Environment Protection Act (EPA), 1986 is the umbrella Act that pertains to management of solid waste in the country. Contentious as the use of land for dumping waste, there has been several struggles and resistance to indiscriminate dumping by the locals. To cite an instance, in 2007, a division bench of the Kerala High Court[10] which had directed the municipal corporation to dump waste at Brahmapuram, had to also order police protection if faced with villagers' protests.

Prabuddhi Wijekoon et al (2022)[11] says that, Leachate is the liquid effluent generated through the interaction of rainwater and degradation products of waste. Landfill leachate is rich in wide range of pollutants, categorized into dissolved organic matter, inorganic macro pollutants, heavy metals and xenobiotic organic compounds - the pollutants including heavy metals, XOCs and NH_3 exhibit acute toxicity and carcinogenic effects for human.

A study viz: 'Landfill Fires Their Magnitude, Characteristics, And Mitigation May 2002/FA–225, Federal Emergency Management Agency United States Fire Administration National Fire Data Center' states,

- **Extinguishing Landfill Fires:** The different dynamics, characteristics, and regulations of landfills and the fires that occur in them suggest that firefighting tactics need to be determined on a case-by-case basis depending on the materials buried in the landfill, which materials have ignited, depth of the fire, and the fire's ignition source. Challenges explored in this report include wind/weather; water supply; multi-agency response; personnel safety; access to, access by and maneuverability of heavy equipment; logistics; environmental impact; and landfill contents (potentially hazardous or illegal). Landfill fires are particularly challenging to the fire service. A large landfill fire will generally require numerous personnel and significant amounts of time to contain.
- **Characteristics of land fill Fires**
    - **Surface Fires:** Surface fires involve recently buried or uncompacted refuse, situated on or close to the landfill surface in the aerobic decomposition layer, generally 1 to 4 feet in depth. These fires can be intensified by landfill gas (methane), which may cause the fire to spread throughout the landfill.
    - **Underground Fires:** Underground fires in landfills occur deep below the landfill surface and involve materials that are months or years old. These fires are generally more difficult to extinguish than surface fires. Underground fires also have the potential to create large. The most common cause of underground landfill fires is an increase in the oxygen content of the landfill, which increases bacterial activity and raises temperatures (aerobic decomposition). These so-called "hot spots" can come into contact with pockets of methane gas and result in a fire.
- **Extinguishing Landfill Fires**
    - **Wind/Weather:** Wind and inclement weather can increase the health hazards for firefighters operating on the fireground (e.g., in extremely hot or cold weather) and can directly affect fire spread.

- **Water Supply:** The use of water to suppress landfill fires is controversial. The application of large volumes of water may actually exacerbate a fire by contributing to the process of aerobic decomposition.
- **Personnel Safety:** Fires, particularly those underground, can undermine the integrity of the landfill, which could cause a collapse under the weight of landfill employees, firefighters, or equipment. Such a collapse could necessitate a confined space, trench, or other type of technical rescue operation in addition to fire suppression.
- **Access to and Maneuverability of Heavy Equipment:** To access waste below the landfill surface or move burning waste away from the landfill, it may be necessary to use heavy equipment such as bulldozers.
- **Logistics:** As with any protracted fire suppression operation, Incident Commanders at landfill fires must address a variety of logistical concerns to facilitate operations. These include rotating personnel on a regular basis, compensating personnel for overtime spent operating at the landfill or filling in at fire stations in the jurisdiction, keeping firefighters on the landfill hydrated and fed, and, keeping records for future reimbursement.

In Finland an experimental study that sheds significant light on methods of extinguishing landfill fires was conducted in Finland in 1993. The study suggested that one way to prevent landfill fires is to sufficiently compact all waste buried in the landfill site. Only one-quarter of the fires reported to the study team were underground; those fires were particularly difficult to extinguish and tended to last over 2 months. In fact, for underground fires, it was found that covering the smoldering refuse with layers of soil actually prolonged some fires.

In Canada during November 1999, a fire ignited at the Delta Shake and Shingle Landfill, a C&D landfill outside Vancouver, British Columbia. Although smoke and steam had been emanating from the landfill for weeks, the fire was finally discovered when flames broke through the landfill surface. The landfill operator originally attempted to extinguish the fire without fire department assistance; ultimately, local officials declared a state of emergency. They determined that although using high-pressure water worked to extinguish the surface fire, it did not extinguish the burning refuse underground. To increase the water's effectiveness, firefighters misted the water and added Class A foam. Once the fire was contained, the firefighters used heavy machinery to excavate burning materials and move them to areas offsite where they could be fully extinguished. Firefighters used infrared technology to determine which loads were "hot" and required extinguishment and which ones were cool enough to be left alone.

3. The Brahmapuram Waste Dumping Yard and Plant

Waste disposal was a major issue in Kochi. To solve this issue, Cochin Corporation reclaimed 15-acre swamp in 2007 at Brahmapuram and a waste recycling plant was built in that area. When the plant was inaugurated in 2008, capacity of the plant was set as 250 tonnes per day. Since the capacity of the waste processing plant was much less than the waste collected per day, waste was piled up and the plant which was inaugurated in 2008 to manage solid waste gradually converted into a landfill. Kochi Corporation was forced to acquire even more land on the demand of nearby residents. At present, the Brahmapuram waste plant is spread over 110 acres of land. Currently, apart from the Kochi Corporation, the Kalamassery, Aluva, Angamali, Thrikkakara, Thripunithara municipalities and the Cheranallur, Vadavukod Puthankurish panchayats also dump their waste at the Brahmapuram waste plant. Every day, nearly 400 tonnes of waste is being dumped at the Brahmapuram waste plant. Out of this, nearly 60 percentage is biodegradable and the rest is non-biodegradable materials like plastic. The Kochi Corporation was having an agreement with some companies to sell the plastic stored in Brahmapuram. However, the company takes in only recyclable plastic. Non- recycled plastics and other non-biodegradable substances are being left there itself. This resulted in the formation of huge waste piles in the area. There were plans to build a waste-to-energy plant in Brahmapuram under a public-private partnership. But the project was dropped due to a lack of funding.

3. 1. History of previous Fires at Brahmapuram

From 2009 onwards, fires were reported in the Brahmapuram waste dumping yard. In the years 2018, 2019, 2020 and 2021, the waste dumps at various parts of the area caught fire during summer seasons. In 2019, there were seven incidents of fire reported to Trikkakkara Fire Station. Around 436 Firemen, 102 Fire fighting vehicles and 41 fire pumps were deployed in the incidents which occurred in the moths of January, February and March. The estimated cost to distinguish fire is around Rs.8,43,000. If salary of personnel is also added, it comes to around Rs.1 crore (Rs.10 million). This also affected the jobs of Fire & Rescue Department like Fire audit, other fire calls, Safety beats, issuing Fire NOC etc. The toxic emissions from plastic and other pollutants seriously affected some of the officers and some personnel were hospitalized. It also affected life of nearby population.

All the above were reported by the Fire &Rescue Department to the concerned Local body authorities and the Government. However the remedial measures suggested by the Department periodically did not get much attention. In 2021,

the Director General, Fire & Rescue Services requested to investigate the incidents apart from taking remedial measures.

4. The Brahmapuram Incident in March, 2023

On 2nd March 2023, the Brahmapuram Fire Station got a call around 2 pm that plastic waste at the dumping yard has caught fire. The station teams and Regional Fire Officer immediately visited the spot and put in all efforts to contain the fire. As the incident was found to be of very high magnitude, the local officers informed the matter to the higher ups while continuing with their efforts to extinguish the fire. The Department also requested immediate investigation into the incident by the Police.

