Spring 2014

Matters Of Air

Franklin Romero Jr.

MATTERS OF MATERIA

FRANKLIN ROMERO JR
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"They knew everything about bullets, shells, rats, death mud, and fear- but air, they did not feel air, they just breathed it. And then, from this ugly, slowmoving, greenish cloud lingering over them, air is being removed. They begin to suffocate. Air has entered the list of what could be withdrawn from us.

- Bruno Latour

"We know nothing about the body until we know what it can do, in other words, what is affects are, how they can or cannot enter into composition with other affects, with the affects of another body.. to destroy that body or to be destroyed by it.. to exchange action and passions with it or to join within composing a more powerful body"

- Deleuze and Guattarri

"We have the power to create the territory of our own existence through the things (and territories) we conceptualise. Within this context the power of urban artefacts is in their ability to enable a deeper understanding of the possible realities lurking in the world."

- David Gissen

"Why advocate the vitality of matter? Because my hunch is that the image of dead or thoroughly instrumentalized matter feeds human hubris and our earth-destroying fantasies of conquest and consumption. It does so by preventing us from detecting (seeing, hearing, smelling, tasting, feeling) a fuller range of the nonhuman powers circulating around and within human bodies. These material powers, which can aid or destroy, enrich or disable, ennoble, or degrade us, in any case call for our attentiveness, or even "respect" (provided that the term be stretched beyond its Kantian sense)."

- Jane Bennett

RESEARCHING AIR

8 CLAIM

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10 DIRTY MATTERS

The reality of the situation is that the current architectural object is incapable of drastically changing or fixing the air pollution problem. In many ways it itself is part of the problem.

12 MANIPULATING MATTER

If the air pollution problem is capable of degrading our bodies and our quality of living so drastically, then matter and energy can likewise stimulate and create new experiences.

14 AUDIENCE

The project seeks neither to be dystopian nor utopian, but wants to communicate, create and represent a potential reality.

16 PROJECT

A hypothetical future will be used to explore the creation of a network of genetically modified systems deployed at the scale of Beijing in reaction to an inevitable air pollution problem.

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Air is a banality.

21 POLLUTED AIR

Polluted air is not.

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Sources are not always anthropogenic, or primary. Gases and compounds released into the atmosphere constantly undergo transformations.

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"Air pollution is typically an issue that can best be resolved through legislative action aimed at emmission sources, by establishing controls..

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There are many types of pollutants. These are some of them.

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Air pollution thus constitues what Garrett Harding would call 'A tragedy of the commons,' with no possible way to bound this object legally, it has come to terrorize any and everyone that breathes, regardless of your direct contribution in its making..

44 OUTSOURCED PRODUCTS, IMPORTED AIR

"We've outsourced our manufacturing and much of our pollution, but some of it is blowing back across the Pacific to haunt us," Steve Davis, a scientist at University of California Irvine, said.

48 THE ECONOMIC ENGINE

China has undergone a very rapid economic growth since the economic reforms began in 1978.
At the same time, the country has been transformed into world's largest producer of carbon emmissions. China is now the greatest polluter in the world, with the US right behind.

50 BURNING A PAST TO BUILD A FUTURE

Coal consumption in China is the primary actor contributing to both economic growth and degradation of the air quality.

52 COAL: A RELIANCE OR DEPENDENCY?

China's structural dependency on coal is unbelievable as much as it is detrimental to the air quality, increase in pollution emissions are not only predicated on this resource they have the greatest impact. Increase in pollution levels in this century are inevitable.

55 COAL PROCESSES

Coal mining results in many processes essential for growing economies, manufacturing, construction and energy are entire dependent.

57 COAL: A RELIANCE OR DEPENDENCY?

China's coal mining, energy and steel producing sectors are all run by state-owned companies, begging the question, "is change even as profitable for the Country?"

58 THE PARADOX OF ENERGY PRODUCTION:

Beijing is the capital of an economic engine, and is itself a machine of political, financial and energy production consequentially afflicted by the tainted air of its own acceleration.

60 A REGIONAL AIR POLLUTION PROBLEM:

Beijings air pollution is not a simple problem, air is an interconnected system of local, regional, continental, and global influence.

62 LIFE IN THE CITY

Beijing's air is oppressive. It limits public interaction and destroys street activity.The experience of urban living is lost in Beijing due to the presence of pollution.

66 CAPTURING POLLUTION

Source controls like these pollution prevention devices are abstractions of atmospheric principles of particulate sedimentation.

80 COMBATING MALIGNANT AIR

Beijing's air is oppressive. It limits public interaction and destroys street activity.The experience of urban living is lost in Beijing due to the presence of pollution.

90 BIBLIOGRAPHY

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CLAIM

ARCHITECTURE HAS THE POTENTIAL TO BRING A CONSCIOUS AND LIVELY POLITICAL ATTENTION TO OUR EXPERIENCES WITH MATTER.

CONTEXT: DIRTY MATTERS

The reality of the situation is that the current architectural object is incapable of drastically changing or fixing the air pollution problem. In many ways it itself is part of the problem.

Air pollution is an imbalance of airborne terrestrial matter that produces unwanted effects on other material bodies. This boundary-less, scale-less and heterogeneous entity is an invasive matter/energy residue that supersedes political, social, spatial, territorial, glandular and even cellular boundaries. It is a transcontinental system that envelops and intoxicates insides and outsides rendering the architectural object a benign form of protection.

This airborne matter is changing the physical, social, political, sensorial, and emotional life of our cities, and in many cases the experience of urbanity is lost due to its own degraded air. Pollution renders the most vital necessity for living organisms into a noxious form of betrayal inducing a social paranoia. In Beijing, contaminated air transforms the public into anonymous mask-wearing beings. These faceless beings are many times encouraged to stay indoors, due to the city's hazardous air conditions. This internalization alienates us from each other, from our environment, and a common sense of political engagement.

THE REALITY OF THE SITUATION IS THAT THE CURRENT ARCHITECTURAL OBJECT IS INCAPABLE OF DRASTICALLY CHANGING OR FIXING THE AIR POLLUTION PROBLEM. IN MANY WAYS IT ITSELF IS PART OF THE PROBLEM.

So how can architecture intervene?

The reality of the situation is that the current architectural object is incapable of drastically changing or fixing the air pollution problem. In many ways it itself is part of the problem.

Excessive air pollution is an issue that is best resolved through legislation, and cooperative engagement prior to its release into the earth's atmosphere. After pollutants are released into the atmosphere, mechanical and technological interventions become futile apparatuses for controlling or removing the problem, if anything their mere existence contributes to it.

Processes used to manufacture these objects are inextricably tied to the creation of pollution in the first place. Making machines to clean up externalities created by other machines renders the human being a "sex organ" for the reproduction of a never ending problem. Thus an architectural response is needed that breaks us away from this system, and reacts to it.

MANIPULATING MATTER

If the air pollution problem is capable of degrading our bodies and our quality of living so drastically, then matter and energy can likewise stimulate and create new experiences.

Architecture can be thought of as a manipulation of matter and energy towards the creation of a human environment. Architects are composers of matter. Buildings are not simply organizations of space and program, they are matter/energy configurations composed of the same material as our air, the earth and our bodies. The same atoms running through your veins at some point in time might have been part of a train track, or made up the composition of another organism.

If the air pollution problem is capable of degrading our bodies and our quality of living so drastically, then matter and energy can likewise stimulate and create new experiences. With 50% of humanity now establishing an urban population, the species' lived experience is dependent on our corporal dialogue with manipulated matter, making architects into agents responsible for its configurations.

Although there is a threshold at which invisible stimuli becomes visible or sensed, air pollution reveals that our bodies are dependent on our environments for their health whether we sense it or not. Our constructed environments shape the way our bodies develop, the sicknesses that afflict them, the emotional stability we maintain, and the amount of stress that affects them.

More than 1 million people are dying prematurely every year from air pollution in China. Pollution kills not only the people which inhabit the city, pollution kills exchange. It sends a clear message that, "humans no longer belong to the city."

Air pollution is a complex byproduct of energy exchange processes that architecture rarely acknowledges directly. Our buildings are inert and lifeless objects that only seem animated through human use, what if our buildings could animate our lives?

AUDIENCE

The project seeks neither to be dystopian nor utopian, but wants to communicate, create and represent a potential reality.

This research is significant to the current trend of globalizing cities across Asia, as well as 'first world' countries. Air is 'the last common property' and is now a resource that has been monopolized by large energy production companies, our modes of transportation, industry, manufactoring and our own insatiable buying and energy-spending habits. How can Architecture determine a course for publicly engaging the individual within the city? How can this project provide an answer by posing a question?

Image
"Respiratory Dog"
COHEN VAN BALEN

PROJECT

"BREATHING IS A BIOLOGICAL CADENCE THAT PHENOMENALLY AND PHYSIOLOGICALLY INVIGORATES MATTER WITH A SENSE OF LIFE."

A hypothetical future will be used to explore the creation of a network of genetically modified systems deployed at the scale of Beijing in reaction to an inevitable air pollution problem.

These experimental objects will be varieties of genetically modified respiratory system-like filtration cavities. They will be used to simultaneously produce clean air and vibrant environments within Beijing while expanding the material, sensorial, and emotional life of the city past its lifeless cold hard-edged objects.

Sited in air pollution, these breathing nodes will become site-specific interactions with air informed by the material compositions of their surroundings: reacting, fusing, morphing, and deforming them to articulate a new contextualized organism that straddles a dangerous and uncanny threshold between the purely synthetic and the seemingly natural.

Breathing is a biological cadence that phenomenally and physiologically invigorates matter with a sense of life. Air pollution threatens living organisms' ability to breathe and contributes to their physical degradation. By bringing attention to these processes through these objects a new sensorial, emotionally powerful and didactic architectural object can arise. Like the subtle warmth, palpitations, and drooling gentleness of a puppy napping on your lap, our cities can awaken with sense of life that connects us emotionally to them.

Image
Beijing
via Reuters

“I dislike seeing the horrible brown earth, and the sea, and the stars when it is dark. I get no ideas in an air-ship.”

“I do not get them anywhere else.”

“What kind of ideas can the air give you?”

He paused for an instant.

-”Machine stops” - E.m. Forster

“One need only look at China’s turbo growth in architectural and urban development to see the proportional relationship between building and pollution. If architecture is part of the pernicious planning that will end with the end of the world, we either have to give up the habit we call ‘architecture’, or architecture has to give up its habit of conniving in an end-of-world future.”

-”Your Architecture Has Consequences”

AIR

Air is a banality.

Largely ignored on a day to day basis, air is simply background noise, heard, felt or smelled. Air constitutes matter/energy interactions that stimulates experience and has major effects on our daily lives. Air is atmosphere. Atmosphere is the suspension of particles close to the surface of a planet due to its gravitational pull. Air is densest closest to the surface and becomes thinner and thinner as altitude is increased, eventually dissipating into space. There is no true boundary between earth and outer space, but in the lowest atmosphere, the troposphere is where all life resides.

The troposphere is where all of our interactions with air occur. Weather, currents, heat transfers, pressure changes, and other atmospheric activities predominantly occur due to interactions between the Earth's surface and the sun: topography, surface states of matter, heat transfers, molecular transformations, and chemical compositions all affect the sensual qualities of air.

Air is one of the most amorphous bodies through which all things on earth communicate. Without it, architectural space would constitute a vacuum where sound, smell and taste would be impossible, aside from being able to breathe.

By volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.039% carbon dioxide, and small amounts of other gases. On average it contains about 1% of water vapor.

POLLUTED AIR

Polluted air is not.

