

Fire-Related Disaster Risk Reduction Approach for Crowd Management : A Case Study of Prayagraj Ardh Kumbh 2019

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ABSTRACT

The first step to make any disaster risk reduction plan for any crowded area, (such as any religious gathering or functions), is to identify and mitigate the condition that might have increased the cause of probable disaster. Prayagraj is one of the mega cities of Uttar Pradesh, having 8 tehsils having a population of 1,117,094. There are less comprehensive studies or statistical data that is available about the fire disaster emergency plans for the dense areas of Uttar Pradesh. Using the case study of Ardh Kumbh 2019, Prayagraj, this paper provides an approach to understand the system faults and the importance of development of a disaster risk reduction plan for metropolitan cities of Uttar Pradesh. It recommends the co-ordination between various stakeholders, infrastructure facilities and Rescue agencies as well as government institutions.

Keywords : Disaster Risk Reduction Plan and Terminologies, Prayagraj in Fire emergency, Mitigation, Preparedness, Prevention

I. INTRODUCTION

Uttar Pradesh has now become one of the most disaster prone states in the last decade or so. There are two kinds of disasters, Natural disaster and Man-made emergencies, like fire accident, flood, earth quake, chemical leakage, biological outbreak etc. The state has seen various disasters in the past decade and has prepared also for disaster management. The Allahabad Ardh Kumbh 2019 was a very good example of preparedness of fire services and other emergency responders for disaster risk reduction at crowded place. Kumbh Mela is a huge gathering of people at a particular place, at a particular time duration who found it a source of inspiration, knowledge and spiritual transformation. It is said that during this period the rivers turned into Amrit and so, several pilgrims from across the world visit the Kumbh Mela to bathe in the essence of purity, spirituality and immortality.

Kumbh Mela signifies the deeply rooted feeling of devotion and faith among millions of Pilgrims across different regions since eternity. The Kumbh Mela, 2019 at Prayagraj was set up over 3200 hectares around Sangam and transformed the area into the biggest ephemeral city of the world. When we talk about the DIVYA & BHAVYA KUMBH 2019, it was expected to be a great congregation inhabiting temporary structures like pandals, tent city etc. and that raised the need for an effective DISASTER MANAGEMENT PLAN so as to increase the coping capacity of people under area of study.

Disaster is explained as a serious disruption of the functioning of society, causing widespread losses which exceed the ability of the affected community to cope using their own resources. Disaster Management refers to the activities which attempt to integrate several interrelated components in an

orderly and coordinated manner. It is a dynamic process and involves stakeholders who work together to prevent, mitigate, prepare for, respond to, and recover from the effects of disaster. Disaster Management can be indicated through a figure given below :-



Figure 1: Disaster Risk Reduction Cycle

Building Blocks of Robust Disaster Risk Reduction Plan

Many research studies have been conducted in many parts of the world to minimize the impact and occurrence of these disasters. The objective is to mitigate the disasters in a systematic method to minimize the damage so that people could return back to their normal life as quickly as possible. Uttar Pradesh has now become one of the most disaster prone states in the last decade or so. The most important part of disaster risk reduction planning is to design face in term of careful structural design, Analysis and evaluation of factor that lead towards hazards. Construction and operation will allow predicting reasonable level of confidence, un-planned event that may create emergency. These considerations enable management to help in preparing an effective plan be based on indentifying the hazards techniques, prediction, and prevention, beside preparation to cope with it.

A detail analysis has to be made from the following view points

- Identification of hazards, risks, processes and operations
- Release scenario, consequences in terms of man-made hazard like physical hazard, heat hazard, fire hazard, radiation and intoxication
- Preparation of on-site and off-site plan, with respect to available resources, survey, feasible path to provide help and incorporate the damages
- Identification of vulnerable zones
- Identification of important facilities in vulnerable zones
- Requirement of various departments for coping with emergency situation.

II. METHODOLOGY FOR DISASTER RISK REDUCTION

Disasters have suddenly affected human life since our existence. In response to this, an individual or a community can have many approaches to decrease and reverse the harmful effects of these disasters. Modern disaster risk reduction terminology has to be defined with full range of disaster management and emergency planning. Comprehensive disaster risk reduction is based upon four distinct components:

1. Mitigation,
2. Preparedness,
3. Response
4. Recovery

Many developing countries are now slowly realizing the importance of beneficial disaster risk reduction and emergency planning and moving towards the safe and better approach to minimize the hazards of disasters. It has now been understood that community participation is one of the key factors for

implementation of a successful disaster risk reduction strategies. All of the above and other important parameters, which are to be defined below, should also be considered so that the damages could be kept to minimum.