A. The Fire & Rescue Department reported that the following difficulties are faced by the Department.

1. Around 30 acres of the dumping yard is inaccessible to Fire fighting vehicles as there are no roads to these area of huge heaps around 32 feet high, just like hills having no road access.
2. There was difficulty in getting water for Fire fighting vehicles as the Hydrants were not found working and road access was not there to the nearby river. River banks were all inaccessible due to waste dumps.
3. There were no firefighting mechanisms in place as required, in the yard.
4. There was shortage of equipments and vehicles to deal with the unexpectedly huge fire.
5. There were also walls built at the riverside, so access to water was not at all there.

B. The Fire & Rescue Department demanded the following steps to be carried out on a war time footing to deal with the situation.

1. A 6 meter wide road to be developed upto the interiors of the yard to get access to the Fire fighting vehicles.
2. The waste dumps to be separated as 50 m^2 heaps with roads on all four sides.
3. Make platforms near Kadambrayar (river) at a distance of 30 meters intervals to facilitate pumping of water.
4. Bio-waste also is seen as dumps, so the spared of waste may become uncontrollable. There are soft portions in the heaps and the persons doing fire fighting are getting caught in such pockets which is very dangerous. In the circumstances more manpower to lift and turn the heaps are urgently required.

5. The District Collector was requested to evoke sections of Disaster Management Act in case any laxity is seen in carrying out all the above requests.

C. Instructions Given to Various Departments.

1. To give seamless flow of water 24 hours to enable uninterrupted fire extinguishing work.
2. To provide sufficient number of Canister masks and N 95 masks to Firemen and other workers.
3. To provide medical facilities as many Firemen were developing health issues due to heavy smoke emitting from the fire.

A decision was taken to have 24 hour deployment of Fire Force in the area. The department also communicated the difficulties being faced by public due to heavy smoke in the area, which is likely to continue.

D. In a nutshell, on receipt of Fire call No: 115/2023 at Thrikkakkara Fire Station, from a person named Rashiq, Senior Fire & Rescue officer P.K. Prasad and team reached the spot with a fire tender and started the effort to extinguish fire; however as they found it uncontrollable, due to strong winds, Prasad informed the same to Station Officer Satheesan. He was attending a meeting at the Collectorate. He immediately started with crew and equipments like Pressure pump etc., seeing the very heavy smoke while approaching the spot, he estimated the hugeness of the task and asked for Fire crew from Thrippunithura, Eloor and Pattimattom Fire Stations. Knowing about the seriousness of the situation, District Fire Officer Harikumar and Regional Fire Officer Sujith Kumar also immediately rushed to the spot with more teams. They somehow controlled the fire. But due to heavy winds in the night, fire became uncontrollable again. The matter was informed to the Headquarters and more Fire Units and even District Fire Officers and Regional Fire Officers, from other Districts/ regions were summoned.

E. The Reason for Spreading of Fire

The waste disposal plant at Brahmapuram is spread over an area of 110 acres at the dumping yard site. Eastern side of the plant is a high plane. The western side lies low. While the Fire crew reached the spot, flames at the western side was around 8 feet high. Wind was strongly flowing from south western side to the North-eastern side. The crisp and dry grass and bush surface caught fire and it spread all over. The wind direction was favourable for easy spread of fire. However there were 32 feet high plastic heaps nearby. As these plastic heaps had huge soft degraded materials in between and layers below this caught fire, the only possible way to control fire was to lift, turn and wet the heaps. Lifting was possible only through excavation. Proclaimers were needed for this task with technical operators. By about the third day of the fire, it was very clear to the Fire Force team

that they needed more number of proclaimers. The Corporation resources were utilised to procure them.

However by the 6th of March the District Fire Officer found that as the Proclaimers used to stop work during late night, the fire was again spreading from under the layers during wee hours in the morning and the entire area again used to be covered by fire and smoke. The Government also got involved in the affairs as there was serious issue in the city of Kochi due to toxic Smoke and celebrities, High Court Judges etc. started airing their grievances in the open. Many were fleeing from the city to other places.

There were periodical meetings held by the Chief Minister, Chief Secretary, Home, Revenue and Local Government Secretaries, Head of Fire Force, Police and the Disaster Management Authority members. In some of the meetings, experts from Scientific Institutions, Cochin University, and a Fire Force Chief from the U.S etc. participated. In all such meetings, ground level officers (Regional Fire Officer/ District Fire Officer) also attended online. The Head of Fire Force was much convinced that 'Lift, Turn, and Wet 'method is the only feasible method. Use of chemical powder was not at all advisable due to technical reasons and also due to the threat of water pollution into the nearly river. This was conveyed to the Government by the Head of Fire Force. The Fire Force team and Member Secretary, Disaster Management Authority had gone through all the available literature on similar fires. This only reiterated their conviction about the methodology.

The Government was requested to make Proclaimers available during night time also along with operators in shifts. Various Quarry owners were contacted by Ministers etc. and this was made available. The presence of Proclaimers with Operators in shifts was a game changer. This increased the confidence of the Fire Force team.

F. The Fire Extinguishing Technique & Methodology

The burning waste materials were deeply excavated and water using pressure pumps were sprinkled over, till the fire was completely extinguished. For the propose, the area was divided into 7 sectors. Each area was made under the command and control of a sector officer. Towards the farthest sectors, i.e., sector 6 and 7, water was lifted from a nearby temple pond using water tender and water lorry. Water was made available in the sectors 1 to 5 from the nearby Kadambrayar using high pressure pumps made available by that time. Through water relay, fire fighting was done. By the 5th day Fire Force officers and vehicles from throughout the length

and breadth of the State were commandeered to Brahmapuram and they were used by turn. Civil Defence Volunteers were also summoned and they diligently associated with the Fire Force team in the fire fighting process. It may be noticed that these volunteers worked without any remuneration of even a single Rupee. Generally during disasters like floods or accidents, à large number of general public come and volunteer to work with the Rescue team. However due to the extremely adverse conditions with highly toxic fumes causing breathing difficulties, no general public came to do any voluntary work. Some of the officers fell extremely sick and they had to be taken to hospitals. However the leaders like the Station Officer Thrikkakkara, Shri.Satheesan, Regional Fire Officer Shri.Sujith and many others, did not go away from the scene even for a single day inspite of many health issues. The District Disaster Management Authority members, the District Collector etc. also came and gave leadership and assessed the situation. Government and the Department Head ensured all support, technical assistance and moral support.

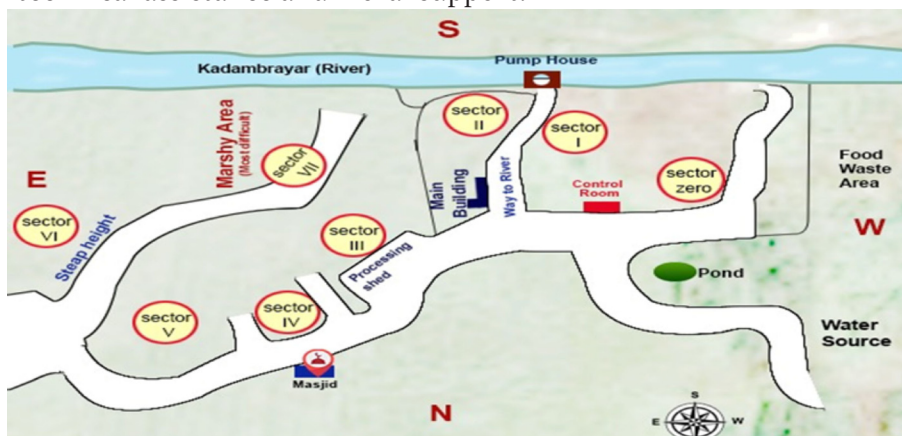


Fig.1: Various sectors of Brahmapuram for extinguishing the landfill fire

G. *Major Challenges*

1. The first challenge was that water was not readily available. The nearby source of water was Kadambrayar (river). The only electric pump available in the plant was not having any electric connection. Diesel generator was also unavailable.
2. The water surface was fully covered with thick water weeds, so it was not possible to lift water. On fourth day, water proclaimers were brought and the water weeds were removed under the leadership of Fire Force officers and then excavation was done. Earth and sand in the river was removed from the river bed.