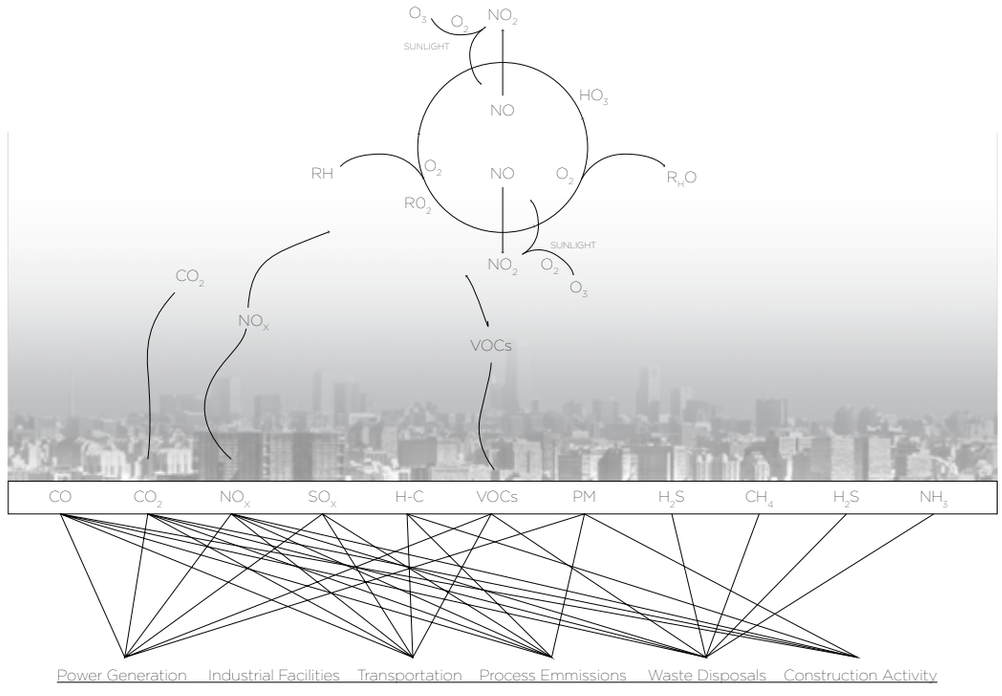
Because of pollution bodies are swindled and suffocated of the most essential life force, and also degrade in this invasive solution. Air is said to be polluted when it is out of balance. Polluted air is an imbalance of suspended matter which produces unwanted effects on organic and inorganic bodies. Air pollution represents a degradation of the most basic and fragile components of life; clean air then becomes the most necessary.

WHAT CONSTITUTES AIR POLLUTION IN URBAN ATMOSPHERES?

Sources are not always anthropogenic, or primary. Gases and compounds released into the atmosphere constantly undergo transformations.

Urban Anthropogenic sources, are most of the focus within this project. The troposphere is the layer of atmosphere between 0 and 15 km away from the Earth's surface. 80% of the atmosphere's mass and 99% of its water vapour and aerosols constitute this layer. Most of our weather and almost all of the air pollutants emitted from near-surface sources are transported, dispersed, transformed and removed in this part of the lower atmopshere.

TROPOSPHERIC OZONE FORMATION



URBAN ANTHROPOGENIC SOURCES

Power Generation	Industrial Facilities	Transportation	Process Emmissions	Waste Disposal	Construction activities
Fossil Fuel Energy	mining, refining, manufactouring, smelting, paper, chemical, metallurgical, pharmaceutical etc.	Automobiles, buses, trucks, airplanes, boats, and other mobile sources	Furnaces, heating homes, office, commercial buildings, fireplaces, stoves, open air burning	Urban household, commercial industrial waste products disposed in landfills, sewage treatment, compost, and refuse dumps	Land clearing, demolition, digging, grinding, paving, painting, and other consruction-related activities.

OTHER SOURCES

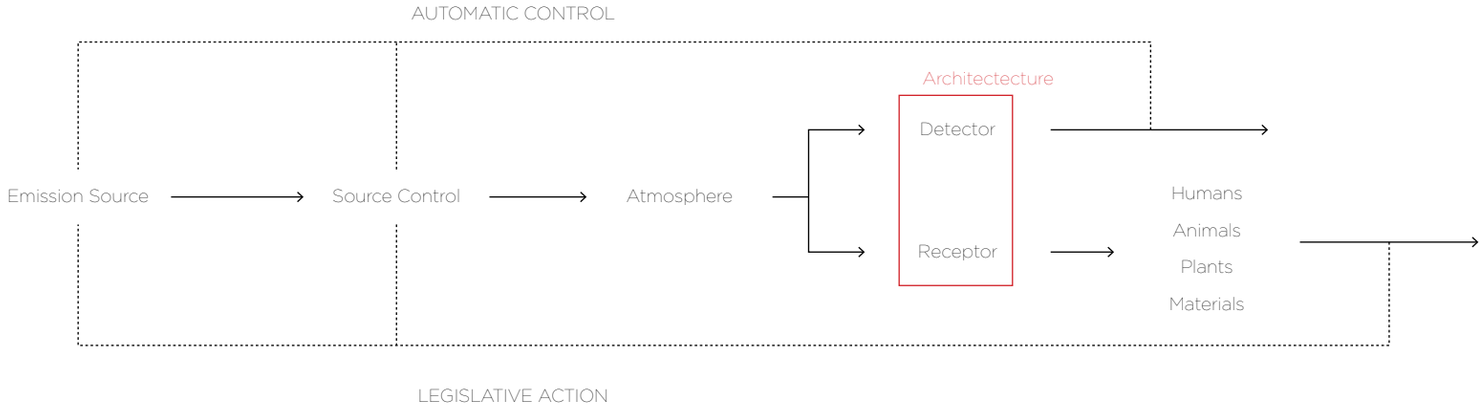
BIOGENIC, GEOGENIC SOURCES	RURAL ANTHROPOGENIC SOURCES
Wind Erosion	Dust Blowing
Forest Fires	Slash Burning
Volcanic Eruptions	Pesticides
Biogenic Emmissions	Decaying Wastes
Sea Spray and Evaporation	Soil Emmissions
Soil Microbial Processes	
Natural Decay of Organic Matter	
Lightning	

emission sources:
Anthropogenic sources
Biogenic sources
Geogenic sourcces

source controls:
Pollution prevention devices
Government Regulation
Market controls

atmosphere:
Diffusion into atmopshere
Transport via winds
Secondary Chemical
Transformations

effects on receptors:
Diffusion into atmopshere
Transport via winds
Secondary Chemical
Transformations

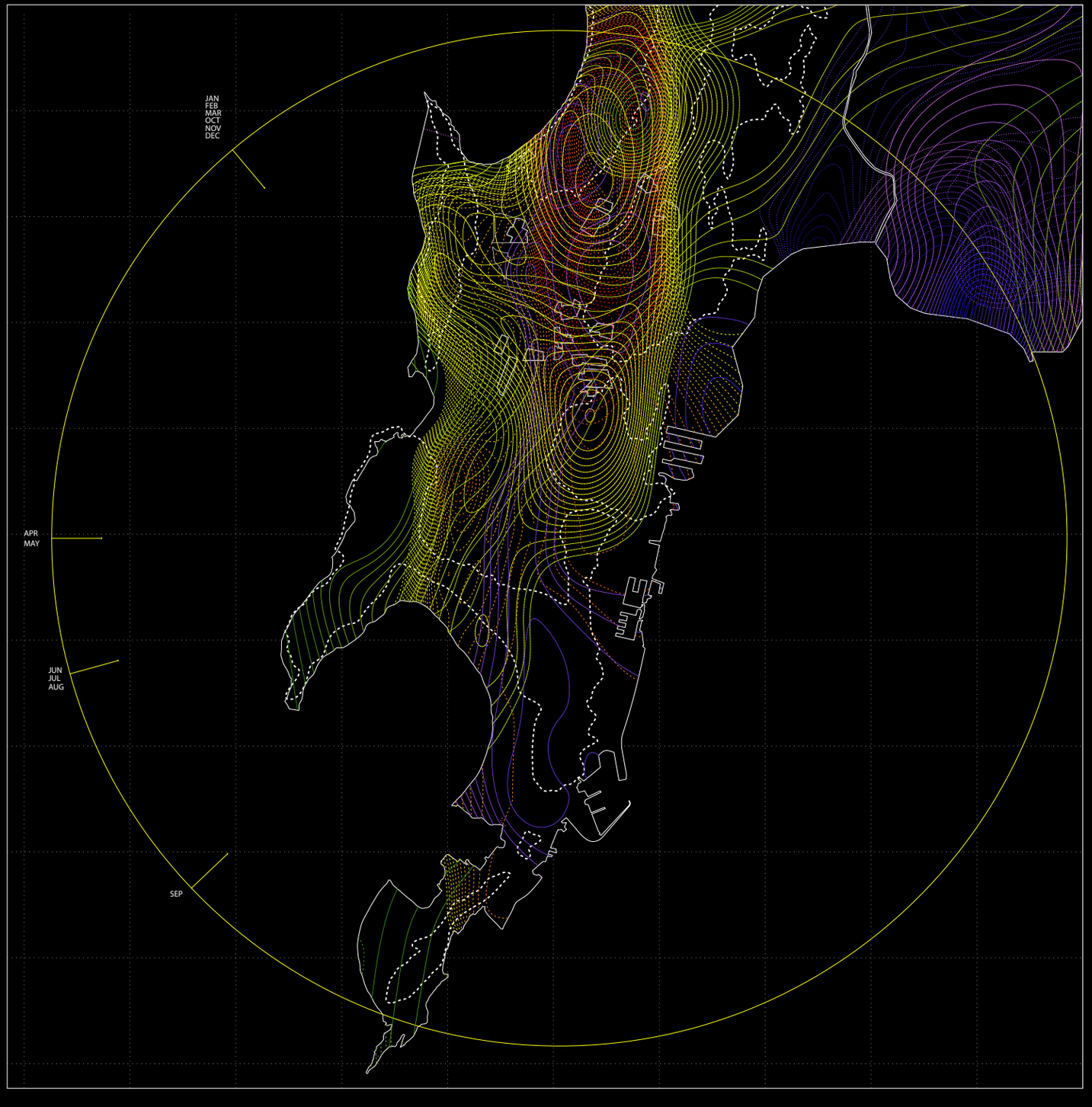


Seinfeld, 1986

URBAN RESPONSE TO AIR POLLUTION

"Air pollution is typically an issue that can best be resolved through legislative action aimed at emmission sources, by establishing controls..

