An assessment of Smoke Pollution break-out and its implications on Environmental hazard and living conditions surrounding Deonar dumping ground, Mumbai.

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*‘In a first, National Aeronautics and Space Administration (NASA) satellites have captured the blanket of thick toxic smoke haze that emanated from the Deonar dumping ground and spread to neighbouring areas as far as Dadar, resulting in poor air quality levels in the city’* - *Hindustan Times,Jan 30, 2016*

***Introduction***

Deonar dumping ground spreads overs an area of approximately 132 hectares around a radius of 2 kilometers.On an average day the waste dumped in the permissible area includes 5,500 metric tonnes of solid waste, 600 metric tonnes of silt and 25 metric tonnes of bio- medical waste.These figures rises to a total of around 9000 metric tonnes at the time before monsoon season as there is drain cleaning which happens and the amount of silt deposited increases.As per the order of Airport Authority of India the landfill is allowed to rise to a maximum height of 35 meters, as there is a flight route above the dumping ground area.Surpassing the mandate the landfill has reached a height of 55 meters and still keeps piling, even after reaching a height of a 16 storey building [11]..

It is one of the 3 dumping grounds present in Mumbai. It is managed by the BrihanMumbai Municipal Council (BMC),the other two landfills are in Mulund and Kanjurmarg.6.11% of the total waste generated is from Mumbai.The dumping ground has been serving the city in disguise for the last 89 years. It has heaped waste from 633 square Kilo Meters of Mumbai to keep the cleanliness that can be currently seen in the city.

When compared to Matunga area where deaths due to respiratory diseases are 0.41% Chembur showed 25% based on a study.This cannot be completely attributed to the dumping ground as respiratory diseases are also caused by other factors,but the comparative increase may be attributed to the pollution emitted from the dumping ground.

The area within the proximity of the dumping ground is called Shivaji Nagar or Baiganwadi (M-Ward) where the population is around 200,000 which includes illegal encroachments.The settlements here are inclusive of migrants from Gujarat, Maharashtra, Uttar Pradesh and Bihar. They also include illegal migrants from Bangladesh who are not registered and neither carries any documentation.

Around 77.5% of the population in M-ward is slum population opposed to 54.1% in the whole of Mumbai,there are a lot of shanties in this area the living conditions and hygiene are seen to be poor.It is also found that they are under constant threat of being destroyed for construction purposes.Infant mortality in the area is 66.47 per 1000 live births a little less than double of what is experienced in the whole of Mumbai which is 34.75 deaths per 1000 live births.The doctors serving in this area are flooded with tuberculosis patients and patients carrying other air- borne diseases which include Asthma, Bronchial infections and respiratory allergies.

Studies have shown that a dumping ground has the potential to emit gases which include a combination of carcinogenic methane,carbon dioxide and hydrogen sulphide along with fine particulate matter which are deadly in nature.The constant emission of methane from the solid waste is always susceptible to catch fire when it mixes with atmospheric oxygen in the dumping ground and while respiratory diseases are a matter of major concern,if fire breakout happen the enormous amount of smoke may worsen the life and the health status in the areas adjacent to the dumping ground area.This further leads to the generation of greenhouse gases which deplete the protective ozone layer. But, if extracted properly Methane can act as a major source of energy.

The United States public health services have identified 22 human diseases and effects that are linked with improper Municipal Solid Waste management system.This includes, chemical inhalation, low birth weight,cancer,congenital malformations,neurological diseases,nausea,vomiting,infectious diseases, chronic respiratory problems,respiratory tract infections,malarial infections,rat plague,mercury toxicity increase (mostly by eating fish affected),plastics ingested by birds,high algal population in rivers and sea,degrades water and soil quality.Rag pickers and waste workers usually do not have any protection precautions while working in dumping ground related activities;hence both are prone to infections due to accidents as well.The other cases which are seen commonly are lower tract infections,skin disease,scabies,diarrhoea,cholera and dysentery..The dumping ground being 89 years old already creates a lot of health hazard in this manner as it has already exceeded the average age of a dumping ground which is 30 years.Now it has crossed 50 years beyond its carrying capacity and has improved its scope of health hazard.