3. The High Pressure pump was made use of and hydrants were charged

H. Strengths

1. Presence of a water body nearby (Kadambrayar)
2. Five High Pressure pumps were available with the Department (800 LPM output). Continuous pumping of water from the river was made possible.
3. Presence of Proclaimers with operators made available in shifts for 24 hours
4. Presence of Civil Defence Volunteers, Some of them were as good as trained Fire Force officers.
5. With team work with top class coordination from top to bottom, the fire was put out completely on 13.03.2023 by 17.30 hours.
6. ***Bottom up planning:*** The ground level officers were given confidence by the higher echelons. Nothing was thrust upon them from the top.

5. Recommendations for future

The following recommendations were given by the Fire & Rescue Department to the concerned.

1. ***Kochi Corporation:*** Bio mining of non-bio-waste at the earliest, ensuring recycling of plastic waste and removal of electronic waste etc. The 10 per cent. residues left after recycling (High Density Polyethylene) may be deposited after making deep mines and these may be covered by earth.
2. The waste has to be divided into clusters. Each cluster has to be limited to a maximum of 750 m^2.
3. A 7 meter wide road has to be left around the clusters for smooth approach by Fire fighting vehicles.
4. A minimum of 8 security personnel may deployed to patrol the area during day and night.
5. CCTV Camera shall be installed to cover the entire area.
6. The personnel deployed at the place may be trained in preliminary fire fighting to operate the fire fighting equipments (to be installed) at the plant.
7. Apart from fire fighting equipments, at both sides of the clusters, Twin Hydrant Outlets with 360° rotation power need to be installed.
8. Around the plant, Ring Main System has to be installed.
9. At the Kadambrayar (river) at 30 meter distance each, platform for facilitating fire fighting may be constructed.

10. Fire pump room has to be installed with
    - Electric Pump Capacity – 2850 LPM
    - Standby Diesel pump - 2850 LPM
11. Near the main gate of the plant, an open water source with a minimum of 2 lakh litre capacity need to be installed and with the 800 LPM pump, water may be pumped from the river.

6. Mission Safe Breath

The Fire & Rescue Services Department named the entire Operation as `Mission Safe Breath'. Indian Navy, Bharath Petroleum Corporation, Cochin Port Trust, Kochi International Airport and LNG Terminal Fire Units extended their limited available support to the Fire & Rescue Home Guards & Civil Defence. The elected representatives of local bodies, MLAs other people's representating and Kochi Corporation and other stakeholder Departments extended their cooperation to the mission. While the Operation ended successfully on 13-3-2023 around 05.30 PM, it was a great relief to the Fire & Rescue Department and other Stakeholders, especially the people of Kochi. Schools and offices remained closed from 06.03.2023 to 15.03.2023 dates.

7. Health Hazards

Breathing toxic gases and contact with waste materials and continuous exposure to the highly polluted environment for several days together affected the health including the mental health of many personnel. The Head of Fire & Rescue Department documented the list of all exposed officers. A request was placed to the Health Department to do immediate medical checkups and continuous treatment and periodical medical checkups to all the exposed persons including the Proclainer Operators.

The Pulmonologist's Association (The Kochi Thoracic Society) Kerala extended their help and arranged a medical checkup. Lungs function tests were conducted. Deep divers showed the best lung capacity inspite of full exposure (probably their training helped them to maintain it) Major structural damages to the lungs were not found, while follow up medical checkup was done in September 2023. Skin and eye irritations were continuing for some of the personnel. Further checkups would continue.

8. Lessons Learnt

As the waste management plant will be there for many more years, we have to expect similar occurrences every year. There shall be strategic planning for fast and effective response and rescue operations. Effective coordination

among different departments will give better results. Normally the Fire and Rescue Services will respond first and Revenue and Corporation will arrange heavy duty equipment and food. Segregation of the waste and dividing the yard in to different sectors without inter connection will prevent spread of fire. Fire water storage, fire pumps and fixed monitors shall be there for effective fire-fighting round the clock As the human resource is very limited for Fire and Rescue Services, participation of Civil Defence Volunteers is very important for the effectiveness of such operations Non-availability of Personal Protective Equipment (Respirators) was one of the problems faced by Fire and Rescue Personnel during the initial days. Availability of such Personal Protective Equipment shall be ensured.

9. Scope for Further Study and limitations of the study

Brahmapuram Disaster Management provides the scholars with opportunities to explore in the field of waste management. New methods of waste segregation, methods to segregate and stalk waste, processing of waste without any environmental implication, effect of the smoke and fumes from such fire in the environment, possibility of water in the surrounding area to get polluted, effectiveness of using water or foam in such situations, its environmental implications, possibility of using some other fire fighting media, etc. may be explored.

The study is based on data and informations collected from the Fire and rescue Services Department. A wholistic study of Kochi City waste Management was not undertaken.

10. Conclusion

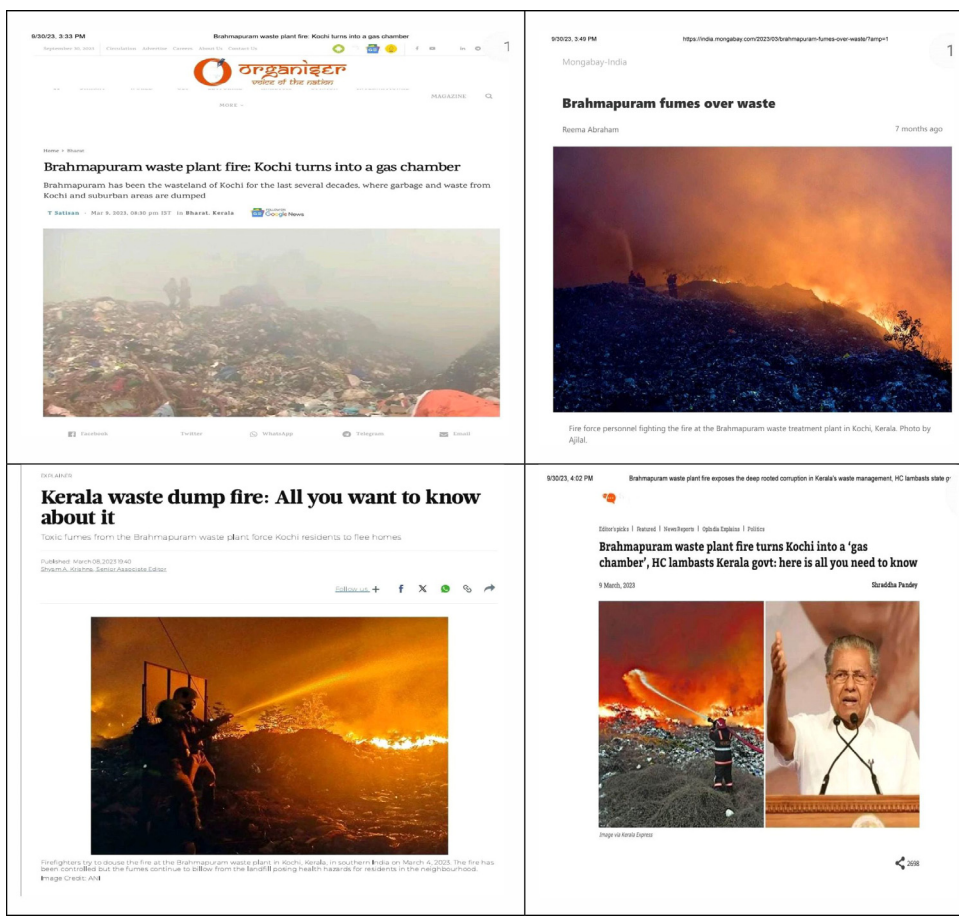
Within 12 days a massive fire at the waste dumping yard situated at Brahmapuram, where most of the city waste of Kochi are dumped was extinguished by the Fire and Rescue Service Department of Kerala. This incident is one of the major Disaster Management Tasks carried out in Kerala. 'Lift, Turn and Wet Methodology was used to extinguish the fire using water. Coordinated efforts by various Departments and especially the technical expertise and hard work of Fire Force personnel along with Civil Defence volunteers made it possible. The type of waste and nature of its combustibility may change. Hence improving the dumping yard and waste management technologies and segregation of waste and accessibility to each point in the plant are required to avoid major disasters in future. Fire fighting system has to be in place at a war footing to avoid major fires.