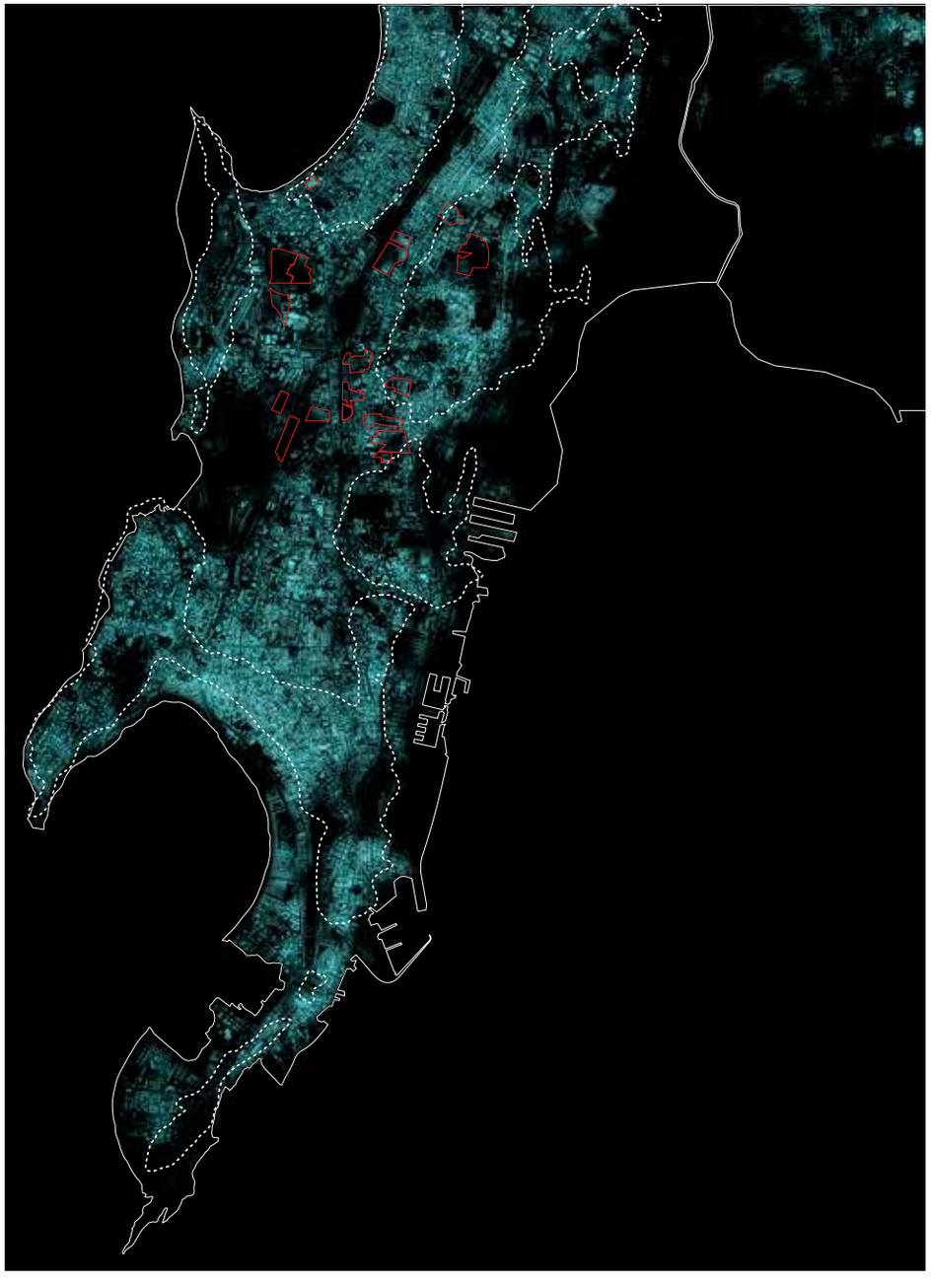
The pollution problem in China is structural dilemma. The companies creating emmissions are all owned by the same state that regulates them. This creates a conflict of interests, incentivizing profit maximization but no change.



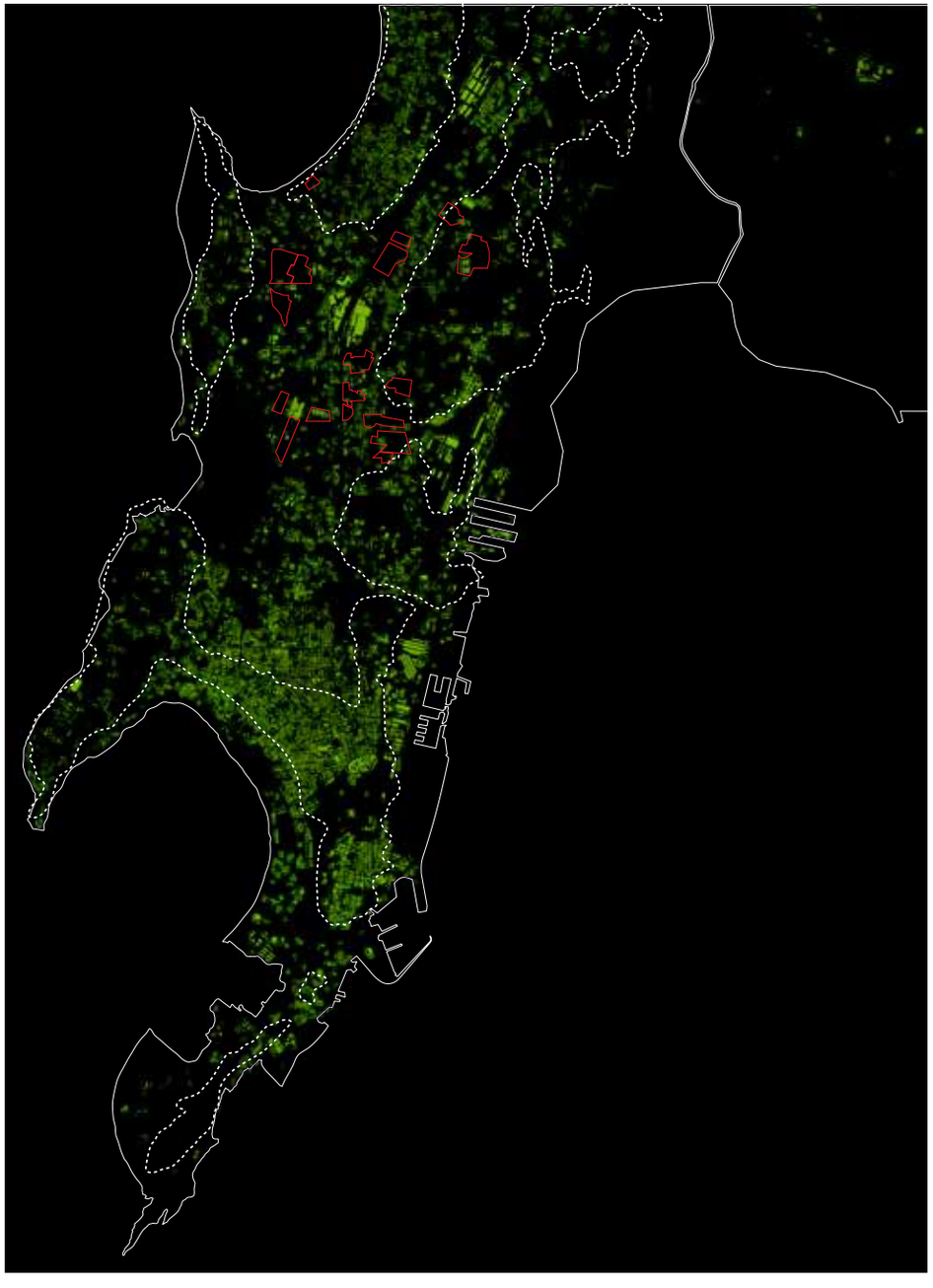
POLLUTION IN URBAN ENVIRONMENTS: MUMBAI

Mumbai is a useful case study because India, even as a steadily developing nation, makes their detected pollution information, and city-related data readily available to the public.

Using Mumbai as a case study for studying air pollution allows for an examination of relationships between point, line, and area sources, climate informations in conjunction with accumulated pollution data from various seasons of the year.

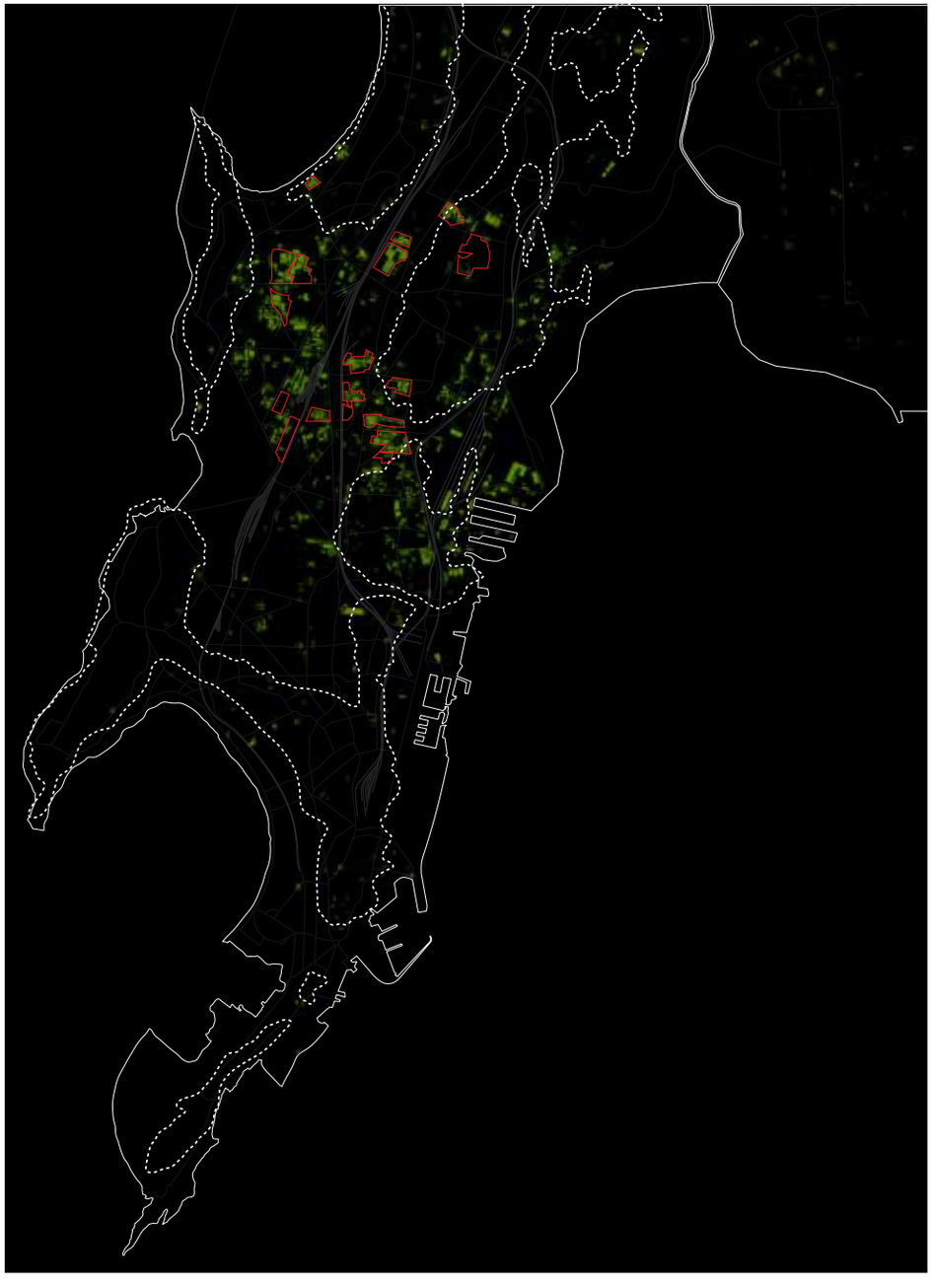


AREA SOURCES
Homes



AREA SOURCES
Commercial

LINE SOURCES



POINT SOURCES

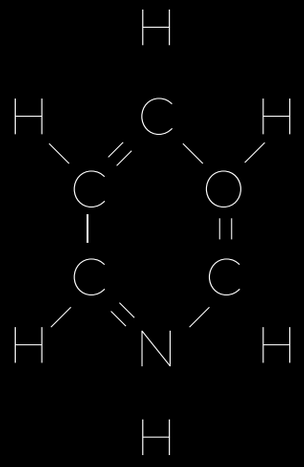
POLLUTANT CLASSIFICATIONS

There are many types of pollutants. These are some of them.

The air pollution problem in China is unclear. A mask has been created around the issue. Detection data is obscured by national governments. What has yet to be obscured is the sensual nature of the object as described by the population.

The following is a list of major pollutants.

image
painting,
butdoesitfloat.com



VOCs, CH4

ORGANIC CARBON COMPOUNDS

SOURCES

Carbon combines to form systems of chain compounds. Carbon compounds are emitted by natural sources, such as transportation, fossil fuel burning power plants, chemical plants, petroleum refineries, certain construction activities, solid waste disposal and slash burning. CH4 is the most abundant. It produced by natural wetlands and rice paddies, and mainly geogenic and biogenic sources. Based on their bonding, VOCs exist in for major groups with many compounds in each group. Anthropogenic VOCs inlcude benzen, toluene, formaldehyde, vinal cloride, phenols, chlorofom, and trichloroethlene. The more toxic of these are called hazardous organic compounds.

BEIJING PRIMARY SOURCES

Methane sources are related to rice patties near Beijing but are not that detrimental.