 Unlike other days, the 28th of January showed a different atmosphere filled with smoke in areas near Deonar. The mid- day news reported that fires had broken out in the Deonar dumping ground on Thursday morning. Initially, the fire brigade was not called as the heavy machinery by BMC was removing waste as an attempt to prevent it from spreading. The smog levels kept increasing and it started gaining more attention.

 **Table 1:The total number of deaths in Chembur and Matunga area due to respiratorydiseases, 2007-08**

|  |  |  |  |
| --- | --- | --- | --- |
| Area | Total deaths  | Deaths caused by respiratory disease | Percentage |
| Chembur | 3,195 | 802 | 25.10 |
| Matunga | 5,103 | 21 | 0.41 |

**Table 2: The level of Particulate matters and Formaldehyde in Sudha Park and Shivaji Nagar area**

|  |  |  |  |
| --- | --- | --- | --- |
| Area | PM10µg/cum | PM25,µg/cum | Formaldehyde, (PPM) |
| Acceptable Level | 100 | 35 | No standard for ambient air |
| Sudha park |  |  |  |
| Day 1 | 306 | 136 | 26 |
| Day 2 | 375 | 161 | 29 |
| Shivaji Nagar |  |  |  |
| Day 1 | 405 | 142 | 56 |
| Day 2 | 445 | 197 | 63 |

[Source : NEERI and KEM Hospital, Mumbai, March 2009]

**DATA AND METHODS**

Hence, this study tries to understand the impact on health and life by a dumping yard of this size,and how a fire can worsen the life of people,and to what magnitude it can impact the health situation.This study also attempts to understand how the health situation has worsened in areas close to the dumping ground have been affected due to the smoke.It is also important to explore the life of workers who generates income out of waste generated from the dumping ground,during the fire breakouts and how the life of a society and those whose incomes are dependent on the dumping ground gets affected by a hazard of this magnitude,when fire blazes across 132 hectares of land and the pollution level increase.In order to achieve the following objectives this study conducts a situational assessment on health issues due to the smoke breakout and finally to understand the effective measures carried out for damage control.

Pollution based readings were computed to bring out evidence based finding from the empirical data on components of air pollution.In this reference the study has used very recent **SAFAR project data from January 3, to 26 February/ 2016–**collected and generated by **Indian Institute for Tropical Meteorology (IITM),Mumbai** and **Environment-Sa India Pvt. Ltd.,Mumbai**.The analysis will further help this study to explore the possible atmospheric interference into gases possibly inhaled in Chembur area as this centre determines air component in areas surrounding Deonar dumping ground.

A purposive sampling was done to understand the after math situation and all the participants willing (Ethical issues taken care of/Informed consent) were included for the study.The brief checklist was administered with all the four groups of respondents and their responses were presented descriptively in best possible manner in the subsequent chapters.

***Study Population***

For the purpose of this study,primary data was collected from the area adjacent to the dumping ground area(which includes Shivaji Nagar, Padma Nagar, Shanti Nagar)immediately after the incident. Interviews were collected from four key population namely

**Household interviews** of the area adjacent to the dumping ground, who are supposed to be the immediate victims of the hazard and have high chances of getting affected due to it

**Dumping ground workers** included the working population who involved in various dumping ground related works which included lorry drivers, waste pickers rag pickers and other dumping ground related workers**,**

**Maximum at Reach Affected Population (MRAP)** collected from the neighbouring locations in Mumbai near the dumping ground this included toll booth employees and security guards.

**Stake holders associated with dumping ground** which included BMC officials, M- Ward officials, Fire Force officers**.**

Therefore around 19 key informant interviews and 42 In-depth interviews were taken along with one Focus Group Discussion (FGDs).

**Table 3: Presents the total number of Key Informants In-depth Interviews and FGDs conducted.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of Interview** | **Household** | **At Site** | **MARP** | **Stake Holders** |
| **Key Informants** | 6 | 4 | 6 | 3 |
| **In Depth Interviews** | 14 | 10 | 12 | 6 |
| **FGDs** | -- | -- | 1 | -- |

**Summary of Findings**

The findings emerges from both secondary data analysis on air quality and primary data collected from the different sets of respondent are presented in subsequent working chapters