When many countries fail to extinguish fire in landfills even after months, it took only 12 days to extinguish the fire at Brahmapuram totally. Every

time we cannot expect that Fire and Rescue services will somehow manage to extinguish the fire within few days. The inter-departmental coordination, Government support, close monitoring and involvement of all stake holders made it possible. The type of waste and its combustibility nature may change. It may not be possible even to stand near the vicinity of such fires and fumes in future. We have to plan for new strategies for waste management and to prevent fire in such landfills. The plans prepared for the fire fighting system in such waste dumping yards shall be implemented immediately. Research into methods of waste disposal and dumping yard fires and effect of such fires on the health of exposed populations and fire fighters may be encouraged.

Appreciations, Media Reports

The Citizens of Kochi gave a belittling appreciation to the Rescue team members. Justice Devan Ramachandran who had appreciated the operation (Wide Order-WP(C) No. 7844/2023 dated 14.03.2023) also was present during the function.



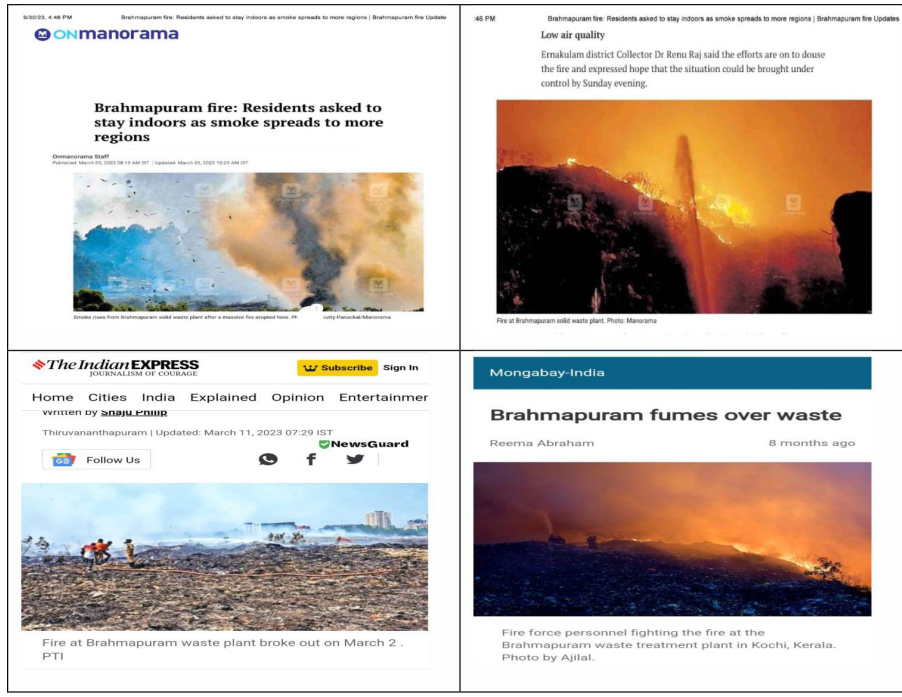


Table 1: List of personal/ Stakeholders Involved

Total no of Fire Force Personnel deployed	1548
Civil Defence Volunteers	423
Proclaimer Operators	40
Municipal Corporation workers	100
Navy	22
Cochin Port Trust	6
Bharath Petroleum Corporation	6
Cochin International Airport	6

Table 2: List of equipments procured form various agencies

Fire Force	High Pressure Pump(800 Lpm)-5
	Fire tender Vehicles- 40
Indian Navy	Fire tender Vehicle- 1
	Helicopter - 1
Kochi International Airport	Fire tender Vehicle-1
LNG Terminal	Fire tender Vehicle-1
Bharath Petroleum Corporation	Fire tender Vehicle-1
Cochin Port Trust	Fire tender Vehicle-1
Private Proclaimers	40

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Irshalwadi Landslide Disaster: Gaps Identified & Lessons Learned

Aashay Gune, Vaishali Mhaske, Appaso Dhulaj, IAS*

Abstract

This case study attempts to share some light on the landslide that led to loss of life and livelihood in Irshalwadi village in the Raigad district of Maharashtra. The authors of this case study have attempted to gather details of this incident and have tried to ensure that the lessons learned will help us in becoming better prepared and save lives in case a comparable situation arises.

Key words: *Irshalwadi, landslide, disaster management*

1. Introduction

On July 19, 2023, more than a hundred villagers belonging to the Irshalwadi village in Maharashtra's Raigad district lost their lives under the debris resulting from a massive landslide. This work strives to get a deeper understanding of the preparedness and mitigation measures implemented by the concerned authorities and to recommend areas for future improvement.

This work is consistent with the PM's 10-point agenda (Agenda No. 9) which states, "Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster". As per the spirit of PM's 10-Point Agenda, following the tragedy, the Department has initiated a brief study of the event to identify any gaps and document the most important takeaways that can be applied to future preparedness, response, and mitigation plans as well as for better risk governance across the state which are in line with Sendai Framework Priority 4 - Enhancing Disaster Preparedness and Priority 2 - Strengthening Disaster Risk Governance to Manage Disaster Risk.

Both secondary and primary data have been referred to in this lesson-learned study. For the primary information, the Tehsildar of Khalapur, Shri Ayub Tamboli, was consulted, and for the secondary information, several reliable press reports and writings were used

2. The Irshalwadi landslide incident

On 19th July 2023, around 11 pm, a landslide brought down the Irshalwadi village, which lay in the Sahyadri mountain ranges in the Khalapur tehsil of Raigad district, most notably near the Irshalgad fort. Irshalwadi was a hilly

village (small hamlet with a population of 219 people and 112 livestock) in Raigad district of Maharashtra. It was located 3,700 feet (1,128 meters) above sea level (latitude 18° 55' 58.9'and longitude 73°14' 4.1'). The fort is located between Panvel, the nearest Municipal Corporation and Matheran, the well-known hill station, and a tourist destination. The average rainfall of the area is approximately 3150 mm with a temperature that can go as high as up to 50°C. Most of the houses in the village are kutcha houses (49 approx.) with seven cattle sheds. Irshalwadi was occupied by the Thakars, a tribal community, with agriculture as the primary occupation. Hikers and trekkers often scale these mountains to reach the Irshalgad fort, and villagers in Irshalwadi catered to these trekkers by offering them tea and snacks, a major source of income for the community. Being a small hamlet, Irshalwadi does not have sufficient basic infrastructure including proper road facilities, electricity supply and Anganwadi. No elected representation from the hamlet to the gram panchayat meant the village remained with limited access to basic infrastructure. Additionally, many families earned a livelihood by selling vegetables in the Panvel market or working there as laborers. A few among them also worked at Alibaug, the district capital.