SECONDARY SOURCES

VOCs are imortant ingredients of photochemical chain reactions with nitrogen oxides (NOx) in the presence of warm sunlight, which result in photochemical smog and ozone.

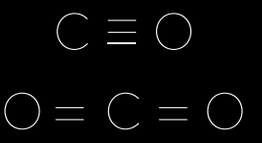
RECEPTION

CH4 is colorless, odorless and flammable.

There are many different kinds of VOCs.

REACTIONS

VOCs are important towards the formation of NO2, ozone and other free radicals.



COX

INORGANIC CARBON COMPOUNDS

SOURCES

Formed by “incomplete and complete combustion of carbon-containing fossil fuels (coal, oil, charcoal, and gas), incineration of biomass or solid waste, and anaerobic decomposition of organic material and in respiratory process of plants and animals.” Anthropogenic sources are considered most responsible for increased concentrations. Concentrations have been observed to be increasing at the rate of .5 percent per year.

BEIJING PRIMARY SOURCES

CO and CO2 sources are related to all carbon-combustion based sources. Most sources for both of these emissions are natural, but through recent combustion technologies, these concentrations have been increased due to humanity.

RECEPTION

CO is colorless corrosive gas.

It is odorless and nonirrating.

Not considered a dangerous air pollutant.

CO2 is a colorless.

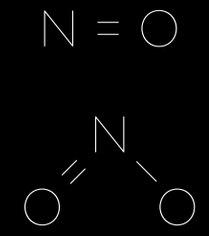
It is odorless.

It is still highly toxic through asphyxiation.

REACTIONS

NO2 absorbs sunlight, more strongly in the yellow to blue end of the visible solar radiation near ultraviolet to form nitric oxide and atomic oxygen.

With the body, it combines with hemoglobin of the blod and reduces the blood’s ability to carry oxygen to cell tissues.



NOX
NITROGEN COMPOUNDS
SOURCES

Nitrogen is a stable gas that makes most of our atmosphere. It also occurs in a large number of nitrogen compounds, which are produced by high-temperature combustion and natural processes such as bacterial fixation, biological growth and decay, lightning, volcanic activity, and forest fires.

N20, NO and NO2 are the most significant oxides found in large concentrations.

BEIJING PRIMARY SOURCES

NO is produced largely by fuel combustion in both stationary and mobile sources such as automobiles. .

SECONDARY SOURCES

NOx are important air pollutants that take part in photochemical reactions resulting in the formation of ozone and photochemical smog. nitrous acit HNO2, nitric acid HNO3 and nitrates are responsible for causing acidic clouds and precipitation

RECEPTION

N2O is colorless corrosive gas.
It has a non-toxic.
Also called laughing gas.
NO2 is a reddish-brown gas.
It has a pungent.
It is an irritating odor.

REACTIONS

NO2 “absorbs sunlight, more strongly in the yellow to blue end of the visible solar radiation near ultraviolet to form nitric oxide and atomic oxygen.”

SOX
SULFUR COMPOUNDS
SOURCES

Combustion of sulfur-containing fossil fuels and organic matter, biological decay, waste disposal, pulp and paper manufacturing, smelting processes, sea spray and evaporation from the ocean.

BEIJING PRIMARY SOURCES

Fossil fuel burning sources, wind blown emmissions from other cities, waste diposal. SO2 are mainly emmitted from anthropogenic sources. SO3 occurs at about 1 to 5% of SO2 concentrations.

SECONDARY SOURCES

Most of SO3 occurs in the atmosphere as a secondary pollutant resultant of SO2 oxidation. SO3 and water interact to form sulfuric acid (H2SO4) which, in turn, may react with ammonia to become sulphate ion SO4. Sulphate aerosol or acid mist is frequently associated with haze and poor visibility in urban atmospheres.

RECEPTION

Sulfur Dioxide is colorless corrosive gas.
It has a pungent, irritating odor.

PM 2.5
UPPER CUT OFF
FINE PARTICULATES

PM 10
COARSE PARTICULATES
ACTUAL DIAMETER:
TEN MICROMETERS

PM
PARTICULATE MATTER
SOURCES

Atmospheric particulates or aerosols include all liquid and solid particles, except pure water, that exist in the atmosphere under normal conditions. Most of these are direct emmissions from anthro-bio-geo sources. while others occur directly in the atmosphere through chemical transformations. These are classified into primary and secondary aerosols just like gaseous pollutants. Anthropogenic sources of PM can be divided into four broad categories: 1. Fuel combustion 2. Industrial process fugitive particulate emissions. 3. Nonindustrial fugitive emissions, and transportation sources. Nonindustrial fugitive emissions can sometimes exceed those of industry.

BEIJING PRIMARY SOURCES

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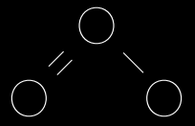
SECONDARY SOURCES

Atmospheric aerosols are solids or liquids ranging in size, once they enter the atmosphere, will under go nucleation, condensation, coagulation and aggregation processes.

RECEPTION

Sulfur Dioxide is colorless corrosive gas.
It has a pungent, irritating odor.



O3
OZONE
SOURCES

Although it naturally forms at high altitudes in the stratosphere by photochemical reactions involving molecular and atomic oxygen in the presence of high-intensity ultraviolet radiation. Ozone is beneficial by absorbing ultraviolet radiation from the sun and thus protecting the life on earth from radiation. In the troposphere Ozone is near the ground and thus effects terrestrial matter in damaging ways.

BEIJING PRIMARY SOURCES

Fossil fuel burning sources, wind blown emmissions from other cities, waste diposal. SO2 are mainly emmitted from anthropogenic sources. SO3 occurs at about 1 to 5% of SO2 concentrations.

SECONDARY SOURCES

Ozone is used as an indicated pollutant for photochemical oxidation products. The toal mixture, frequently referred to as smog, causes eye irritation, lachrymation, and respiratory difficulties for people walking or working outdoors.

RECEPTION

Ozone is a bluish gas.
It has an acrid, biting odor that is distinctive characteristic of photochemical smog.

AIR AS A GLOBAL OBJECT

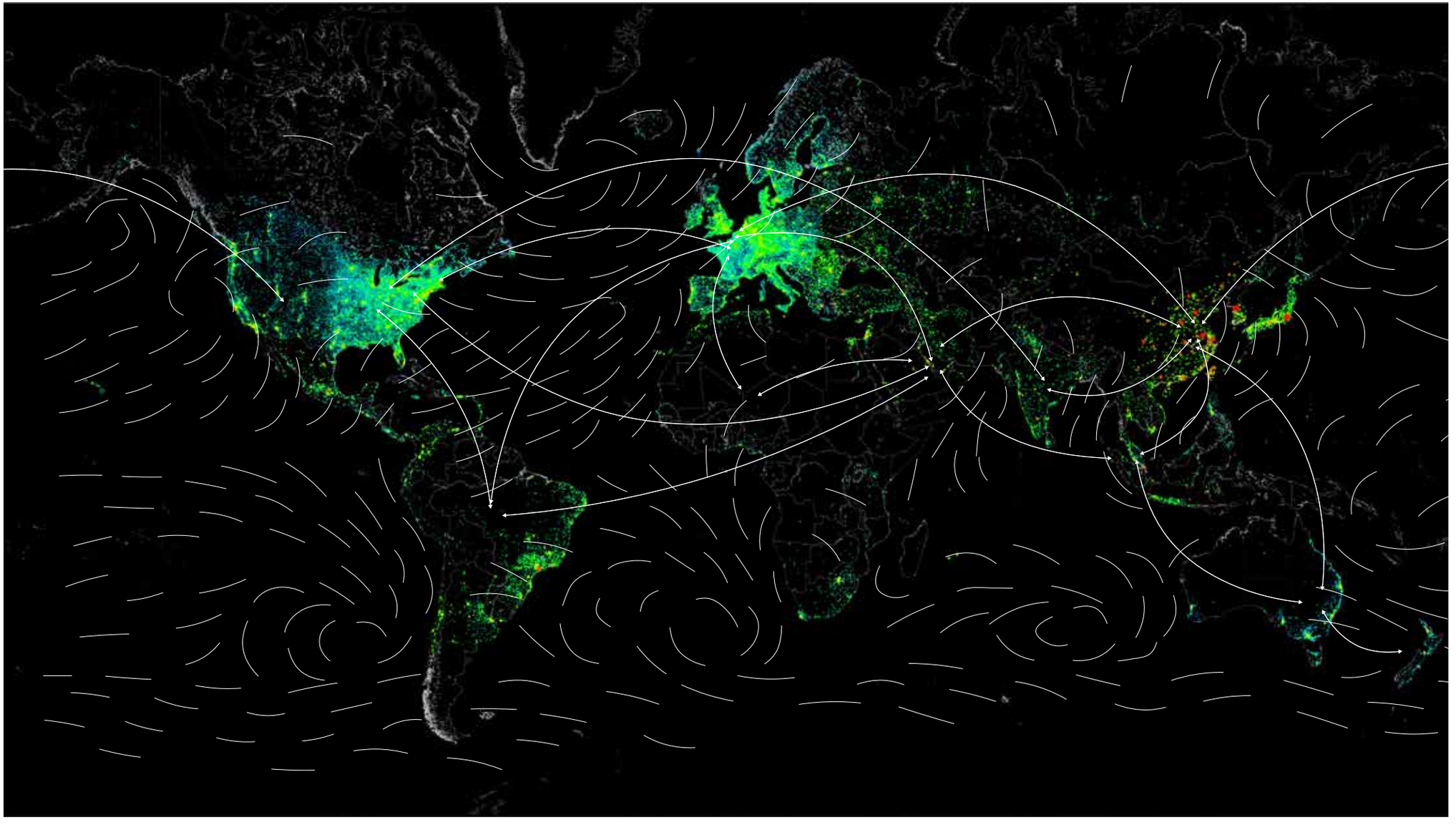
Air pollution thus constitues what Garrett Harding would call 'A tragedy of the commons,' with no possible way to bound this object legally, it has come to terrorize any and everyone that breathes, regardless of your direct contribution in its making..

Peter Sloterdijk captures a problem that air poses for all bodies on the planet. Our air is not only a metaphor for the "machinations of the stock market" or the "technological info-sphere," it is a direct result of their shifts, pulls, rises and falls. As countries modernize, globalize, produce, and consume more, our laws, economics and living processes actually drastically change the composition of our air supply.

The catastrophic element in what Sloterdijk says remains potent. Air is a boundariless object at odds with the territories of politics. "Air," declared Sloterdijk in a lecture at Tate Britain, is 'the last common property.' Air pollution thus constitues what Garrett Harding would call 'A tragedy of the commons,' with no possible way to bound this object legally, it has come to terrorize any and every citizen that breathes, regardless of your participation in its making.

Air is a "potent metaphor for the invisible and, for many, incomprehensible machinations of the stock market and the technological info-sphere, both of which can cause catastrophic changes to one's life without initial detection and, again, without the possibility for an assailant to be clearly identified, denying even the possibility of plotting revenge while in the midst of personal crisis."

-Terror from the Air, Peter Sloterdijk



Wind currents, Internet map, flight strategy for major airline s overlay information collage

Our air is not only a metaphor for the "machinations of the stock market" or the "technological info-sphere," it is a direct result of their shifts, pulls, rises and falls.

OUTSOURCED PRODUCTS, IMPORTED AIR

"We've outsourced our manufacturing and much of our pollution, but some of it is blowing back across the Pacific to haunt us," Steve Davis, a scientist at University of California Irvine, said.

Trans-boundary pollution is a problem that stems from consumption habits. Linking pollution to the manufactoring of exports destined from China to the U.S. and Europe a report in the "Proceedings of the National Academy of Sciences" by scientists at University of Calitfornia Irvine showed the interrelations between air and consumption. The molecules that constitute this pollution also caused weather disturbances and climate change.