 **Air Quality Measurement and Level of Pollution**

The pollutants which are observed to check Air Quality Index includes the following gases:[Carbon Monoxide(CO)](http://www3.epa.gov/ttn/naaqs/standards/co/s_co_history.html),[Nitrogen Dioxide(NO2)](http://www3.epa.gov/ttn/naaqs/standards/nox/s_nox_history.html),[Ozone (O3)](https://www.epa.gov/ozonepollution/table-historical-ozone-national-ambient-air-quality-standards-naaqs),[Particle Pollution(PM)](http://www3.epa.gov/ttn/naaqs/standards/pm/s_pm_history.html)which includesPM2.5&PM10 and [Sulfur Dioxide(SO2)](http://www3.epa.gov/ttn/naaqs/standards/so2/s_so2_history.html)**.**The table and the graphs represents the pollutant levels and it’s changing trends from January 3rd to February 26th and values have been merged and averaged for 4 days each.

**Table 4: Levels of pollutants in air during the observed time period**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DAYS/ CHEMBUR | PM10 (ug/m3) | PM2.5 (ug/m3) | CO (ppm) | O3 (ppb) | NO2 | SO2 (ppb) |
| 3 -7 January | 92.5 | 53.1 | 0.87 | 34.7 | 96.7 | 7.7 |
| 8 -12 January | 285.2 | 139.9 | 1.01 | 31.8 | 73.1 | 10.1 |
| 13 -17 January | 153.8 | 99.2 | 0.92 | 23.7 | 40.6 | 8.5 |
| 18 -22 January | 148.7 | 93.8 | 0.72 | 24.8 | 26.1 | 15.5 |
| 23 -27 January | 160.2 | 101.3 | 0.75 | 30.2 | 14 | 20 |
| 28 January-1st February | 324.7 | 219 | 1.32 | 25.3 | 73.5 | 24.7 |
| 2 -6 February | 251.6 | 164.2 | 0.78 | 29.3 | 69.2 | 27.1 |
| 7 -11 February | 165.4 | 105.3 | 0.92 | 24 | 72.4 | 26.2 |
| 12-16February | 150.8 | 101.9 | 0.84 | 31.3 | 62.3 | 27.2 |
| 17-21February | 128.8 | 85.7 | 0.88 | 22.2 | 27.1 | 27.8 |
| 22-26February | 126.8 | 80.9 | 1.83 | 36.3 | 17.5 | 24.7 |

**Figure 1: Levels of PM10**

**Figure 2: Levels of PM2.5**

**Figure 3: Levels of NO2**

**Figure 4: Levels of CO**

**Figure 5: Levels of O3**

**Figure 6: Levels of SO2**

The measurements of the above are collected by the project on an hourly basis,everyday.According to definition of pollutants defined by various air quality departments and SAFAR the following are considered as major pollutants.The data for each of the above pollutants were compiled and an average for each of the pollutants was observed on an interval of four days each from the 3rd of January 2016 till the 26th of February 2016 to observe the actual levels of the pollutants before the smoke breakout,the level of pollutants during the smoke breakout and the levels of pollutants after the smoke breakout.With these average values line graphs were prepared with the X- axis showing the days of observation of pollutants and the Y axis showing the pollutant level as per the measurement observed during the time period.It was seen that the levels of PM10,PM2.5,NO2 and CO had become high during the days of breakout.Hence, the chances of respiratory, heart and problems with regard to lungs have high probability among the affected population.

**Issues emerging from household interviews**

The findings emerging from the interviews carried out had brought out details with regards to

1. The situational assessment of fire breakout on their health, the way it had affected their life during those days and their experience with regard to the breakout of fire.
2. The health condition and the approach and access to healthcare facilities and affordability with regard to such services.
3. The social problems and the other issues faced allied with the dumping ground.
4. The living condition of the population in the area, including occupation, shelter, water supply, and toilet.

According to the key informant interviews, the massive fire breakout on 28th January 2016,led to a continuous fire for almost 16 days including huge amounts of smoke emitted and spread over the surrounding areas.At different times they experienced different levels of smoke with different odour,due to the direction of wind,initially most of them could not walk around properly because nothing could be seen due to the dense smog.One of the respondent mentioned that he felt smoke in his breath for almost 25 days.

