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materials: abou

other:

>budget: abou

>key terms: Sara

Abstract:

Bad air is a problem that needs immediate action to protect our population from the adverse health effects of breathing poor quality air. As it stands, these issues will seem to only get worse and worse, and it is for that reason that cities around the world need plans of contingencies to mediate the risk to our most vulnerable populations. In this proposal we lay out a plan of action that consists of stockpiling different types of high-quality masks such as N95 and KN95 respirators at various points throughout the 5 Boroughs with a strict plan of distribution through those locations via existing city infrastructure such as MTA transportation vehicles like buses. This plan uses lots of land and different vacant buildings that can be adapted to house the stockpiles of masks while existing transportation infrastructure can be used to deliver the supplies throughout different parts of the city. Using existing artificial intelligence algorithms to find the best route for dispatchers to send out masks will decrease the amount of time that people have to endure the harsh air quality without protection.

Intro:

One does not have to look too far than a month from the time this proposal is sent out for an event that would have benefited greatly from an emergency plan such as ours. Starting around June 6<sup>th</sup>, 2023, and ending at around June 9<sup>th</sup>, the air quality in NYC was one of the worst in the world [3] by many estimates. And for many other cities in the region such as Philadelphia and Washington DC, the worst quality air they had seen in their history. This prolonged period of bad air was brought about by fires taking place in the region of Quebec in southern Canada and brought to the Northeast United State by air currents [1]. For some time now, there have been ways of tracking the air pollution in the air by groups such as NOAA and the EPA.

One of these metrics is known as the air quality index (AQI), which is a quantity used to communicate the level of air pollution and establishes different ranges that correspond to the different levels of health concern different groups of people can experience. The AQI focuses on the health effects that can occur whilst spending prolonged periods of time in that air. In the AQI there are five major air pollutants that are specified by the Clean Air Act. They are ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide [2]. During the time NYC was filled heavily with smoke the AQI went up higher than 400 on a scale that goes up to 500. Figure 1 tracks air quality at different times during the time interval of June 2<sup>nd</sup> and June 9<sup>th</sup> and it is not hard to see how much and how quickly the air quality deteriorated. Given how hazardous the air was for healthy people,

not to mention vulnerable groups, it is a good idea to create a plan of action that the city can follow should this happen again.

It is now possible to get readings of the air quality readily from websites such as NOAA.gov and different private companies such as IQ-Air at a daily, even hourly rate. Given the speed at which air monitoring happened, it would be prudent for the City of New York to develop this plan of action for when these events should occur. We know that at least in the short term, events such as these are not only possible but increasingly likely.

Figure 1: Data from the New York City Community Air Survey and New York State Department of Environmental Conservation plotted by the New York Times showing the hourly concentration of PM 2.5 particles, measured in micrograms per cubic meter, for seven NYC locations.

Sources:

[1] <https://www.nytimes.com/interactive/2023/06/08/upshot/new-york-city-smoke.html>

[2] <https://www.weather.gov/safety/airquality-aqindex>

[3] <https://www.nesdis.noaa.gov/news/noaa-satellites-tracked-historic-levels-of-harmful-smoke-impacting-millions-the-eastern-us>

## Background

Air pollution has emerged as one of the most pressing environmental issues of our time. The detrimental effects of poor air quality on human health and the environment have been recognized for centuries. From the early days of industrialization to the present, the history of bad air quality serves as a cautionary tale of the consequences of unchecked pollution.

The history of bad air quality dates back to ancient civilizations. The burning of fossil fuels, deforestation, and industrial activities have contributed to the release of pollutants into the atmosphere throughout history. However, it was during the Industrial Revolution in the 18th and 19th centuries that air pollution became a pervasive issue.

As industrialization spread across Europe and North America, the combustion of coal and the rise of factories led to significant air pollution. The rapid urbanization and concentration of industries in cities created a toxic combination of pollutants, including sulfur dioxide, particulate matter, and heavy metals. Cities such as London and Manchester experienced severe smog events, leading to thousands of deaths and widespread health problems.

One of the most infamous incidents related to air pollution was the Great Smog of London in 1952. A combination of weather conditions and widespread coal burning led to a thick layer of smog that enveloped the city for several days. The event resulted in an estimated 12,000 deaths and forced the government to address the urgent need for air pollution regulations.

The latter half of the 20th century witnessed a growing awareness of the environmental impacts of human activities. The publication of Rachel Carson's "Silent Spring" in 1962 highlighted the dangers of pesticide use and catalyzed the modern environmental movement. This awakening brought air pollution to the forefront of public consciousness and led to the establishment of environmental regulations worldwide.

The health consequences of air pollution are well-documented. Poor air quality is linked to respiratory diseases, cardiovascular issues, allergies, and increased mortality rates. Moreover, air pollution negatively affects ecosystems, causing acid rain, ozone depletion, and climate change. The economic costs associated with healthcare expenses and reduced productivity further underline the seriousness of this problem.