Black carbon molecules, nitrogen oxides, and carbon monoxide originating in manufactoring plants in China were blowing over the Pacific, directly effecting pollution levels on the west coast of the United States Weather patterns accross the Northern Hemisphere are said to be effected as well, as air pollution is "resulting in thicker and taller clouds and heavier precipitation." Black carbon also has impacts on melting glaciers, where the particles are captured and contribute to the heat capture and dissipation that leads to their melting.

Even considering issues, international climate change talks are difficult. On its pollution recently, "China argues that developed nations should take responsibility for a share of China's greenhouse gas emissions, because they originate from goods demanded by the west."

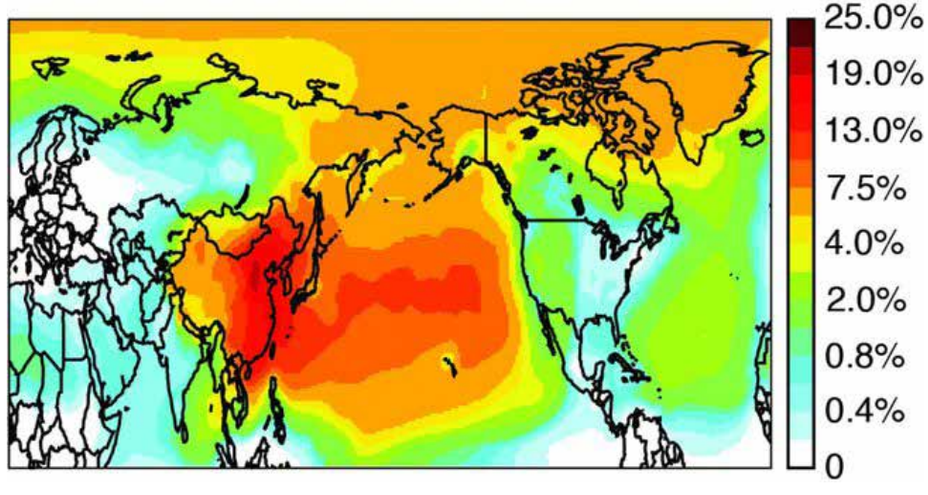
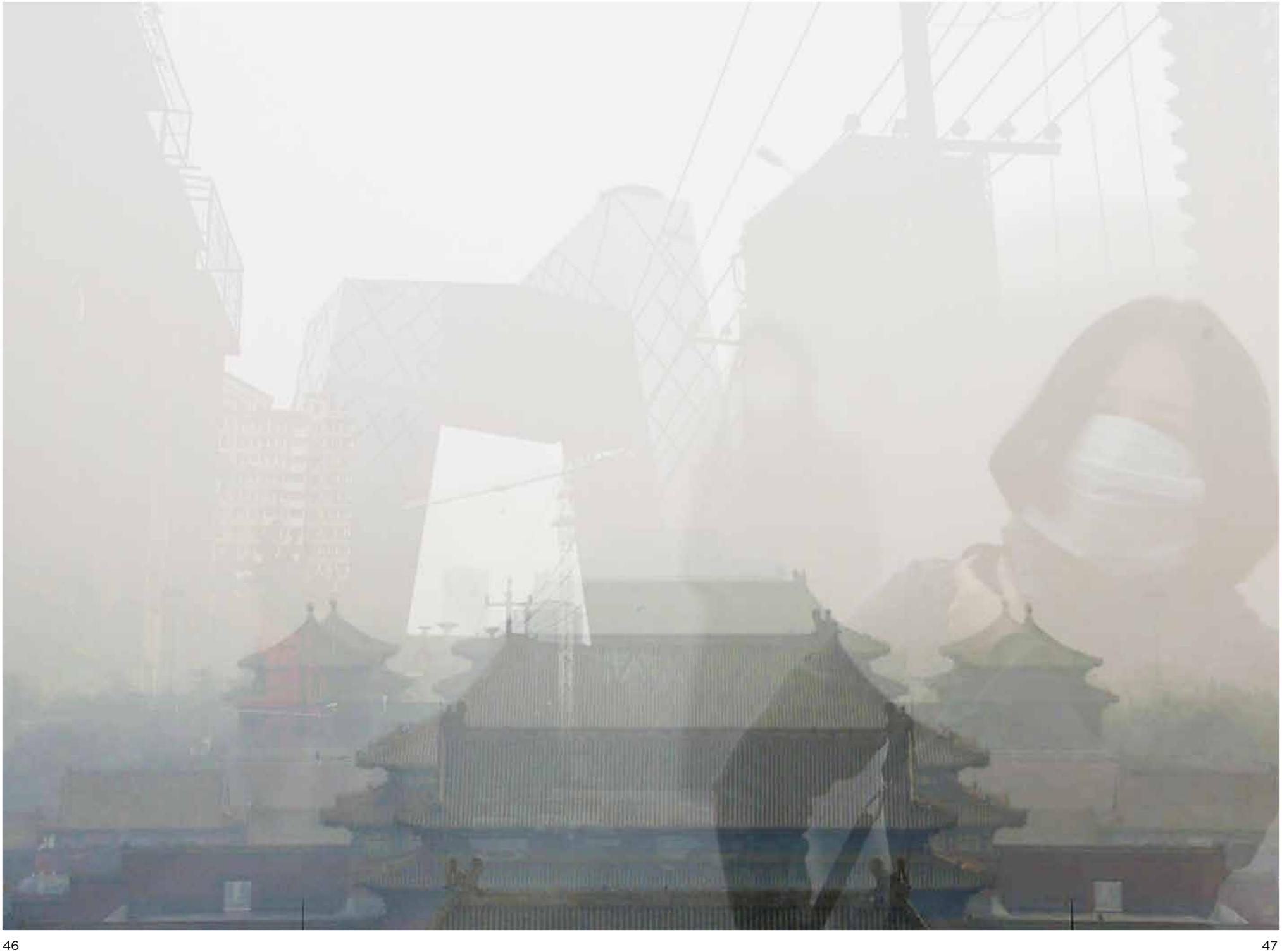


Image
Annual average percent of black carbon pollution related to Chinese exports. UCI

http://www.washingtonpost.com/world/study-pollution-from-chinese-factories-is-harming-air-quality-on-us-west-coast/2014/01/21/225e9b1e-8281-11e3-bbe5-6a2a3141e3a9_story.html
http://www.bbc.com/news/science-environment-27027876
http://news.uci.edu/press-releases/made-in-china-for-us-air-pollution-as-well-as-exports/



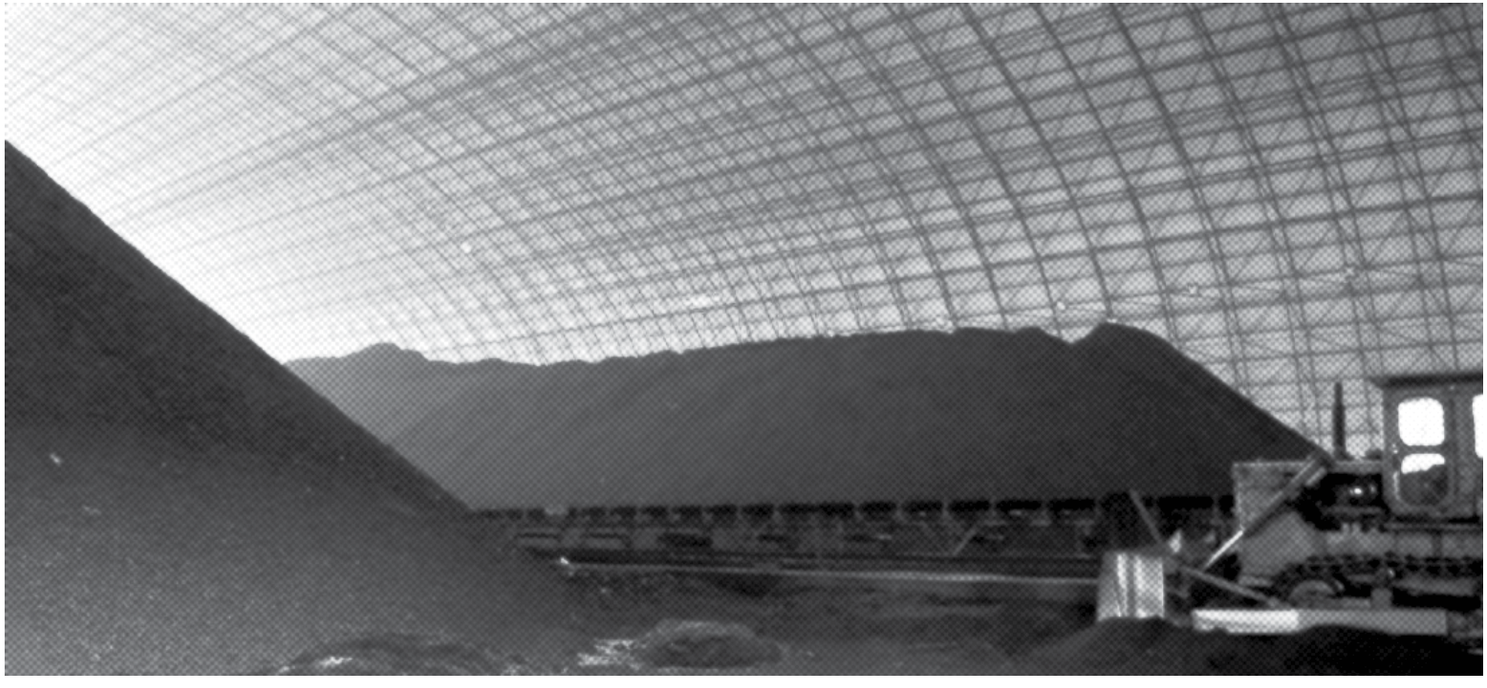


Image
Coal storage in China, source: reuters

THE ECONOMIC ENGINE

China has undergone a very rapid economic growth since the economic reforms began in 1978.

In the past three decades, the annual economic marker or GDP (the market value of all officially recognized final goods and services produced within a country in a year) in China has consistenly been above 8% (sustanaible economies are around 5%). From 1980-2005 the urban population in China increased from 19.6% to 40.5%. This growth has resulted in an increase in energy consumption, automotive production and use, construction booms, etc. Many of these effects have become major contributors to the air pollution problem in China.