An Arabic teacher (Age 42) who was interviewed said that

*‘….When I woke up early on the day the fire broke out, while preparing for my lectures,I felt the smoke in the air and thought that it was fires which usually occurred;when rag pickers burn waste to obtain scrap,it is when people started making noise that I realised that the situation was intense’.*

Fires are a common affair near the dumping ground.Most of the respondents believe that rag pickers put fire on a regular basis.

About the fires the Key Informant cited that

*‘....fires are common, every time rag pickers collect scrap and put waste to fire to get metal,but during my stay here I’ve not seen a fire of this intensity,*

There were different reasons that some felt was responsible for the fire on the dumping ground, out of which rag pickers were blamed the most,but some also view contractor as the defaulter.

*‘……..the fires occurred because the contractor who was in charge of the dumping ground was removed and his contract was terminated.Before the contractor left everything that had happened was under control.*

 *-*70 year old respondent,Scrap business .

There were also precautionary measures taken to avoid further exposure children to the poisonous air

*‘…..The BrihanMumbai Municipal Council had asked around 74 schools to shut down during the smog breakout,as there were many cases of children getting sick, moreover the smog levels were so high that it would have forced shutting of all windows in school which would in turn suffocate.*

The health situation had worsened due to the fire and many had diseases which were already prevalent got aggravated due to the fire.Those who were patients, suffered more and were not comfortable due to the break out as mentioned by respondents.Most of the respondents faced health issues.Initially,due to the breakout many of them could not continue staying there as the levels of smog increased and affected their health condition adversely.

*‘......I shifted my son to a relative’s house near Mulund due to his worsening heart condition, smoke levels and since he was coughing and chest pain started to develop.All of them could not shift due to lack of space in relatives house.Conditions in Mulund were also not good but manageable.’*

 *-*30 year old respondent,School teacher

Some respondents did not have any place to go in nearby areas.Hence,they had to adjust to extreme conditions and living in public spots

*‘…….During the fire breakout my brother(suffering from lung cancer)due to some breathing problems used to stay in railway stations till the smoke reduced’*

-25 yearsold respondent.Shopkeeper

pregnant women were also victim to severe smoke problems,and there had to be adequate action taken to prevent any complications in pregnancy

*‘……..The fires had caused a major situation in my house hold as my elder brothers wife was pregnant she wasn’t supposed to breathe in bad air.They all had shifted to their relative’s house in sandhrust road for a few days.My elder brother and his wife had not returned yet to avoid complications*

Age:41 years,Occupation:Scrap worker

The type of houses in which respondents lived in varied from cemented houses to shanties mostly semi- pucca and kacha houses.Those living in shanties usually experience problems like threats to remove house and to move out of their living setup.When there were complaints and protests to shut the dumping ground the authorities take action like destroying houses and demolishing shanties.Some of the respondents were agitated with the act and responded in the following manner.

 *‘This is my country what right do they have to say that I cannot live here.If they try to remove me from here they have to give me another place to stay in,*

While another respondent standing near the demolition drive which was happening in the area by BMC said .............*‘Why do they want to shift us?To improve this place?Is people more important or garbage? The authorities are to be dumped here.The rulers would even cover themselves in garbage to get money.Why wouldn’t they destroy our houses?*

35 year old female respondent,Fruits vendor

Hence,various issues with regard to the dumping ground after the fire breakout and the living conditions were understood,most of the families interviewed were seen to have some health issues.

**Issues emerging from workers related to dumping ground**

Individuals who got affected the most are those who worked in close proximity with the dumping ground. This includes workers in the dumping ground such as lorry drivers,helpers of lorry drivers,rag pickers and the workers who are associated with recycling in the medical waste area in the dumping ground.

The rag pickers make a life out of the dumping ground,collecting waste and scrap earns them their daily life.There is a big setup worked out in this area.Initially, it was given to a contractor,who was allowed to process the waste dumped and he earned Rs. 40 / tonne, “....*and there were a lot of dealings working out with regard to the dumping ground.”*said the Key Informant.

Hence, through these interviews we segregated it into a few sets to understand various phenomena and could carry out my observation as researchers.It is segregated into the following manner;

1. The way fire had impacted their working condition.
2. The health situation of the worker after the fire breakout
3. Their approach to health care services
4. The working condition of the individual
5. The health situation of the worker

It was understood that fire also impacted their normal life and routine, along with their income.It was found that almost all of them were directly or indirectly affected by the fires and smoke.