#### Sources:

World Health Organization. (2021). Air pollution. Retrieved from <https://www.who.int/news-room/air-pollution>

Environmental Protection Agency. (2021). Air pollution history. Retrieved from <https://www.epa.gov/history/air-pollution-history>

National Geographic. (2021). Air Pollution. Retrieved from <https://www.nationalgeographic.com/environment/article/air-pollution>

#### Materials:

Our proposal considers using N95 masks due to their efficiency. According to Sara Berg's article "What Doctors wish patients knew about wearing N95 masks" for the American Medical Association, she talks with physician and member of the AMA Louito Edje, MD, who notes that "N95 masks offer the highest level of protection because they protect against both large and small particles rather than just large particles." and if worn as instructed, they can block 95% of particles in the air. However, they are not designed to last for very long. For this proposal, it was agreed that the masks would be made of new, environmentally friendly materials. The suggestion compromised was for N95 masks made out of new materials. The idea of making the respirators out of washable material for them to last a long time seemed efficient in our view.

"Using an N95 mask to protect yourself from pollutants, dust particles, and more? You must be aware that most N95 masks available in the market are meant for limited usage and cannot be washed. But if you want to go for a wise purchase, you can go for a washable N95 mask that can be gently cleaned to ensure proper health and hygiene levels."

-Aorohy Kapoor for his article for The Times in India, "N95 masks: Washable & affordable choices for your safety"

Using washable N95 Masks would additionally reduce how much money people would spend on masks, yes. As Cestus Armored Gloves' article compares reusable masks to disposable ones, it said that reusable masks are the best option for people outside of the healthcare field, better food for the environment, and tend to be more comfortable.

We will also be relying on using existing infrastructure to stockpile on these masks, such as MTA buses, street cleaners, garbage trucks and emergency vehicles.

Link:

<https://www.nytimes.com/wirecutter/reviews/best-cloth-face-masks/>

<https://www.ama-assn.org/delivering-care/public-health/what-doctors-wish-patients-knew-about-wearing-n95-masks#:~:text=There's%20added%20protection%20with%20N95s,-%E2%80%9CNow%2C%20more%20than&text=%E2%80%9CThis%20is%20the%20reason%20that,rather%20than%20just%20large%20particles.%E2%80%9D>

<https://cestusline.com/blogs/news/reusable-face-mask-vs-disposable>

<https://timesofindia.indiatimes.com/most-searched-products/health-and-fitness/health-care/washable-n95-masks-affordable-choices-to-breathe-clean-air-outdoors/articleshow/81774842.cms>

Budget:

Necessity:	Cost:
Gas	
Workers	\$200,000 for a thousand workers working 8 hours.
Masks	\$1.5 Million

**Table 1:** The costs for new workers, gas for the vehicles and the masks.

The above table 1 shows the cost for the masks, payment to new workers under a 8 hour workday, and gas for the vehicles.

**Description of our Soltuion**

Due to the coronavirus epidemic and concerns related to airborne pollutants, such as the recent air quality incident caused by the Canadian wildfire; the demand for face masks is expanding at an exponential rate. However, there is no system in place to distribute high-quality masks quickly and efficiently to solicited regions that need them. Our solution is to add inventory to existing stockpiles of masks throughout the city. Table 2 shows existing locations throughout the metro area that are suited to house such stockpiles.

[add table that includes the stadiums, hospitals, CUNY ... etc]

Select hospital; two per borough.

CUNY Colleges

All Stadiums

-Yankee Stadium (Bronx)

-Madison Square Garden (Manhattan)

- Barclay Center (Brooklyn)
- Citi Field (Queens)
- Metlife Stadium (New Jersey)
- Kenneth P Lavallo Stadium (Long Island)
- The armory (Manhattan)
- Ichan Stadium (Randalls Island)
- USTA Bille Jean King National Tennis Center (Queens)
- Richmond County Bank Ballpark (Staten Island)

After the sites are identified, our saluting uses existing artificial intelligence algorithms such are the traveling salesman problem [sitation needed] to find the most efficient routes throughout the city while minizing the resource required to do so. by using current infrastructure such as MTA buses, sanitation trucks, and emergency vehicles as a form of delivery system.

Why it'll work.

In 2023 New York has a population density of 421 people per square mile despite its 47,126 square mile size. In 2010, the population was around 8,175,133, with an average density of just under 28,000 persons per square mile. As shown in Figures 1 and 2.

According to the figures, the rate of population growth is up 1.1% over the previous year when childbirth and immigration are factored in.

Figure 1: NYC Density Chart in 2010

# New York City<sup>in 3D</sup>

Census tract population density, 2010

Population - 8,175,133 Source: 2010 Census

- > 100,000 people per square mile
- > 80,000 people per square mile
- > 60,000 people per square mile
- > 40,000 people per square mile
- > 20,000 people per square mile
- 0 - 20,000 people per square mile