The impact of the landslide was severe as the village lay at around 1200 meters above sea level, and out of the 228 village inhabitants, residing in 49 households, only 142 could survive. Out of 49 Kuccha households, 32 houses were completely damaged while 17 were partially damaged. Owing to severe rainfall for four consecutive days before the incident, which continued for two days even after the landslide, the Khalapur tehsil administration had anticipated the possibility of a landslide. Moreover, people in nearby villages were reporting rainfall-related incidents and asking for help, contributing to making the administration proactive. However, as Irshalwadi was not marked in the list of vulnerable villages shared by the Geological Survey of India, the administration did not anticipate it as a location for the disaster.

Based on the weather alerts received from the State EOC and IMD, the district administration had taken necessary action at the district level, which included declaring a public holiday on 19th July 2023. Weather alert advisory was also disseminated through the media. The rainfall received between 14th July to 24th July period at Chowk Revenue Circle is represented in the below graph.

The Irshalwadi locals reported the landslide incident to the district authorities at 11:20 pm. The Tehsildar control room responded quickly by reaching the location by 11:30 pm, almost half an hour after its occurrence. And by midnight, they could reach the top of the debris and commence the rescue operations. The

Khalapur taluka administration was quick to respond, with the SDM reaching out to the district and state-level officials, and the Tehsildar managing the ground-level operations.

The Tehsildar established contact with the public works department, police department, ground-level NGOs and doctors. Such a segregation of responsibilities ensured operational efficiency with four ambulances reaching the site of action in quick time. It also ensured that telephone calls and messages related to administrative matters were directed to the SDM, and the Tehsildar could efficiently address the operational queries.

Around 11:30 pm, the district administration asked the State EOC to provide support in the search & rescue operations. At 12:57 am, the State EOC asked NDRF to deploy their team for the rescue operation, to which the NDRF responded by assigning two teams at 1:11 am. Meantime, the local team had rescued six people. The NDRF team reached the location at 4:33 am. As heavy rains posed a challenge to the airlifting operations, the NDRF team, along with a local team, commenced the rescue operations on the ground. They were joined by the police department, a team of 100 NDRF, 25 TDRF, local NGOs, active citizens, and *Aapada Mitras*. HAM radio station was set up to ensure efficient communication.

Rescue operations involving helicopters were also attempted, but challenging weather conditions constantly created roadblocks. Consequently, National Disaster Relief Force (NDRF) suspended the search operations four days after the incident, with 29 bodies recovered, but 57 declared missing. The Irshalwadi landslide incident follows the two similar major events in Maharashtra in the last ten years, namely Malin village landslide (District: Pune, July 30, 2014) and the Taliye village landslide (District: Raigad, July 22, 2021).

3. Relief and Rehabilitation

The administration has built shelter homes at Chowk village for those rescued from the disaster site. Every rescued family has been provided with a container home with facilities that include access to electricity, tap water and round-the-clock medical facilities. Additionally, an Anganwadi center has been built for children so that their learning and nutritional needs are not discontinued.

4. Gaps Identified

- Three sites in the Khalapur tehsil find their name in the Geological Survey of India (GSI)'s list of landslide-prone villages, and Tehsil authorities have been arranging temporary shelters for evacuating its residents as preparedness measures for a landslide disaster. As Irshalwadi was not in the list of landslide-

prone areas, there was no advanced evacuation as the administration did not associate it with a landslide. Updating the GSI's list by conducting a new mapping exercise for the region is recommended to ensure enhancement in the preparedness measures before the onset of the rainfall next year.

- The Tehsil administration often experience frequent interruptions from the common people in their rescue operations. These interruptions range from clicking selfies at the location, shooting videos to constantly asking questions to the rescue officers. There are times when people assemble in large numbers leading to chaos and confusion. The Tehsildar recommends empowering Tehsil-level officers to take strict action against people who obstruct the officers performing their duty during such disasters. The area under operation should be immediately cordoned off, and only a few important people should be allowed at the site of action.
- While there are community settlements in the Sahyadri mountain ranges, there are no Pucca roads in many places, thus creating challenges in rescue operations, especially during unfavourable weather conditions. As candid feedback, the Tehsildar, Khalapur tehsil, shared that pucca roads should be made in every mountainous region in consultation with the Forest department so that rescue operations can be conducted seamlessly.
- Surviving community members saw mudslides in some locations but as they were not sensitized about these early warning signs for a landslide, they failed to understand its severity. Lack of awareness within the community about these indicators has also resulted in massive loss of human life.

5. Lessons Learned

- For many years, July has been the wettest month of the year in Maharashtra. According to the Indian Meteorological Department, Raigad received close to 67% of the average annual rainfall up till July 26. Throughout the month, it was either in the red zone or the orange zone. Anticipating heavy rainfall in July, preparatory measures to avoid the potential risks due to heavy rains and thunderstorms should begin well in advance, preferably in May and June.
- Irshalwadi is situated at a height of about 1100 meters above the sea level. The emergency rescue team found it difficult to reach the affected area as most of the roads in the area were kutcha roads, thereby posing multiple challenges to the rescue and relief operations. With the permission of the forest department, Kutcha roads could be upgraded to Pucca roads to facilitate effective emergency response, rescue, and relief operations.
- Strict regulations should be put in place by the government authorities to

ensure that no new settlements crop up in the hilly areas, as they would lead to farming or livelihood-related activities and affect the forestation. Moreover, in addition to damaging the ecosystem, it is difficult to approach these settlements in case of an emergency.

- Irshalwadi was never included on the list of the Western Ghats' landslide-prone sites according to data from the Geological Survey of India. In recent years, climate change has contributed to an increase in the risk (existing and emerging) of hydro-met hazards (erratic rainfall) and resulting geological hazards (rain-induced landslides). Therefore, Hazard, Risk, and Vulnerability mapping of the area should be made a regular practice by the state so that the newly identified risk-prone areas can be brought to the attention of the relevant authorities and appropriate preparedness and mitigation measures can be taken at the taluka, district, and state levels.
- According to Dr Satish Thigale, former head of the geology department, Pune University, cracks in the mountain surface, tilting of trees and mud flowing along with water are prominent indicators of a landslide. The local administration usually pays a visit to villages which are mapped by the Geological Survey of India as landslide prone. From this experience, we learn that the administration should monitor the indicators of a landslide in every village, irrespective of whether they are mapped by the GSI. The department should undertake a comprehensive landslide hazard risk and vulnerability mapping exercise in the hilly regions of the state.
- Several NGOs and voluntary organizations promptly offer food, shelter, and medical care to the affected populace. However, because they lack specialized training in emergency rescue, their involvement is restricted to offering relief. According to the Tehsildar, NGOs could be utilized more effectively if the government equips them with the right Search and Rescue equipment and gives them the necessary training. A group of volunteers could also be established. As far as the Khalapur tehsil is concerned, there are active NGOs who help when there are vehicle collisions on the Mumbai-Pune Expressway. Training of NGOs, community-based organizations, and community volunteers like Aapada Mitras in relevant rescue techniques is critical. Identification of landslide hotspots and ensuring availability of heavy equipment to the local administration will help us mitigate the impact of landslides to a greater extent.