*‘………During fire I could not go for rag picking because nobody was allowed inside and also due to lot of smoke I was not able to collect anything. There were security forces employed for almost 10 days and there were fire force who was bringing down the fire, could not see anything that was happening around.’*

 -Female rag picker, Age 22

The rag pickers were also ones against whom FIR was lodged and allegations were brought up against them with regard to the fire breakout even most of news media had reported against rag pickers as the culprits for the breakout of fire.

 *‘………I had not faced any health issues before but after fire broke out my eyes started burning due to this I was not able to go to collect material this affected our income.Policeman came and asked me whether I put fire or whether I knew any person who was involved in this, and he kept scaring me interrogating.’*

 Male rag picker, Age 35

While lorry drivers had other issues they put up and they had spoken about their cases in this manner;The situation that lorry drivers and helpers were equally worse and they had to follow a different schedule while the fire kept burning,the BMC had directed the lorry’s to dump the waste in the other dumping grounds in Mulund and Kanjurmarg during this period of time to avoid further complication and fire aggravation

*‘……....When I woke up early in the morning to pick my lorry from the dumping ground,I couldn’t see anything because of the smoke, and even after taking the lorry I had to drive slow and had to put headlights and keep honking while driving during the first many day and I had my day running very slow during these days.’*

Another narrated

*‘……….after fire broke out it was very difficult to work there and our lorry got order to dump garbage in Mulund dumping ground.This took more time to dump garbage in Mulund than usual time when we use to dump garbage in Deonar,because Mulund is really far from the location from where we collect waste,we reached home really late during those days.’*

 -waste lorry helper

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**Maximum at Reach Affected Population (MRAP)**

There were many pictures posted showing views before and after from all around the city.While even NASA had detected a similar situation during the breakout,and saw the unusual pattern of smoke movement throughout the city.Hence, it is important to study the areas which may have gotten affected by the smoke due to the dumping ground fires,which is within close proximity of Deonar dumping ground. According to usual reports and before the fires had happened the areas which are usually affected by the dumping ground are,Vashi,Mankhurd,Govandi,Chembur,Ghatkopar.Interviews were collected from these areas,it also included Vadala and Kurla to study the reach of smoke, and to possibly understand its impact.

Interviews were mainly collected from security officers during the process,near the thane creek there were toll booth workers and officers who were interviewed to understand the larger effect of the fire breakout as they were working there during the fire breakout,it helped understand how the fires had impacted their lives.

From the in- depth interviews taken we could gather information about

1. The impact of smoke, and fire breakout from Deonar dumping ground.On their job and the area.
2. The impact on smokes on their and their family’s health.
3. Source of information with regard to breakout of fire.
4. The general health situation of the individual and treatment seeking behaviour
5. The living setup of the individual interviewed& their working condition and connection in the area.

The smoke mainly hit Ghatkopar,Vadala,Chembur,Govandi,Mankhurd and Vashi among the areas I selected,to interview security guards and workers employed outdoors after the smoke situation.

Further we queried into the health situation of themselves and their family due to the breakout,that was seen in the area,also with regard to how it had affected the life around the area in which they were employed

*“…..my headaches had increased. I visited the doctor.It was not only me but my parents too had to visit the doctor because their blood pressure had increased. I came to know about the fire from my sister who stays in Ramabhai Colony. ….”*

24 year old Respondent,Ghatkopar (E),Security Guard

The health situation of most of those interviewed in the areas where smoke affected was seen as mainly they were working outdoors and inhaling the smoke throughout the day.

While,in Vashi toll booth,the respondent stated.

 *“…. I developed strange eruptions on my lips.I haven’t visited the doctor for this because it hasn’t caused any problems.I have seen dense smoke during the morning times.It becomes very difficult to see. Around 15 accident happened mostly due to the smog conditions as nothing much could be seen once they reached above in the bridge during the days of smog everyday when I return home to chembur,I get this very bad smell and it becomes really difficult to breathe ..”*

33 year old Respondent,Vashi,MSF Toll Booth Officer

Not only was his health affected,but according to his response he said that there were almost 15 accidents which took place on the top of the bridge during those days because of improper vision,and that it had created a lot of traffic blocks and had caused a lot of havoc during those days.