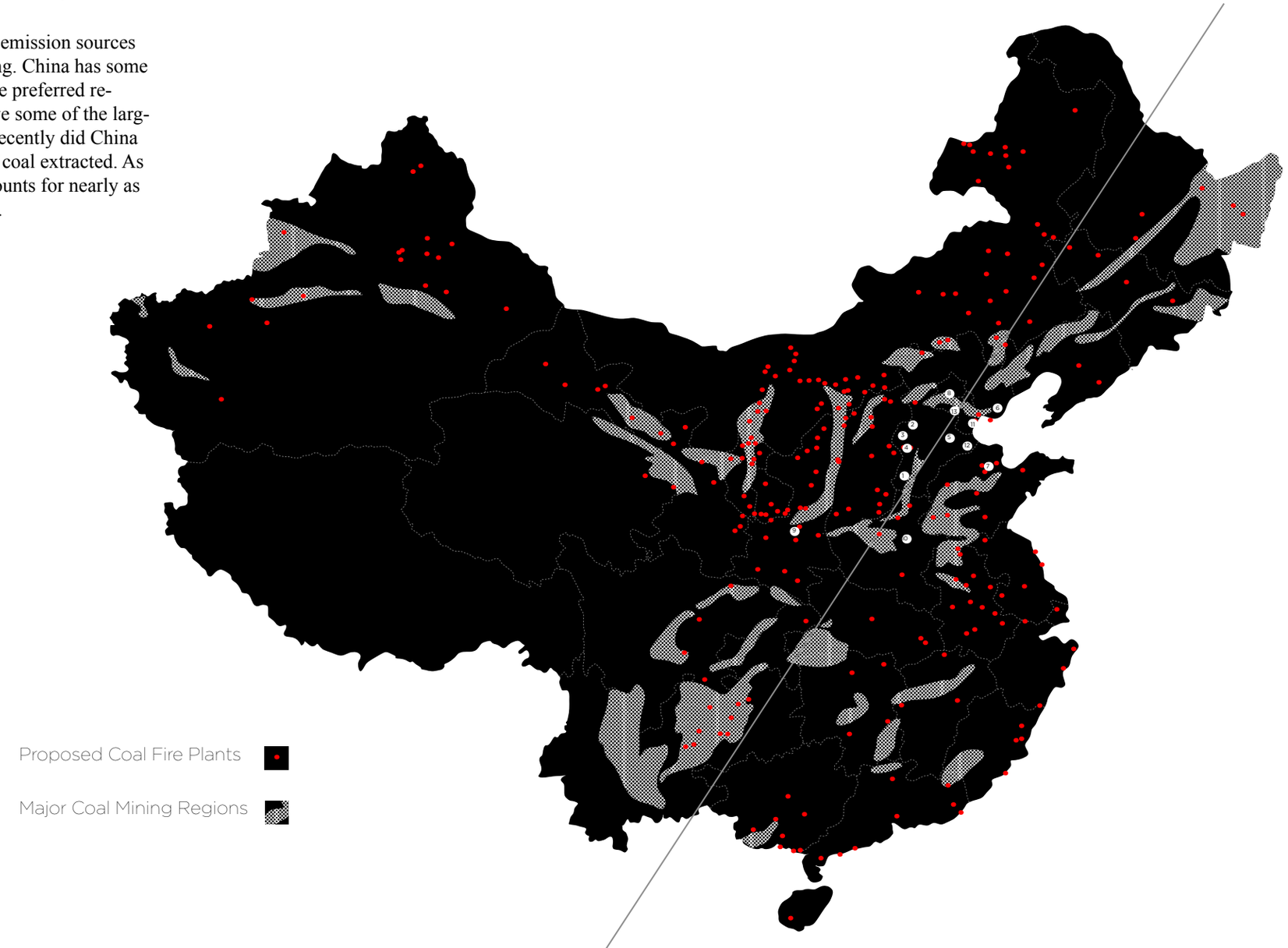
At the same time, the country has been transformed into world's largest producer of carbon emmissions. China is now the greatest polluter in the world, with the US right behind.

In January 2013 smog limited visibility to les than 200 meters, closing highways, grounding flights, forcing people to stay indoors. Even with environmental regulations similar to those imposed by the United States, China's own state-owned enterprise structure proves to dissuade any possibilities of true environmental change.

BURNING A PAST TO BUILD A FUTURE

Coal consumption in China is the primary actor contributing to both economic growth and degradation of the air quality.

Some of the largest pollution emission sources are energy production and manufactoring. China has some of the largest in the world and coal is the preferred resource. China and the United States have some of the largest deposits of coal in the world. Only recently did China surpass the United States for amount of coal extracted. As of 2013, China's coal consumption accounts for nearly as much as the rest of the world combined.



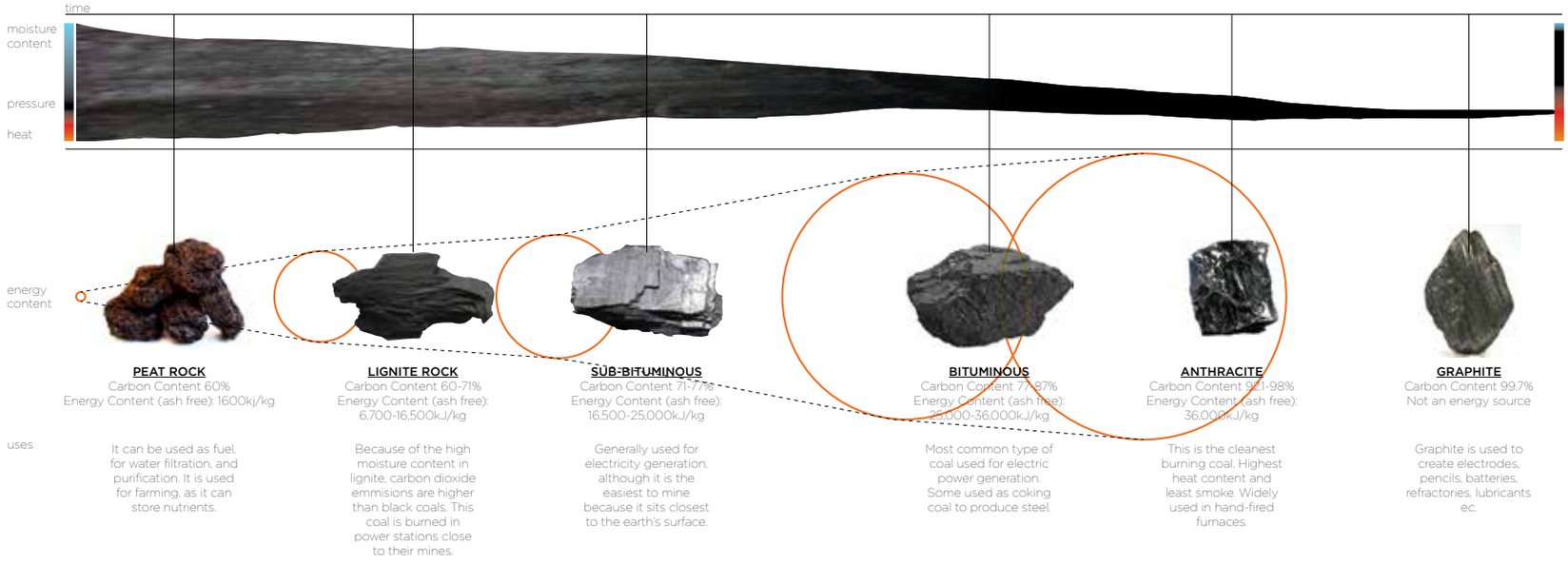


Image
Shower at a coal mine
Source
The Atlantic

COAL: A RELIANCE OR DEPENDENCY?

China's structural dependency on coal is unbelievable as much as it is detrimental to the air quality, increase in pollution emissions are not only predicated on this resource they have the greatest impact. Increase in pollution levels in this century are inevitable.

Although coal is a major emission source of sulfates, black carbon and other pm 2.5 particles, its use is growing. Even with their current pollution problems, in 2013, China's planning authority approved 15 new large-scale coal mines increasing capacity by 100 million tonnes. This amount is equivalent to 10% of the US's annual usage. It is estimated that China's total coal production capacity could be 4.7 billion tonnes by 2015.

Image
coal mine
Source
BBC

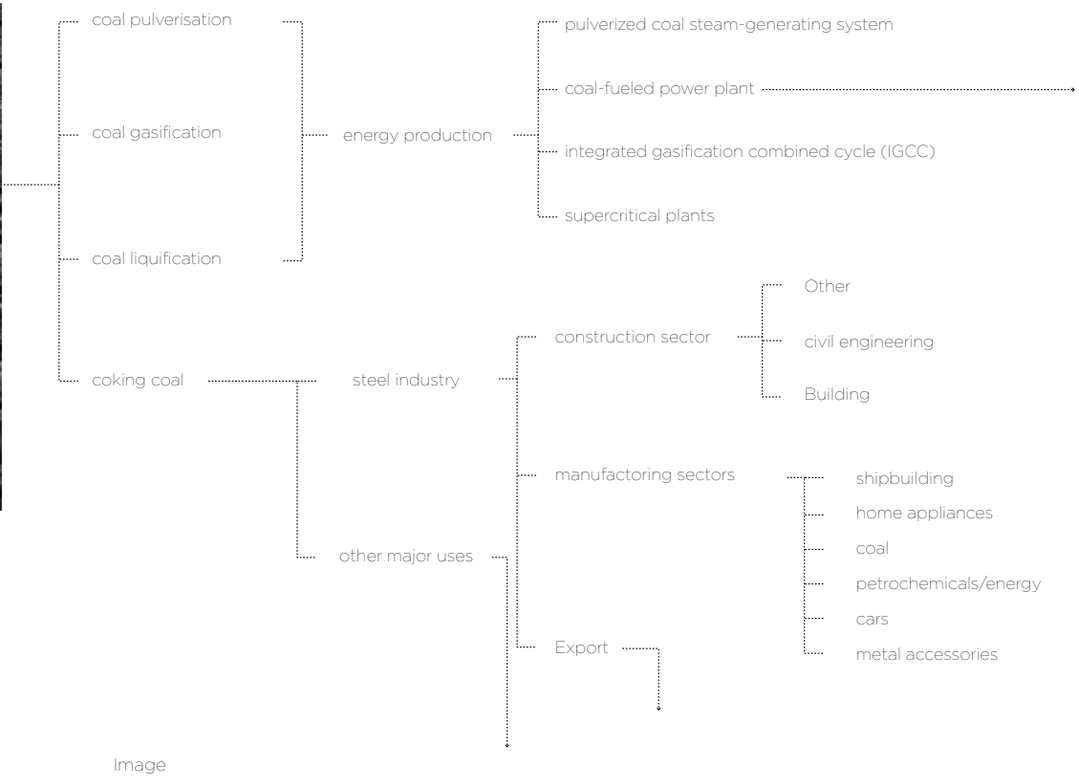


Image
coal plant under
construction
Source

COAL PROCESSES

Coal mining results in many processes essential for growing economies, manufacturing, construction and energy are entire dependent.

Coal mining results in many processes essential for growing economies, manufacturing, construction and energy are entire dependent.

LARGEST COAL MINING COMPANIES

山东能源 SHANDONG ENERGY

冀中能源股份有限公司 JIZHONG ENERGY RESOURCES CO.,LTD.

神华集团有限责任公司 SHENHUA GROUP CORPORATION LIMITED

同煤集团 DATONG COAL MINE GROUP

陕西煤业化工集团有限责任公司 Shaanxi Coal and Chemical Industry Group Co., Ltd.

中国中煤能源集团有限公司

山西焦煤 SHANXI COKING COAL

LARGEST STEEL COMPANIES

沙钢集团 SHAGANG GROUP

HBIS 河北钢铁集团

BAOSTEEL BAOSTEEL GROUP CORPORATION

鞍钢股份有限公司 ANGANG STEEL COMPANY LIMITED

武汉钢铁(集团)公司 WUHAN IRON AND STEEL(GROUP) CORP.

HBIS 唐山钢铁集团有限责任公司 TANGSHAN IRON&STEEL GROUP CO., LTD.

鞍山钢铁集团公司 ANSHAN IRON AND STEEL GROUP CORPORATION

CHINA PRODUCES 50% OF ALL THE STEEL IN THE WORLD.

CHINA ACCOUNTS FOR 47% OF GLOBAL COAL CONSUMPTION- ALMOST AS MUCH AS THE ENTIRE REST OF THE WORLD COMBINED.

75% OF ALL ENERGY PRODUCED IN CHINA COMES FROM COAL

COAL: A RELIANCE OR DEPENDENCY?

China's coal mining, energy and steel producing sectors are all run by state-owned companies, begging the question, "is change even as profitable for the Country?"

The Chinese Steel industry is incredibly reliant on coal. Dominated by large state-owned groups which are owned by shareholds through local authorities, provincial governments and even central authorities 70% of all steel produced uses metallurgical coal as a vital ingredient.