पुढारी

इर्शाळवाडीवर दु:खाचा कडा कोसळला

१६ ठार; २३ जखमी, ९८ बेपत्ता, १०२ जण वाचले

खोपोली : प्रशांत गोपाळे

बुधवारी मध्यरात्री ११ वाजताच्या सुमारास खालापूर तालुक्यातील इर्शाळगड वाडीवर दु:खाचा डोंगर कोसळून १६ मृत्यूमुखी तर ९८ जण बेपत्ता झाले आहे. ६ जण गंभीर जखमी झाले असून त्यांच्यावर पनवेलच्या एमजीएम रुग्णालयात उपचार सुरू आहे. एका रात्रीत इर्शाळगड वाडीत होत्याचे नव्हते झाले. एकुण ६० घरांपैकी ४८ घरांवर दरड कोसळली तर १२ घरे अंशत: बचावली आहेत. १०२ लोक डोंगरकड्याचा आवाज आल्याने जिव मुठीत घेवून धावत सुटली तेवढीच बचावली आहे. तर मदतीला आलेला अग्नीशमक दलाच्या जवानाचा हृदयविकाराच्या झटक्याने मृत्यू झाला. नातेवाईकांचा टाहो फोडणारे आवाज आणी दरडी खाली सापडले शेकडोजण त्यामुळे येथील वातावरण शोकाकूल होते.

दोन वर्षापूर्वी २३ जुलै २०२१ च्या मध्यरात्री अशीच दुर्घटना महाड तालुक्यातील तळिये गावात घडली होती. यावेळी ढिगाऱ्याखाली ४० घरे सापडून ८४ जणांचा मृत्यू झाला होता. याच घटनेची पुनरावृत्ती दोन वर्षांनी खालापूर तालुक्यातील इर्शाळवाडी गावात झाली आहे. खालापूर तालुक्यात इर्शाळगडाच्या पायथ्याशी तीन किलोमीटरवर ही वाडी आहे. ही वाडी चौक गावातील मुख्य रस्त्यापासून सहा किलोमीटर उंच डोंगरात आहे. इथे जाण्यासाठी रस्ता नाही केवळ डोंगरातील पाऊलवाट आहे. मोरबे धरणाच्या वरच्या बाजूला असलेल्या पान २ वर ▶

प्रचंड पावसामुळे घडली दुर्घटना

खालापूरात सोमवार आणि मंगळवार दोन दिवसात ४४४ मिलिमिटर एवढा तुफान पाऊस झाल्यानंतर बुधवारी संध्याकाळी पाच वाजेपर्यंत ९७ मिमी पाऊस पडला होता. जवळपास ५४१ एवढी पर्जन्यवृष्टीमुळे इरसालगडाच्या माथ्यावरचा काही भाग इर्शाळवाडीच्या घरांवर कोसळला. जवळपास ४८ घरे या ठिकाणी असून अडीचशे पेक्षा जास्त लोक वस्ती आहे. गडाचा कडा कोसळल्याचा आवाजाने अनेकाने घराबाहेर पळ काढला. तर झोपेत असलेल्या अनेक कुटूंब काही कळायचे आत मातीच्या ढिगाऱ्याखाली गाडले गेले. घटनेची माहितीवाडीतील मंदिरात बसलेल्या काही तरुणांनी चौक गावात दिल्यानंतर प्रशासन तातडीने कामाला लागले. खालापूर तहसीलदार आयुब तांबोळी यांनी सर्व यंत्रणांना सुचना देत घटनास्थळी धाव घेतली.

जखमी इसमांची नावे

प्रविण पांडुरंग पारधी,(वय: २१वर्षे)
यशवंत राघो डोरे, (वय: ३७ वर्षे)
भगवान हरी भवर,(वय: २५वर्षे)
मनिषा यशवंत, (डोरे, वय: ३५)
वर्षे रामी रामु पारधी,(वय: ७७ वर्षे)
कमली महादु पारधी,(वय: ५० वर्षे)

मृतांची नावे

- रमेश हरी भवर, (वय: २६ वर्षे)
- जयश्री रमेश भवर, (वय: २२ वर्षे)
- रूद्रा रमेश भवर, (वय: १ वर्षे)
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- सुदाम तुकाराम पारधी, (वय: १८वर्षे)
- दामा भवर, (वय: ४०वर्षे)
- चंद्रकांत किसन वाघ,(वय : १८ वर्षे)
- राधी रामा भवर, (वय: ३७ वर्षे)
- बाळी नामा भुतांब्रा,(वय: ७० वर्षे)
- भास्कर बाळू पारधी (वय: २६)
- जयश्री भास्कर पारधी (वय: २०)
- अन्वी भास्कर पारधी (वय:६ महिने)

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महाराष्ट्र टाइम्स
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वर्ष : ६२ । अंक : १७१

इर्शाळवाडीवर मृत्यूची दरड

खालापूर तालुक्यातील आदिवासी वाडी होत्याची नव्हती ■ १६ मृतदेह हाती, ५०-६० जण बेपत्ता

बुधवारी रात्री साडेअकराच्या सुमारास घडली दुर्घटना. इर्शाळवाडीतील अनेक जण झोपेतच असल्याने काही कळायच्या आतच काळाने घातला घाला. बचावाचीही संधी नाही.

स्थानिक नागरिक, पोलिस पथक, एनडीआरएफ, गिर्यारोहकांच्या संस्थांनी मातीचे ढिगारे उपसण्यासाठी केली प्रयत्नांची शर्थ. मृतदेह, जखमींना पायथ्याशी आणताना अनेक अडचणी.

जागत्या-नांदत्या वाडीत घडलेल्या दुर्घटनेने पसरली शोककळा. आप्त, नातेवाईक गमावल्याने वातावरण शोकाकुल. बेपत्ता झालेल्यांचा शोध घेताना सारेच व्याकूळ.

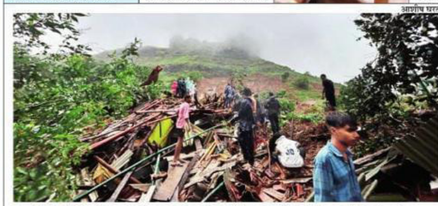
मदतकार्य करता करता दिवसअखेर मृतांचा आकडा पोहोचला १६वर. पाऊस, अंधार यामुळे संध्याकाळनंतर थांबवण्यात आले बचाव व मदतकार्य. आज पुन्हा सुरू होणार बचावकार्य.

म. टा. वृत्तसेवा, उरण/पनवेल/अलिबाग

दरड कोसळल्याने उद्ध्वस्त झालेल्या पुणे जिल्ह्यातील माळीण आणि महाडमधील तळीये या गावांच्या वेदनादायी आठवणी ताज्या करणारी दुर्दैवी घटना बुधवारी रात्री रायगड जिल्ह्यातील इर्शाळवाडी या आदिवासी वाडीत घडली. खालापूर तालुक्यातील इर्शाळगडाच्या पायथ्याशी असलेल्या या वस्तीवर दरड कोसळून सुमारे ३५ ते ४० घरे दरडीच्या ढिगाऱ्याखाली गाडली गेली. मध्यरात्रीची वेळ असल्यामुळे झोपेत असलेले हे गाव अक्षरशः होत्याचे नव्हते झाले. ४८ कुटुंबांतील २२९ आदिवासी या गावात राहत होते. यापैकी काहींनी यातून कसाबसा जीव वाचवला, परंतु शेकडो आदिवासी या मातीच्या ढिगाऱ्याखाली अडकून पडले होते. अवघ्या काही तासांमध्ये अत्यंत जलगतीने बचाव पथके घटनास्थळी पोहोचल्यामुळे गुरुवारी रात्री उशिरापर्यंत १०३ जणांची ढिगाऱ्याखालून जखमी अवस्थेत सुटका करण्यात आली. परंतु १६ जणांचा या घटनेमध्ये मृत्यू झाला. तर, बचावकार्यासाठी निघालेल्या नवी मुंबई अग्निशमन दलातील एक अधिकारी हृदयविकाराच्या झटक्याने मृत्युमुखी पडला. गुरुवारी सकाळी घटनास्थळी पोहोचलेले मुख्यमंत्री एकनाथ शिंदे यांनी दिवसभर तिथेच थांबून बचावकार्यावर देखरेख केली. काही मंत्री आणि विरोधी पक्षांतील नेत्यांनीही घटनास्थळी धाव घेतली. दरम्यान, मृतांच्या वारसांना प्रत्येकी पाच लाख रुपये मदत केली जाईल, अशी घोषणा उपमुख्यमंत्री अजित पवार यांनी विधान परिषदेत केली.