**Further focus group discussion was done to understand what individuals felt about the current scenario due to the breakout.**

**This was carried out in Chembur west in a public bench near the railway station**

“…*I stay very close to the Dumping Ground. I have seen the fire. It was really bad*…”responded the 40 year middle age man.

When inquired regarding the after effects of the fire, the 37 year old informed us how he had got sick and had to visit the doctor

“…*I had great troubles in breathing.Earlier I thought it due to this smoke it would be fine once the smoke subsides but I guess those bad chemicals and garbage had made things difficult.I had to resort to medications….”*

However the 40 year old guy had a major point to make.

“*….. I don’t think shutting down the dumping ground is the solution.Where would the waste go then?The government needs to find a better way of managing the waste.If they close this ground ,they would then search for another place for the same purpose and then some other place would get affected.So not finding a new way but finding a better technique should be the Government’s solution…”*

**Issues emerging from- Stake Holders Interactions**

**M-WARD OFFICE DEONAR**

The officer in charge of data gave certain statistics based on M ward in which dumping ground is located.

*‘…….The population which comes under the jurisdiction of M-ward is 10, 00, 633 of which around 75% are Muslim population.Surrounding the dumping ground in 2Km radius,the population is around 1,00,000- 2,00,000 of them who have gotten registered of which 80- 85% are Muslims.The exact estimation of population in this area cannot be calculated because there are regular illegal encroachments which occur in this area..’*

It was further learned that;

*“……Tuberculosis is the major health issue faced by a major population in this area.BMC has provided ambulance services for people suffering from TB if they call 108, services are active 24x7.”*

An official also said that

*”….. there are more private medical services provided there than the government services, people avail more of private services than government*.”

**MANKHURD FIRE STATION**

The **Officer-in-charge** of the fire station gave estimations with regard to what had happened up close in the dumping ground during the massive fire breakout.According to him

He said that the fire force in Mumbai is not well planned and not adequate;

“….*fires had happened even previously in the dumping ground,but it did not get the attention that the 2016 fires got.According to the need there should be a fire station in every 4 km radius,in Mumbai according to it requires more than 100 fire stations, but it only has 34 fire stations.*

During the fire breakout according to him

*…. it was very hard to access the dumping ground because the engines had to ride through the dump which was very hard due to uneven surface.”*

About the working of the fire force he said

*“……..Due to the massive impact of fire,fire engines from all the 34 stations had arrived,during fires the major fires almost 28 vehicles were operating to take down the fire which spread across the dumping ground. 2 main officers were took turns and were directing the fire force action against the fires,even the chief of Mumbai fire station operations had come to the spot during the breakout,along with a few political leaders.”*

According to what he said

*“…….the fire has gone under the top layer of waste and he doesn’t know how far it has trickled down.Hence it will take a minimum of 6 days of continuous rain to completely put a stop the fire which got aggravated on 28th January 2016.*

He also spoke about the fire force personnel’s and how they were affected by the smoke;

*“……Almost 120 fire personnel and 5 officers were included in the operations to bring down the fire during the breakout.Of which 3 employees were injured while the action was carried out.One of them was hospitalised due to suffocation which he underwent during the breakout.*

The fire station has decided to

“……*constantly keep two fire engines near the dumping ground currently to prevent any further breakouts, and two fire fighters are also present at the location.”*

**BMC Office- Shivaji Nagar**

The BMC office situated near the dumping ground held most of the data based on the dumping ground. There was a big procedure for obtaining the data completely and due to the breakout they were not allowed to give out any interviews as per the order they received,but they gave some basic information of the current functioning of the dumping ground.