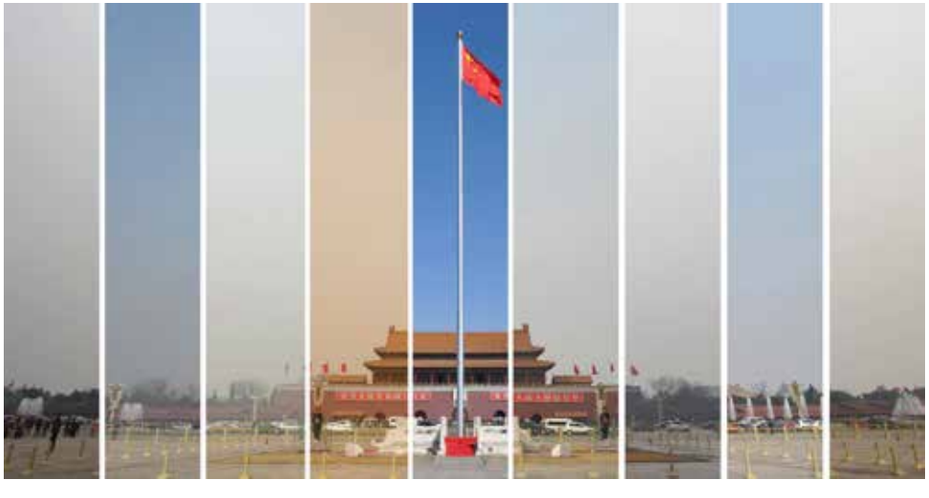
THE PARADOX OF ENERGY PRODUCTION:

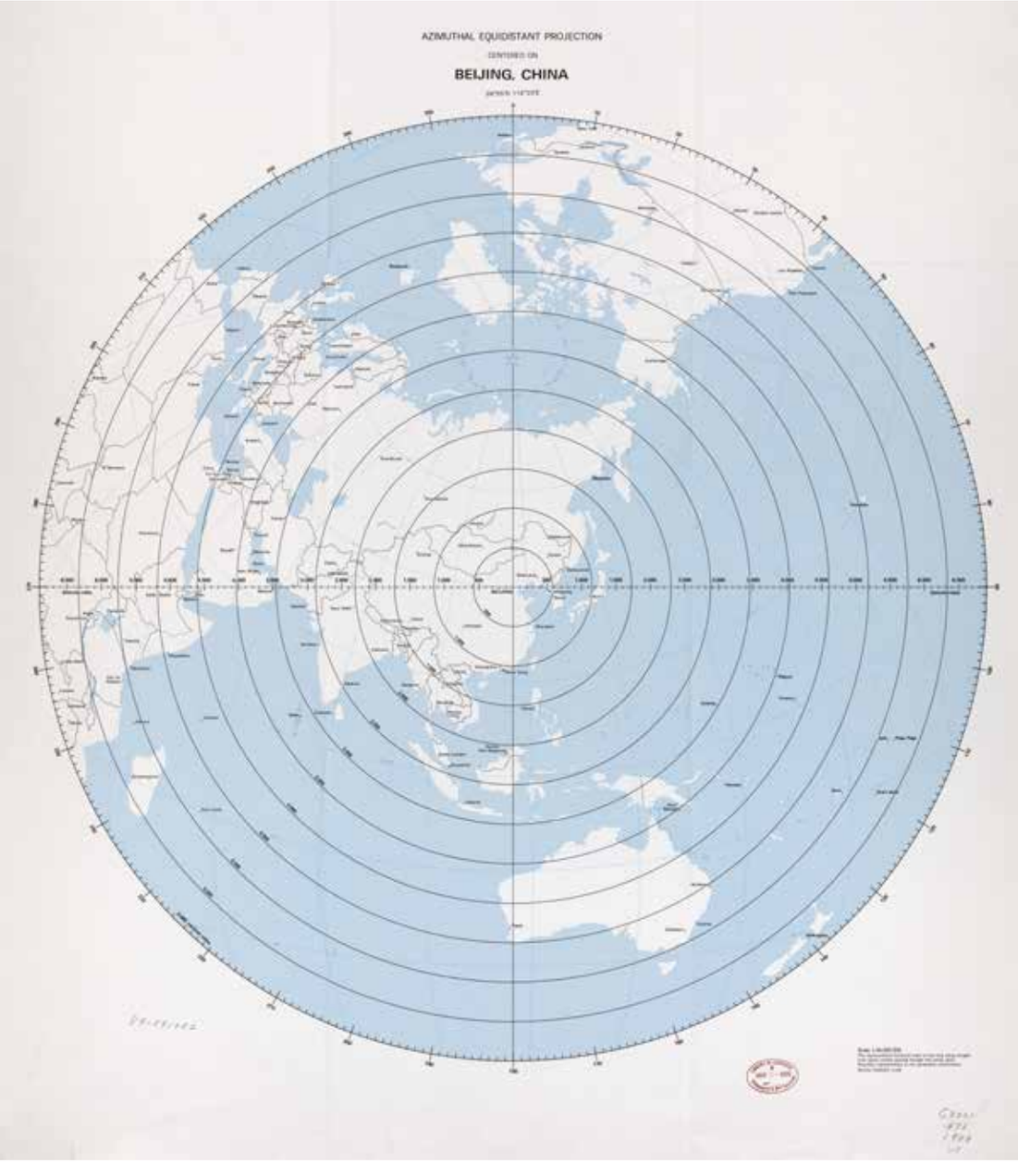
Beijing is the capital of an economic engine, and is itself a machine of political, financial and energy production consequentially afflicted by the tainted air of its own acceleration.

An economic insatiability has fetishized growth and commanded the political agenda for decades. Within a nation desiring to lift many out of poverty, and possibly make a few billionaires along the way, air pollution has not been a priority.

Beijing is the capital of China
39.9139° N, 116.3917° E

Image
coal plant under
construction
Source
The Guardian





A REGIONAL AIR POLLUTION PROBLEM:

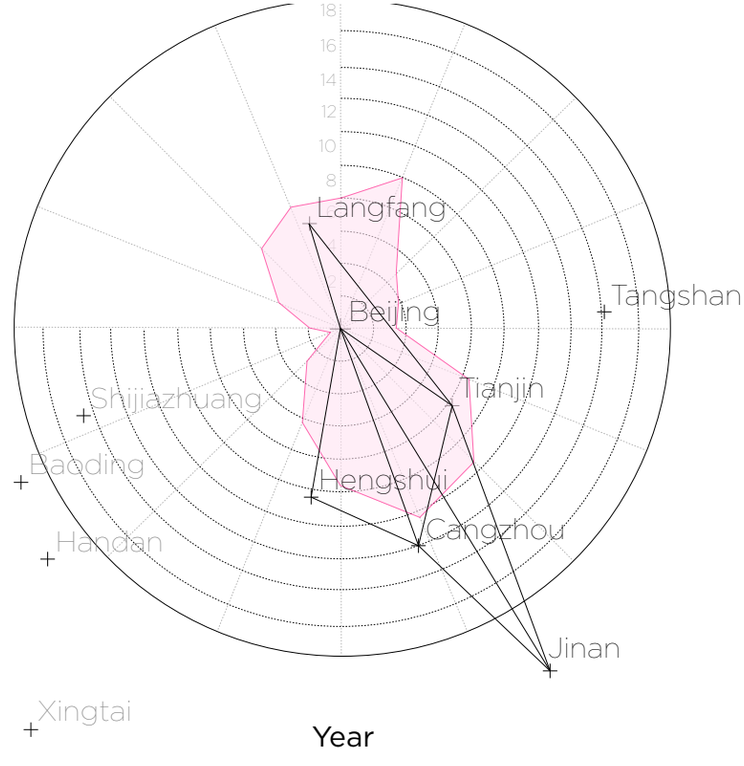
Beijings air pollution is not a simple problem, air is an interconnected system of local, regional, continental, and global influence.

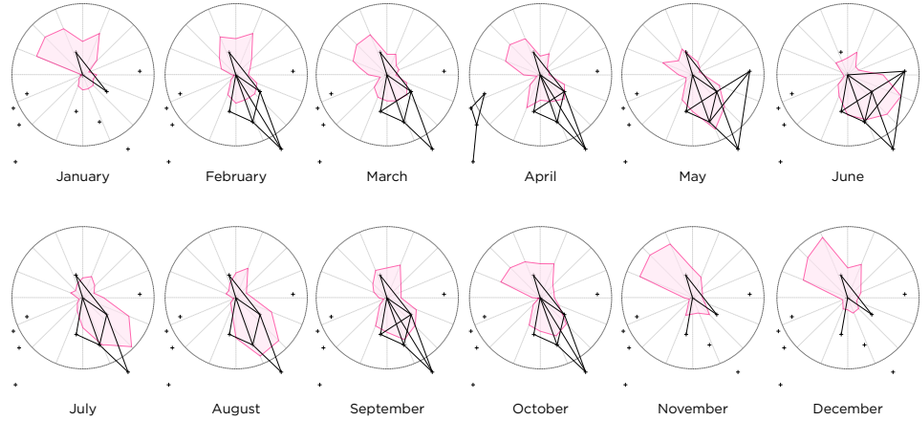
Although Beijing has moved, and removed coal plants from its surrounding urban center, created strict emissions standards for vehicles, and created license plate based driving days, pollution will still remain a problem for the city. Prior to the Beijing Olympics, tests were done and local sources indicated that 34% of PM 2.5 on average and 35%-60% of ozone during periods of high concentrations were attributed to sources outside of Beijing. This marks regional air pollution a problem for the capital.

Surrounded by three large heavily populated, urbanized and industrialized provinces: Heibei, Shandong, and Shanxi, even with Beijing's strict emissions standards in place, the capital is not capable controlling the problem. Officials have tried to improve the air quality in large cities by "imposing local coal production quotas and reducing the country's reliance on coal, including.. natural gas deals with Russia, but due to growing energy needs, demand and coal reliance is only expected to grow.

Reducing pollution in China will require an all around structural change.

Wind Relationships between proximous city centers. Beijing sits downwind from at least 5 major polluters.





IT'S SO BAD THAT PEOPLE COMMONLY WALK THE STREETS WEARING MASKS. PARENTS WON'T LET THEIR KIDS PLAY OUTSIDE" - NPR

"THE REASON I'M PROPOSING COMPENSATION IS TO LET EVERY CITIZEN SEE THAT AMID THIS HAZE, WE'RE THE REAL VICTIMS"

"INSIDE THE LIVING ROOM, WHERE THE KIDS CONSTRUCT DENS OUT OF SOFA CUSHIONS, THE LEVEL OF AIR POLLUTION - OR MORE SPECIFICALLY, FINE PARTICULATE MATTER - WAS AN ESTIMATED 208 MICROGRAMS OF $PM_{2.5}$ PER M^3"

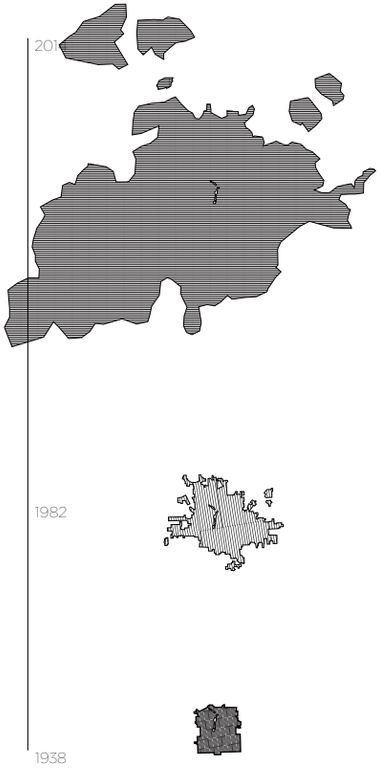
"I WOULD PERSONALLY RATHER BREATH THE AIR AT THE WORLD TRADE CENTER,' SAID EMERITUS OF PHYSICS AND ATMOSPHERIC SCIENCE AT UC DAVIS."