निद्रावस्थेत असताना कोसळले संकट...१०
सविस्तर बातम्या...२, ३

आशीष घरत



बुधवारी रात्रीच्या मिट्ट काळोखात दरड कोसळल्यानंतर गुरुवारी सकाळी दिसू लागली ती अशी उद्ध्वस्त झालेली इर्शाळवाडी...

'दरडग्रस्तांचे कायमस्वरूपी पुनर्वसन करणार'

'इर्शाळवाडी दुर्घटनेतील आदिवासींचे बचावकार्य करणे व वाचलेल्यांना सुरक्षित स्थळी हलवणे यास प्रथम प्राधान्य दिले जात आहे. या वाडीतील लोकांचे कायमस्वरूपी पुनर्वसन करण्यासंदर्भात विभागीय आयुक्त व जिल्हाधिकारी यांच्याबरोबर चर्चा केली आहे', असे घटनास्थळी पोहोचून बचावकार्याचे नेतृत्व करणारे मुख्यमंत्री एकनाथ शिंदे यांनी स्पष्ट केले. बचावकार्यात येणाऱ्या अडथळ्यांबद्दल बोलताना मुख्यमंत्री म्हणाले, 'सतत पाऊस होत असल्याने बचावकार्यात अडथळे येत आहेत. दोन हेलिकॉप्टर तैनात केली होती. परंतु खराब हवामानामुळे ती येथे पोहोचू शकली नाहीत.'

माधव गाडगीळ यांचे सरकारकडे बोट

पुणे : 'पश्चिम घाट जैवविविधता तज्ज्ञ समितीचा अहवाल सरकारला सादर करून काळ लोटला; पण योग्य वेळेत मंजुरी आणि त्याची अंमलबजावणी झाली असती; तर निश्चित काही घटना टाळता आल्या असत्या. लोकांचेही प्राण वाचले असते', असे निरीक्षण ज्येष्ठ पर्यावरणशास्त्रज्ञ माधव गाडगीळ यांनी गुरुवारी नोंदवले. 'सह्याद्रीच्या भौगोलिक रचनांचा अभ्यास न करता, शास्त्रज्ञांच्या मार्गदर्शनाशिवाय व लोकसहभागाशिवाय जोपर्यंत अशी कामे होत राहणार तोपर्यंत दुर्घटनांचे प्रमाण वाढतच राहणार आहे', असे भाकीतही त्यांनी वर्तवले. ➤ वृत्त...२

पुन्हा संकटाच्या खाईत

अलिबाग : सन २०१९मध्ये निसर्गाने दिलेल्या दुर्घटनेच्या इशाऱ्यामुळे येथील अनेक आदिवासी कुटुंबांनी पावसाळ्यात आदिवासी वाडीतील घरे सोडून डोंगराखाली जाऊन राहण्याचा विचार केला होता. पण, वन विभागाने त्यांच्या झोपड्या पाडल्या व त्यांना पुन्हा इर्शाळवाडीचाच आसरा घ्यावा लागला. पावसाळा संपेपर्यंत वन जमिनीवर आदिवासींना राहू दिले असते, तर आज अनेकांचे प्राण वाचले असते, असे बोलले जात आहे. ➤ वृत्त...२

अग्निशमन अधिकाऱ्याचा मृत्यू

नवी मुंबई : इर्शाळवाडी येथे बचावकार्य करण्यासाठी जात असतानाच हृदयविकाराचा झटका आल्याने नवी मुंबई महानगरपालिका अग्निशमन दलातील सहाय्यक केंद्र अधिकारी शिवराम यशवंत ढुमणे (५८) यांचे गुरुवारी निधन झाले. हा भाग अत्यंत दुर्गम असल्याने साहित्यासह पथकांमधील जवानांना पायीच चालत जावे लागत होते. यावेळी ढुमणे यांना हृदयविकाराचा झटका आला व त्यांचे निधन झाले. ➤ वृत्त...२

कोकणात ५६६ दरडप्रवण क्षेत्रे

चिपळूण : कोकणात महाड तालुक्यात दोन वर्षांपूर्वी झालेल्या तळीये गावच्या आठवणी पुन्हा एकदा जागा झाल्या. कोकणात दरडीचा धोका असलेल्या गावांची संख्या मोठी असून, ५६६ ठिकाणे दरडप्रवण क्षेत्राच्या यादीत आहेत. दरडप्रवण क्षेत्राच्या यादीत इर्शाळवाडी गावाचा समावेशच नव्हता. दरडप्रवण क्षेत्रात असलेल्या गावांचा व वाड्यांचा आकडा रायगड जिल्ह्यात ४२० आहे. रत्नागिरी जिल्ह्यातील १२६ ठिकाणांचा पण समावेश आहे. ➤ वृत्त...२

गाडगीळ अहवालाचे काय?

मुंबई : ११ संवेदन जिल्ह्यातील नागरिकांचे पुनर्वसन करणार का? गाडगीळ समितीच्या अहवालाच्या अंमलबजावणीचे काय झाले, अशा प्रश्नांची सरबत्ती विरोधकांकडून सरकारवर विधानसभेत करण्यात आली. डोंगरावर, पायथ्याशी असणाऱ्या गावांची काळजी घेण्याची सूचनाही यावेळी करण्यात आली. तर, 'सरकारने गाडगीळ समितीच्या अहवालानुसार संवेदनशील गावांचे मॅपिंग केले आहे', अशी माहिती फडणवीस यांनी सभागृहाला दिली. ➤ वृत्त...३

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अर्जुन कदम । सारिका सावंत । दिनेश सुतार
आपलं महानगर वृत्तसेवा

चौक /खोपोली/माथेरान : खालापूर तालुक्यातील इर्शाळवाडी दरड दुर्घटनेतील ६ जणांचे मृतदेह शुक्रवारी आढळून आले. त्यामुळे मृतांचा आकडा २२वर पोहचला आहे. दुर्घटनेच्या दुसऱ्या दिवशी सकाळी ८.३० वाजता सुरू झालेल्या शोधकार्यात प्रचंड पाऊस, दाट धुके आणि सोसाट्याचा वारा यामुळे कमालीचा व्यत्यय येत होता. वस्ती उंचावर असल्याने तसेच जाण्यासाठी योग्य रस्ता नसल्याने जेसीबी, पोकलेन, डम्पर यांसारखी यंत्रसामुग्री तेथपर्यंत पोहचू शकली नाही. याशिवाय खराब हवामानामुळे लष्कराच्या हेलिकॉप्टरचीही मदत घेणे शक्य होत नसल्याने केवळ फावड्यांच्या सहाय्याने १५ ते २० फूट उंच साचलेला चिखल आणि दगड हटविण्याचे काम सुरू आहे.

पान

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इर्शालगडाच्या पायथ्याशी असलेल्या इरसालवाडी आदिवासी पाड्यावर काळाची झडप; दरड कोसळल्याने शेकडो आदिवासी बांधव ढिगा-याखाली अडकले;

प्रशासनाने व सामाजिक संघटनांनी मदतीसाठी घेतली धाव !