Table 1: Factors for disaster risk reduction strategies

Sr No	Methodology	Parameters	Important Factors
1.	Safe Area Selection	Availability of open assembling areas nearby the disaster prone zone must be earmarked as a safe area.	(a) It is also one of the important factors that could minimize the impact of disaster in emergency situation.
2.	Optimum Path	In this step, after selecting a safe assembling area for each of the major hazards origins, identify an ideal safe lane so as to provide social infrastructure to the spotted vulnerable site.	(b) This ideal path should be designed with the help of computing tools and discussed and shared with the concerned decision making authorities to avoid a disturbing scenario.
3.	Emergency Care & Transport for the Injured	It is most neglected part while preparing the disaster management and emergency planning especially in case of metropolitan cities like Prayagraj.	(a) In Prayagraj there are few large government hospitals that are operating. (b) In case of an emergency almost all the medical care will be likely provided by them. (c) So robust planning for a medical facility is extremely important. (d) Taking medical experts on the board will help in order to build an effective disaster risk reduction plan for any town or city or any urbanized area.

III. FIRE DEPARTMENT PERSPECTIVE IN FIRE & DISASTER SAFETY

Uttar Pradesh Fire Services started functioning in 1944 with 8 Fire Stations and 198 Fire Service Personnel and presently it has 343 Fire Stations in 75 districts with more than 7730 Fire Service Personnel. Previously Uttar Pradesh Fire Services had 166 Fire Service Stations at the time of formation of the new state Uttaranchal. The Uttar Pradesh Fire Services is

presently equipped with more than one thousand Fire Engines and attends to fire incidents and fire related calamities. The motto of Uttar Pradesh Fire Services asserts “WE SERVE TO SAVE.” A translated idea of original motto in Sanskrit that is “TRANAY SEVA MAHE.”

Based on this motto there are three priority wise objective concepts.

- Primary Objective: SAVING LIFE.
- Secondary Objective: SAVE National and Public PROPERTY.
- Tertiary Objective: Salvage and Preservation.

Table 2 : Primary, Secondary & Tertiary Objective of Fire Department

Sr No	Objectives	Action Plan
1	Primary	<ol style="list-style-type: none"> To withstand HOT and HUMID conditions full of SMOKE and to search for casualties by following proper SEARCH PROCEDURE methods. Use of Modern technology like PVC, FOAM textiles and furnishings that evolve noxious smoke, which have toxic effect. Assisting during disasters, building collapse, drowning rescues etc that require immediate lifesaving.
2	Secondary	<ol style="list-style-type: none"> To check Fire and Smoke damage loss with the help of latest technological developments in fire-fighting so as to curb and check this damage. To take care to extinguish fire at its seat such that property does not get spoiled or damaged because of water used by the Fire Service for firefighting.
3.	Tertiary	<ol style="list-style-type: none"> Render Advise in general on Fire Protection and Fire Prevention. Providing Fire Protection to V.V.I.PS during the arrivals and Departures by air or in public meetings. Providing fire protection to the public during the exigencies, like communal riots, strikes, Festival, public gatherings, Large Processions etc. Fire Department also provides stand by facility to public for their private functions on payment of nominal charges as fixed by the Government from time to time

“Uttar Pradesh Fire Services is playing a vital role in saving the lives and property of people from fire apart from discharging preliminary role. It is an exceedingly important agency, and deserves strong support from Government and Society at large.”

FIRE SERVICES DURING PRAYAGRAJ KUMBH

Hazard Risk & Vulnerability (HRV) Assessment

Table 3 : Hazard Risk & Vulnerability (HRV) Assessment

Hazard Assessment	<ol style="list-style-type: none"> Fire Hazard (due to use of combustible materials, Electric Lines, Storage of Combustible Items and LPG cylinders) Electric Hazard (use of Electricity in the area) Explosion Hazard (Terrorist activity, Gas Cylinder) Drowning (Bathing at Ghats) Stampede (Congregation of large number of peoples) Epidemics (water/food born disease, communicable)
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Risk Assessment	<ol style="list-style-type: none"> 1. Fire 2. Drowning 3. Infections 4. Stampede 5. Chemical Leak
Vulnerability Assessment	<ol style="list-style-type: none"> 1. Children, Pregnant Woman, Old people, Disabled persons 2. Tents and other temporary structures along with the material used for their construction which includes the office of govt. departments. 3. Storage facility (Food Supply, Gas Cylinders etc.) 4. Other structures and services used for distribution of electricity, water and communication. 5. Transport facilities 6. Emergency services (due to disruption of basic services required for their efficient functioning).