*“…….Before the fires had occurred according to the official there used to be around 900 trucks which brought in dump on a daily basis, this would bring in around 7000- 9000m tonnes of waste every day.”*

After the breakout there are massive protests to shut down the dumping ground, they said

*“…….we have found an area to safely dump waste for the time being, hence currently only waste from Ghatkopar, Kurla, Chembur, Govandi and Mankhurd . This includes around 442 lorry’s taking a maximum 3 shifts a day. The number of waste lorries were being monitored and reduced, only registered lorries are allowed. It brought down the amount of waste carried to 1767 metric tonnes of waste a day.”*

They also spoke about the order from the Airports authority Of India

*“…….Waste is not allowed to cross the 36m height once it crosses they level the waste and try reducing the height using JCB. Now it has reached around 55 meters.*

**Conclusion and Recommendations**

The fire which started on 28th January 2016 continued till 14th of February 2016, and further burned in March 2016. Prior to the fire, tuberculosis was found to be the major disease and was even fatal for certain residents of the area according to the stakeholders.It can further be concluded from the findings that the fire breakout worsened the health condition of those who were already sick before the breakout. According to most of the respondents those individuals who were prone to further respiratory problems were even moved from their homes to relatives home and other areas to prevent further complications and created a huge chaos to the residents.Especially those who suffered from Asthma became more critical and were given further medical attention to avoid encounter with fatal situations which caused out of pocket medical expenses in most of the families.The smokes had caused at least 15- 20 accidents which occurred on Vashi bridge during the first three days of breakout,which according to the MSF officer placed at the toll booth was unusual and was mainly because of the smog levels.The amount of waste dumped in the Deonar dumping ground had reduced substantially after the breakout of fire according to the BMC officials,it used to be a minimum of 4000 metric tonnes a day and it had come down to 1767 metric tonnes a day.

The findings of air quality index analyzed from **SAFAR project data** from January 3, to 26 February/ 2016–collected and generated by **Indian Institute for Tropical Meteorology (IITM),Mumbai** and **Environment-Sa India Pvt. Ltd., Mumbai**.Shows that the levels of PM10,PM2.5,NO2 and the CO levels in the atmosphere in areas near the Deonar Dumping Ground has gone up.Though the levels of CO shot up it did not change in standards,but all the other 3 had increased and was not within the desired quality of air.Hence, contributed to the probableincidence of premature death.Primarily in the elderly and those with heart or lung disease;aggravation of respiratory and cardiovascular illness.Decreased lung function and symptomatic effects,including acute bronchitis,particularly in children and asthmatics;New cases of chronic bronchitis due to the levels of particulate matter,it also increased the scope of diseases and issues due to increased content of NO2 which includes Reduced lung function,resulting in difficulty breathing, shortness of breath and other symptoms.Respiratory symptoms,including bronchitis,aggravated coughing, and chest pain.Increased incidence of respiratory problems.It also leads to the premature ageing of lungs which further complicates the functioning of the lungs.While O3 and SO2 did not undergo any significant change in air quality or changing trends.

During this study about Deonar dumping ground and after math of the recent fire situation were observed.It was seen that Deonar dumping ground is a relief to thousands of people and indirectly a relief to the whole of Mumbai.From the group discussion which took place in Chembur west the respondents stated that **“*where will all this dump go if the dumping ground shuts down*,”** and from the interviews taken from the work force involved in various activities relating to Deonar dumping ground,it is seen that rag pickers,contractors,medical waste company,lorry drivers and helpers,made a living out of the dumping ground and waste related activities and processes.Contradicting the boons,the fire station officer stated that the fire has gone underneath and has not been tamed completely yet, as waste has piled up to 55 meters high,how much ever water sprayed by the fire engine would not be good enough as it is not possible to assess how far the fire has trickled down and he said that only continuous rains for 6 days can completely take the fire down.

Hence this study can be concluded on the basis of a SWOT analysis.SWOT analysis (alternatively SWOT matrix) is an initialism for strengths,weaknesses,opportunities, and threats—and is a structured planning method that evaluates those four elements of a project or situation. A SWOT analysis can be carried out for effectiveness of a Program,situation assessment,place,industry or person. Below is the SWOT analysis for the situation (Fire break out) and the place (Dumping Ground) based on the findings of the study.