नरेश जाधव / जिल्हा प्रतिनिधी:

खालापूर तालुक्यातील मोरबे धरणाच्या वरच्या बाजूस इर्शालगडाच्या पायथ्याशी असलेल्या आदिवासी ठाकूरवाडीवर काल रात्री 11: 00 ते 11: 30 वाजेच्या दरम्यान सतत सलतधार पडत असलेल्या पावसामुळे दरड कोसळली असून यामध्ये मोठ्या प्रमाणात जिवितहानी झाली असल्याची माहिती समोर येत आहे. तर रात्रीच्या सुमारास दरड कोसळल्याने मातीच्या ढिगाऱ्याखाली अडकलेल्या आतापर्यंत 16 जणांचे मृतदेह बाहेर काढण्यात यश आले. त्यामध्ये एक लहान बाळाचा देखील समावेश आहे. तर येथील लोकवस्तीची अंदाजे 200 ते 250 लोकसंख्या असून 100 ते 150 जण ढिगाऱ्याखाली असल्याची माहिती समोर येत आहे. ढिगाऱ्याखाली अडकलेल्यांना बाहेर काढण्यासाठी शर्थीचे प्रयत्न सुरू आहेत. त्यामध्ये जेष्ठ नागरिक यांसह महिला, पुरुष, वयोवृद्ध, तर लहान बालकांचा देखील समावेश आहे.

सविस्तर माहिती अशे की खालापूर तालुका हद्दीतील मोरबे धरणाच्या वरील बाजूस इर्शालगडच्या पायथ्याशी असलेली हे इर्शालगांव ठाकूर आदिवासी समाजाची अंदाजे 40 ते 50 घराची मोठ्या प्रमाणात वस्ती असून या गावाची लोकसंख्या अंदाजे दोनशे ते अडीचशेच्या दरम्यान असल्याची माहिती येथे उपस्थित असलेल्या नागरिकांकडून मिळाली. तर इथे ये जा करण्यासाठी नानिवळी गावच्या वरील बाजूने इर्शालगडावर व इर्शालगांव येथे जाण्यासाठी देखील ह्याच रस्त्याचा वापर करून डोंगरावर चढण्यासाठी पायी रस्ता असून खूप मोठ्या प्रमाणात चढ उताराचा सामना करीत इर्शालगांव व त्यानंतर गड असा रोजचा दैनंदिन प्रवास येथील श्र रहिवासी व पर्यटक याच मार्गांचा वापर करीत आहेत. पण काल रात्रीच्या सुमारास गावावर जी दरड कोसळून त्यामध्ये येथील नागरिक यांसह निष्पाप जीवांचा देखील बळी गेल्याची दुर्दैवी घटना घडली आहे. हे ऐकून साऱ्यांची मने सुन्न झाली. मागील काही दिवसांपासून रायगड जिल्ह्यासह अनेक तालुक्यात पावसाने मुसळधार लावल्याने अनेक भागात पाणी साचून काही ठिकाणी नदी, नाले यांना पूर आल्याचे देखील पहावयास मिळाले. तर काही ठिकाणी पूरपरिस्थिती निर्माण झाल्याने जनजीवन विस्कळीत झाले आहे. पण कालची घडलेली घटना ऐकून अनेक जणांच्या काळजाचा ठोका चुकला. तर कालची रात्र म्हणजे वै-याची रात्र असे म्हटले तर वावगे ठरणार नाही. का कुणास ठाऊक नियतीला काय मान्य होते ? डोंगरभाग, रात्रीची वेळ, काळाची झडप, अनेक जण गाढ झोपत असल्याने नियतीने गाढ झोपेतच त्यांचा घात केला आणि एका क्षणात होत्याचे नव्हते झाले. दरड कोसळली, दरडीखाली अनेक माणसे, मुलेबाळे व त्यांच्यासह मुकी जनावरे देखील कोणताही आवाज न करता कायमची गाढ झोपी गेली. जणू काही काळाने त्यांच्यावर झडपच घातली अन सर्व गांव शांत झाले. पण, या प्रसंगातून याच गावातील अंदाजे दहा ते बारा घरे सुरक्षित होती. तर काही मुले ही गावातच असलेल्या शाळेत बसून मोबाईल वर पपजी गेम खेळत होते. त्यांना दरड कोसळली हे माहीत पडताच त्यांनी त्यांच्या काही नातेवाईक यांना संपर्क साधला. मग इथून सर्व सूत्रे हलली. हळू हळू ही घडलेली गोष्ट सर्व ठिकाणी वाऱ्यासारखी पसरू लागली की इर्शालगांवावर दरड कोसळून सर्व गाव मातीच्या ढिगाऱ्याखाली अडकला. हा हा म्हणताच बातमी वाऱ्यासारखी पसरली. तर काही व्हॉटसअप ग्रुप वर देखील याचे अपडेट घर बसल्या सर्वांना मिळू लागले. अपघातग्रस्तांच्या मदतीसाठी या ग्रुपच्या माध्यमातून अपडेट मिळताच ज्यांना जसे जमेल तसतसे मदत कार्य करण्यास सुरुवात झाली. जिल्हाधिकारी कार्यालय टीम, अपघातग्रस्तांच्या मदतीसाठीचे गुरुनाथ साठेलकर व त्यांची संपूर्ण टीम, एनडीआरएफ टीम, टीडीआरएफ टीम, आपदा मित्र टीम, अनके रेस्क्यू टीम, अनेक सामाजिक संघटना टीम, प्रांताधिकारी, तहसीलदार व त्यांची संपूर्ण टीम, रायगड जिल्हा व कर्जत खालापूर तालुका पोलीस यंत्रणा, आदिवासी संघटना टीम, अनेक सामाजिक संघटना, राजकीय नेते, मंत्री, शासकीय यंत्रणा, जिल्हा आपत्ती व्यवस्थापन, यांसह नातेवाईक मंडळी यांच्या व्दारे मदत घेत संपूर्ण टीम ही घटनास्थळी म्हणजेच दरड कोसळलेल्या ठिकाणी पोहचत मदत कार्य सुरू झाले. पण रात्रीचा गर्द अंधार व मुसळधार पडत असलेल्या पावसामुळे पुढे काय करायचे ? कुठे असतील घरे व त्यामधील माणसे? कसे शोधणार ? कारण सगळीकडे अंधारच असल्याने काही गोष्टीचा अंदाज येत नसल्याने रात्रीचे मदत कार्य थांबवून सकाळी शोध मोहीम सुरू झाली. पाहाते तर काय दरड कोसळून जवळजवळ संपूर्ण डोंगराचा भागच कोसळल्याने या गावातील बहुतेक घरे व त्यामध्ये असलेली माणसे, मुलेबाळे व मुकी जनावरे ही या मातीच्या ढिगाऱ्याखाली सापडली असल्याचे कळताच मदत कार्य करण्यास सुरुवात झाली. अनेक ठिकाणी शोध सुरू झाला, उपस्थित टीम यांच्या माध्यमातून खोदकाम सुरू करून ढिगाऱ्या खालून खोदून मृतांना बाहेर काढण्यास सुरुवात झाली. तर उपस्थित नागरिक व रहिवाशी यांच्याकडून देखील सामाजिक संस्था व जवान यांनी माहिती घेत मृतदेहाचा शोध लावत खोदकाम करून ते बाहेर काढण्यासाठी प्रयत्न करण्यात आले अशून आतापर्यंत तेरा मृतदेह बाहेर काढले असून त्यांची योग्य ती चौकशी करून व तपासणी करून मृतदेह हे त्यांच्या हद्दीत दफन करण्यात येत आहेत. तर काही जखमी यांना त्वरित जागेवर उपचार करीत पुढील उपचारासाठी हलविण्यात आले असल्याची माहिती नागरिकांनी दिली. तर यामध्ये अंदाजे एकूण शंभर ते दीडशे लोक ढिगाऱ्याखाली अडकले असल्याची माहिती समोर येत आहे. तर त्यांना बाहेर काढण्याचे काम युद्धपातळीवर सुरू असुन अंधार झाल्याने शोधकार्य थांबविण्यात आले आहे.

Fig.1: Snapshots of various Media coverage of the incident

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