Figure 2 : Framework for Disaster Management, Prayagraj Ardh Kubh, 2019

The methodology followed by Fire Department for HRV was;

Identification of key hazards affecting crowd safety.

1. Determining the number of people who will attend.
2. Did an audience profile.
3. Assessing venue and site suitability

4. Assessing existing precautions – what more should be done?
5. Creating a crowd management plan with stakeholders.
6. Mock Drill.

Importance of Fire Services

- ✚ Fire Safety
- ✚ Incident Stabilization
- ✚ Property Conservation
- ✚ Public Education
- ✚ Mass Sensitization

Fire Safety Procedures

In most of the MELAs, temporary structures / pandals are being erected for residential purpose / Cultural Programmes / and Exhibitions. KUMBH MELA was not the exception. Temporary structures / pandals were made from highly combustible materials. Apart from the above fuel used for cooking purpose in these temporary structures like wood, dung-cake kerosene oil, LPG etc. were also a great hazard. Traditional CHULHAS and stoves were used for cooking. Temporary Electrical Wiring was also giving fuel to the fire. If any Fire broke out in these temporary

structure could involve the entire MELA area within minutes. Hence, It was of utmost importance to formulate plan and made strategies to prevent the outbreak of fire and if break out then control it just at the point of origin without further spread and extinguish it to save life and property.

Fire Service MOTO, 'WE SERVE TO SAVE' was a great inspiration behind all the Fire Safety Arrangements. Fire Service can stand up to the mark complying with its MOTO only if proactive role is played by the organization rather than reactive. Fire service personnel were involved from the initial phase of KUMBH MELA i.e. planning stage and they were deployed to the site since starting. Keeping in view the expected crowd density and hence difficult access to the entire area, more than 4000 hydrants

were installed in the area. 43 Fire Stations, 15 sub fire stations and 1 static post in each of the 13 AKHARAS were established.

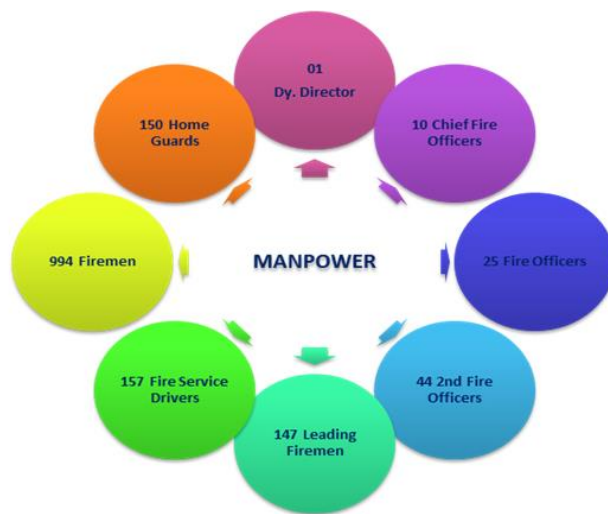


Table 4: Manpower Allocation by Fire Services

Fire Prevention & Preparedness Strategy at Kumbh

Table 5: Fire Prevention Strategy at Prayagraj Kumbh

Sr No	Nature of Hazard	Suggestion
1	Combustible nature of tents / pandals	Treat the material with fire retardant chemicals so as to limit the spread of fire and the same was implemented effectively and efficiently by coordination with concerned authority.
2	Less sensitization of public against disaster risk	A drive was carried out to train not only the staff but the pilgrims also regarding fire safety. Video communication, NUKKAD NATAK, Banner, Pamphlets and onsite training awareness programs were of great benefit in achieving the goal.
3	Deficiency Rectification	Pandals and tents were checked randomly by CFO KUMBH along with sector Magistrate and observed deficiencies were rectified on the spot. Concerned persons were made aware of the hazards related to the particular activity.
4	Response time	Water mist bikes were positioned at strategic locations and locations of Fire Stations, Sub Fire Stations and other posts were also finalized to minimize the response time
5	Response Mechanism	<p>Three Tier Response mechanism was employed to control any fire emergency</p>

The nature of hazards is very important to mitigate any probable cause of fire in crowded locations. It is very important to exercise response mechanism on timely basis so that the practised strategies can be used in case of real emergencies. Mass sensitization regarding disaster risk and their mitigation strategies should be communicated to the public in advance so that the impact of disaster can be minimized within the golden hour. The team management and activity distribution as per incident response should be very clear to all stakeholders during disaster situation.