**Swot Analysis**

|  |  |
| --- | --- |
| **Strength**  | **Weakness** |
| * Location of Deonar dumping ground is best suited to collect waste from most of the locations in east and central Mumbai.
* Collects,up to 9000 tones of Waste every day hence its carrying capacity is to be valued
* The area occupied by the dumping ground is 132 hectares in a radius of 2 Kilometers. Hence, there is enough space to carry Solid Waste and Medical Waste separately.
* The close proximity of Dumping Ground to the Asia’s largest abattoir makes the transportation of waste quicker
* The scraps obtained from the dumping ground are recycled for the production of useful materials.
* The dumping ground employs and is a source of living for many individuals, in various areas, informal sector includes rag pickers, and the formal sector includes lorry drivers, lorry workers, and waste processing employees.
* The designated area of the dumping ground succumbs further encroachment and settlement in that area due to the land fill.
 | * The location of the dumping ground and its close proximity to the surrounding areas causes air contamination and foul smell.
* The carrying capacity has exceeded the average age of the dumping ground, and is getting filled beyond its actual capacity.
* Pilling up of waste has caused many tensions between BMC and AAI as it has exceeded the maximum height prescribed by the AAI.
* The residential area near the dumping ground experiences health issues due to contamination and pollution and infectious diseases have spread vividly among the population closest to the dumping ground.
* Fires which breakout from the dumping ground pollutes the Air and worsens the Air Quality.
* Smoke emitted due to fires have spread to areas near the dumping ground and caused illness to areas farther from the dumping ground. Bigger fires have further damaged the living conditions of the people around the dumping ground
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| **Opportunity** | **Threat** |
| * Better management, segregation of waste and recycling of waste can further create space and solution for the increasing garbage in the city.
* If smooth and proper methane extraction is initiated it can reduce the further chances of fire and can be used for different purpose.
* The dumping ground if managed purposefully can be used as a more organised employment creation and generation for low income workers.
* An organised scrap collection mechanism can be developed to ensure full utilisation of scrap dumped in the landfill.
* A further solid waste management can be implemented to generate natural gas.
* The Dumping Ground if collaborated with AAI can ask for more purposeful land and can be shifted to Khargar to reduce or share burden.
 | * A small trigger to the methane gas if not extracted properly by atmospheric oxygen can cause massive fires
* Close proximity to the dumping ground and easy access to the dumping ground creates an ease in the spread of epidemics.
* The atmosphere can extremely get contaminated due to emission of gases and worsen the air quality and hence create havoc to normal clean air.
* It affects animals which feed from the dumping ground and can infect other animals and human beings which come in contact with it.
* Disposal of toxic waste can lead to formation of undesired gases and can be fatal.
* Any kinds of fire can cause a potential threat and can cause pollution which can spread to large distances affecting the health of a larger population.
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The SWOT analysis brings out one pin points fact that if the dumping ground is managed better it can serve the people and the city longer and in prolific manner,however any situational such study should imply evidence based findings and needs more exploration,experimentation and explanation.

 **Study Limitations**

* The findings are based on in- depth interview and key informant interviews, but along with a structured questionnaire prepared for qualitative research which gives better generalizability of study findings.A quantitative survey would have given a much more authentic structure to the study.
* The study was done immediately after the fire situation,the whole atmosphere was smog filled and it was tough to collect data from the areas near the dumping ground.
* Language was another major barrier as most of the responses had to be translated and hence had taken up a lot of time to conduct in-depth interviews, during most of the interviews.
* Further,it was difficult to interview dumping ground workers and rag pickers during the expected time of interview as there was strict security and policemen employed near the dumping ground restricting entry or interaction .
* Among the stake holders the BMC office near the dumping ground were not willing to give proper interview as they had been given orders from the higher authority to not interact with anyone with regard to the breakout or the dumping ground as it was a sensitive issue.

**Recommendations**

* Government and BMC should demarcate the proper boundary of dumping ground to avoid trespassers and nuisance.
* Children living nearby should be stopped and appropriate action must be taken to prevent their entry into the dumping ground. This should be done to safeguard their health and to prevent any accidental fire trigger which can be started by them.
* Proper plan and technology should be invested for methane gas extraction from the dumping ground to prevent the gas from catching fire when exposed to atmospheric oxygen.
* Fire stations should be provided with more vehicles and machinery to contain fires that occur in the landfill to prevent massive fire break outs.
* Residents should be made aware of the condition of air and how to minimise health risks.
* Children and women should be given free respiratory health kits to safeguard their health in these kind of conditions.
* Dumping ground should be managed in a better manner and stakeholders should be held accountable and should be penalised for such incidents.
* Regular and periodic survey is recommended to analyse the situation of the health impact in areas adjacent to the dumping ground.

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