Response Mechanism in Case of Fire Incident

Response Teams were formed to deal effectively with any Fire Incident detailed as under :-

Table 6: Response Mechanism in Case of Fire Incident

Team Structure	Work to be done by the team
Search and Rescue	The team was formulated to save the life of pilgrims / persons trapped in fire.
Cordon	The team was formulated to secure the incident area and prevent unauthorized access to hazard zone so that other teams can work effectively and efficiently.
Fire Fighting	The Team was formulated to fight, control and extinguish the Fire.
Salvage	The team was formulated to prevent the indirect damages from fire.
Water Supply	The team was formulated for quick supply of water in case demand arises.
Electrical Safety	The team was formulated to

cut off / restore of electrical supply to a particular area.

Triage

The team was formulated to give medical treatment to segregate the injured and dead persons and give medical treatment as per priority fixed during segregation.

The line departments and private bodies should have integration with fire department. The local fire authority should monitor fire prevention and preparedness measures to ensure relevant standards are met. Management and health personnel should consider potential fire hazards in the planning process and discuss any concerns with the fire authority. Management should also consider safety requirements and specific approvals if they intend to use any inflammable material. The response mechanism implemented in Prayagraj Kumbh was practical and enhanced the coping capacity of district disaster management cell. The seven bifurcated team responded properly and mitigated any probable situation in no time.



IV. RECOMMENDATIONS & ACTIONS

Table 7 : Recommendations and action to be taken

Sectors	Actions to be taken
Community	A committee should be formed to plan life safety.
Community	Life safety plans should be coordinated with public safety agencies and a variety of groups on the premises (e.g., management, employees in general, safety and security officers, and others).
Govt Organization	Training, education, drills, and exercises are an investment in life safety. Records should be maintained of such activities for regulators, insurers, and others. The records should be secured in multiple locations.
Volunteer	A chain of command and hierarchy of life safety volunteers should be maintained. For example, a building executive can choose floor wardens who can choose assistant floor wardens and searchers. Floor wardens and assistants are trained, and then they train occupants and lead drills. Searchers ensure no one is left behind.
Govt Organization	Training for floor wardens and assistants should include these topics: the variety of risks (e.g., fire, workplace violence), the evacuation plan, escape routes, safety, means of communication, what to do if someone is injured, where to assemble outside the

	building, and counts.
Govt Organization	Wardens can be supplied with evacuation kits containing flashlight, reflective vest, clipboard for recording employees outside the building, and a flag to mark the rendezvous point.
Community	Evacuation plans should include occupants with special needs, and employees should be assigned to assist them
Structural	Evacuation of high-rise buildings is complicated because of the number of occupants and the time needed to evacuate, especially those in upper floors. A minor fire may require evacuation of the floor containing the fire and two floors both above and below the fire. A serious fire would require a total evacuation.
Community	Evacuation plans should include areas of refuge (e.g., oversized landing at a stairwell or sealed smoke or fire compartments on a floor) and how they will be used. A method of communication should be installed at the area of refuge.
Non Structural	Before opening a door during a fire emergency, feel the door with the back of your hand to gauge temperature. If it is warm, opening it may cause smoke and fire to enter. This means you may be forced to stay in your office or apartment. Stuff the cracks around the door with towels. Telephone the fire department to inform them about your location and go

	to the window with a flashlight or wave a sheet.
Non Structural	If the door is not warm, brace your body against it, stay low, and slowly open it. If there is no smoke or fire, evacuate.
Non Structural	If smoke is around you, stay low because smoke rises. Place a cloth over your mouth and nose.
Govt Organization	Employee information is crucial during an emergency, and it should be up-to-date. Also important is a contact list of public safety agencies, medical services, regulators, government officials, critical suppliers, and others. Building and site maps are important to indicate such features as utility shutoffs, water lines, electrical and other utilities, floor plans, exits, stairways, hazards, and high-value assets.
Govt Organization	Practitioners responsible for safety and fire protection programs should seek feedback to improve performance. Feedback can be gathered from training, drills, and exercises. Also, audits can expose deficiencies in the expertise of personnel, equipment, systems, communications, and coordination with others.
Community	An airborne hazard (e.g., WMD) outside a building may necessitate sheltering-in-place. For example, a plume of hazardous material may be approaching a high-rise building with no time to evacuate, and traffic would block escape. Ideal rooms to shelter-in-place

would be on the opposite side of the approaching plume, above the first floor, windowless, and with a minimum number of vents and doors. Duct tape or other materials can be used to seal the room, and the HVAC system should be turned off. Because many hazardous agents are heavier than air, occupants should shelter-in-place in upper floors.

Crowd management situations involving fires, nothing can be more lifesaving than a well-established fire drill policy. Conducting a walk-through of the inside of the venue with Fire Department officials can help in identifying any potential hazards or problem areas. Use experience of fire department to ensure lanes to exit doors are unblocked, doors are unlocked, lighted exit signs are clearly visible from every spot inside the venue, and whether flammable materials are present.

Decisions on Open Fires

For any outdoor function - especially those that offer on-site camping, disaster professionals should learn local fire codes with respect to open campfires or barbecue pits. Regardless of local laws, venues are still responsible for the safety of their guests, so make sure you share crowd size, demographics, or any other factors that may affect the decision to allow open flames, and make your decisions in concert with local fire officials.

Fire Safety

Trash receptacles should be emptied as often as possible. Especially when fires are present, full trash bins provide favourable conditions for fires. Preparation is key, crowd management staff should be

trained in the use of fire prevention equipment, how to respond to fires, and the movement of crowds to designated safe areas.

Identify Security Concerns

Law Enforcement officials like Police, Home guards, Paramilitary forces etc can be utilized to identify crowd management concerns on the outside perimeter of any crowded venue helping in establishment of safe routes of travel to and from the venue or when escorts for patrons should be offered. They can help determine if any hidden areas exist within the venue. Areas that are not clearly visible to the public should be blocked from access at all times to keep patrons safe.

Use of Force

Safety may require decisions involving force when handling or evicting unruly or inebriated patrons. Police, Home guards, Paramilitary forces etc should always be called when needed, but in the absence of professional law enforcement, you must train your staff on how to remove patrons safely. When force is required, discuss methods with local law enforcement and what effect these may have on your crowd management strategy.

Hiring Private Security Bodies as Staff

If a consistent theme of discussions before any function includes disorderly or unruly crowds, decision makers may consider hiring local police to augment in-house staff. Good hiring practices can take the pressure of public safety off the venue's less experienced staff and leaves decisions to professionals. In addition to mitigating responsibility in the use of force, it will create a safer atmosphere for both patrons and staff.

Other Considerations

Bag Checks

Make sure you check with local laws with respect to checking the private belongings of your patrons. Bag checks can be time consuming endeavours for large venues, and the time required to perform bag checks must be considered when determining the number of gate entrances to your venue. The opinions of Police, Home guards, Paramilitary forces etc (and discussions with other venues about crowd management) should be considered when planning bag checks and the thoroughness with which the bag checks are performed.

Chain of Command

A formal chain of command should be established for accurate communication between inside and outside crowd management staff. Structured communication will allow for more effective response times in the event of an emergency and also allows for better coordination Police, Home guards, Paramilitary forces etc and Fire Officials.

Considerations on Event Cancellation

Issues on safety are paramount; if unruly crowds, weather, fire, security, or weather might compromise crowd safety, the decision to cancel or postpone an event must be considered. Excluding the weather, these decisions will be made jointly by the venue, promoter, entertainers, law enforcement, and the Fire Fighter. However, the venue holds ultimate responsibility for safety, and often common sense will dictate whether the show will go on.

V. CONCLUSION

A comprehensive fire emergency safety management strategy has been shown where the fire department has mitigated the disaster risk in such a large

gathering. The paper also demonstrates how the best practices in fire safety management at Prayagraj Kumbh can be implemented in complex developments. The proposed recommendations on robust fire safety management approach consist of fire management team plan along with fire emergency procedures and maintenance plan. Each strategy can be developed in detail to suit the characteristics of development and minimizing any kind of fire risk at crowded places. This paper can be act as a guideline for the further development of fire safety management plan for important locations throughout the nation. The steps utilized in fire safety and disaster risk reduction at Prayagraj Kumbh may be utilized as guidelines for other crowded places. India is vulnerable country and apart of fire hazard and risk the fore department can be utilized in multi sectoral approach for training and sensitization of other line department for sustainable development.

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