"WHEN YOU GET OFF THE AIR PLANE, IF YOU WERE TO TRAVEL TO BEIJING YOU WOULD IMMEDIATELY FEEL YOUR EYES STINGING AND YOUR THROAT RASPING"

LIFE IN THE CITY

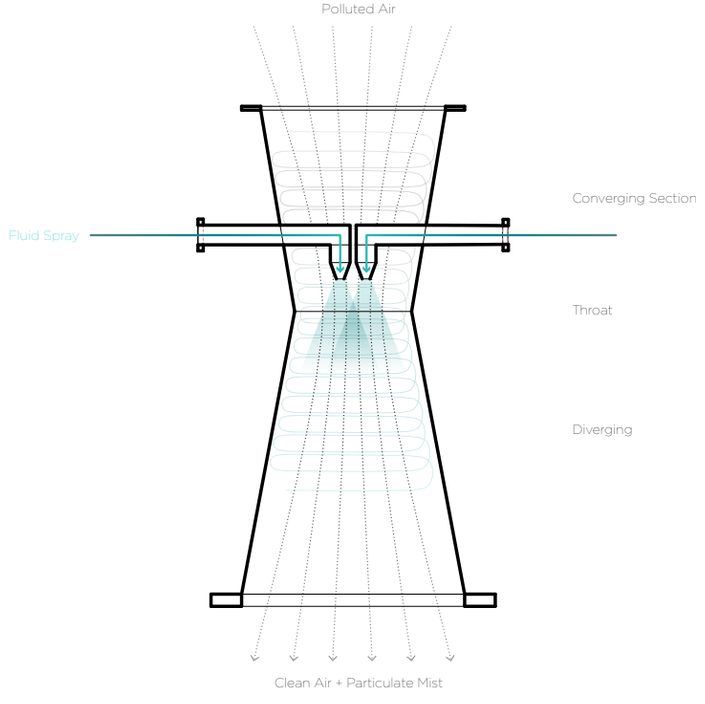
Beijing's air is oppressive. It limits public interaction and destroys street activity.The experience of urban living is lost in Beijing due to the presence of pollution.

Li Guixin is the first individual to sue the government for failing to fix air pollution problems. The man from Shijiazhuang said, "the reason I'm proposing compensation is to let every citizen see that amid this haze, we're the real victims." Although he is not a resident of Beijing, the frustration with air pollution in China is clearly evident. Although the central government has recently promised $275bn towards the issue in the next five years,


201
1982
1938

CAPTURING POLLUTION

Source controls like these pollution prevention devices are abstractions of atmospheric principles of particulate sedimentation.

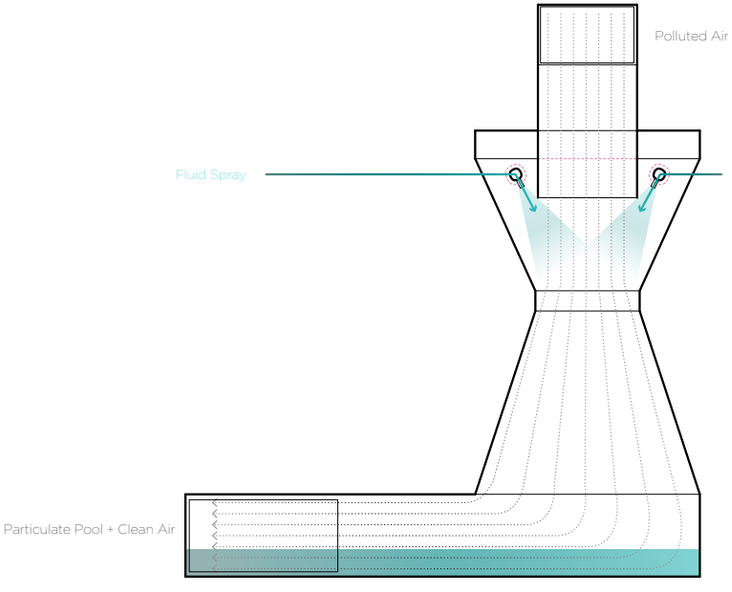


VENTURI SCRUBBER

Can be used to collect both Particulates and gaseous pollutants but are more effective in removing gas pollutants through wet deposition.

Polluted Air -> Cyclone -> Fluid Misting --> Clean Air + Particulate Mist

Pollution Control Devices ->Wet Scrubbers-> Wet --> Venturi

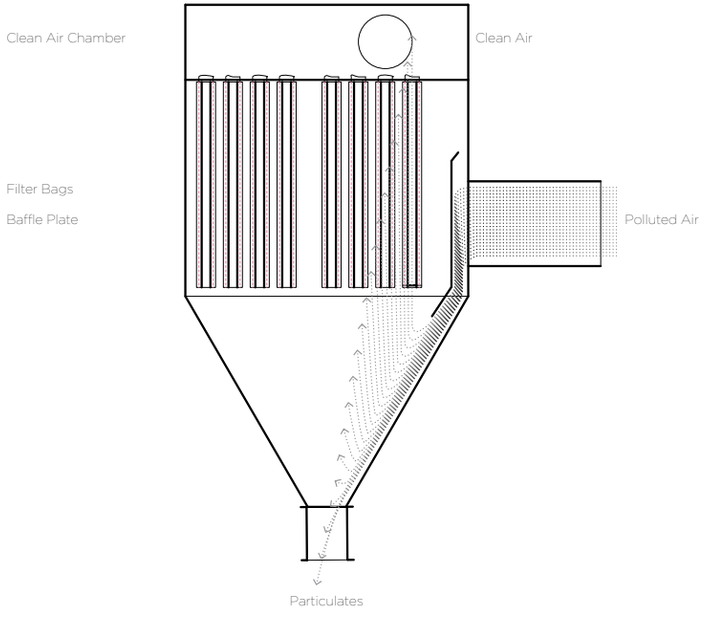


SPRAY VENTURI W/ RECTANGULAR THROAT

The throat takes a different form where turbulances are created and particulates are knocked out of the air flow.

Forced Polluted Air -> Fluid Misting --> Clean Air + Particulate Pool

Pollution Control Devices ->Wet Scrubbers-> Wet --> Venturi

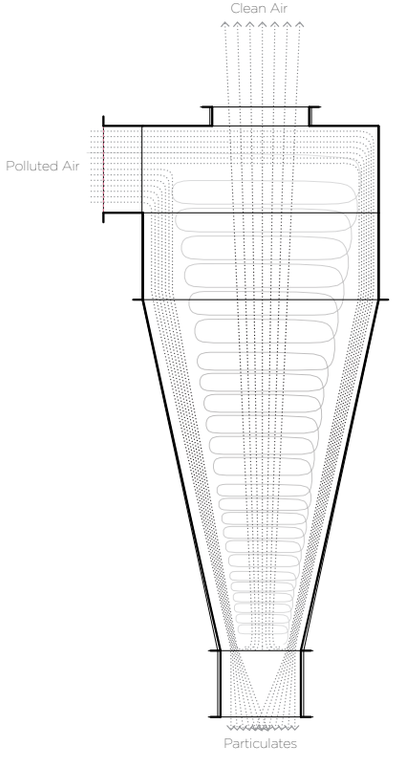


REVERSE AIR FABRIC FILTER DUST COLLECTOR

Upon entering the dust collector chamber particles strike a baffle plate, used to interrupt air flow. Larger particulates fall into a hopper. Any remaining are trapped outside of filter bags.

Polluted Air -> Baffle Plate -> Cyclone -> Clean Air

Pollution Control Devices -> Dust Collector -> Fabric Filter

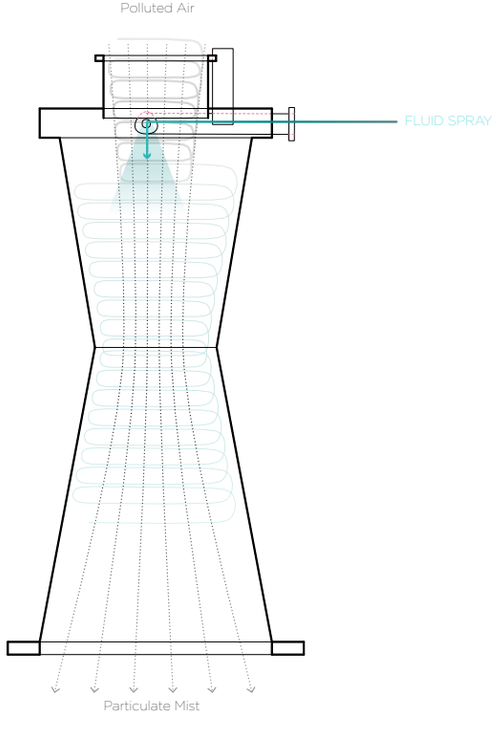


SINGLE CYCLONE

Used for dust and larger particles. Creates a cyclonic action which forces particulates down the walls and into hoppers

Polluted Air -> Cyclone -> Particulate Seperation --> Inner Cyclone --> Clean Air

Pollution Control Devices ->Dust Collectors Inertial Separators -> Multiclone Seperator

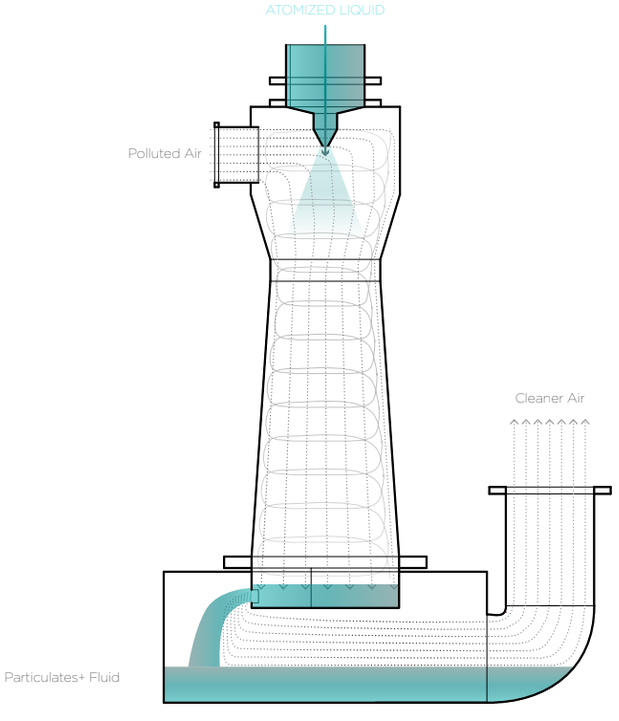


VENTURI SCRUBBER W/ A WETTED THROAT

Can be used to collect both Particulates and gaseous pollutants but mainly used for highly abrasive, or high temperature dusts

Polluted Air -> Cyclone -> Misting .> Particulate Mist

Pollution Control Devices ->Wet Scrubbers--> Venturi

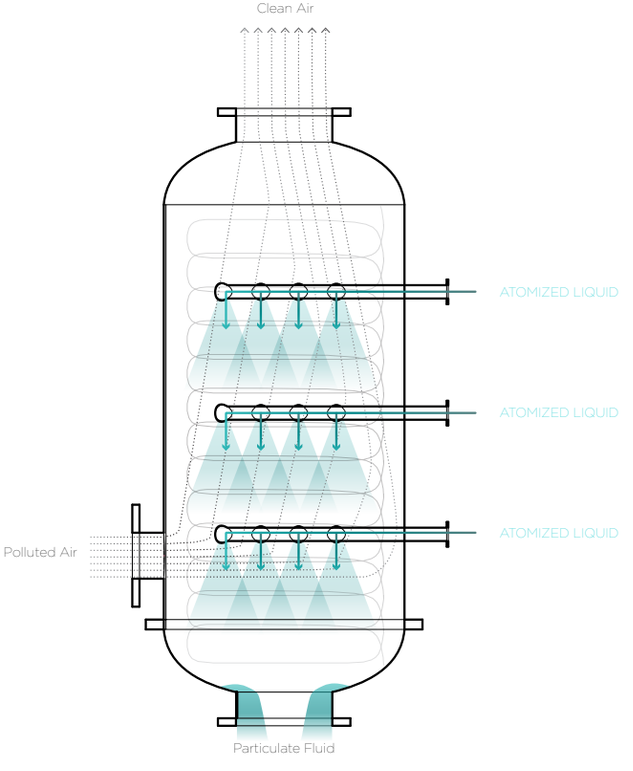


EJECTOR VENTURI

This venturi can process gas without the aid of a fan or blower. The liquid spray forms a partial vacuum inside the scrubber. Best for catching particles 1 micrometer or more.

Polluted Air -> Cyclone -> Misting .--> Particulate Pool + Cleaner Air

Pollution Control Devices ->Wet Scrubbers --> Ejector Venturi

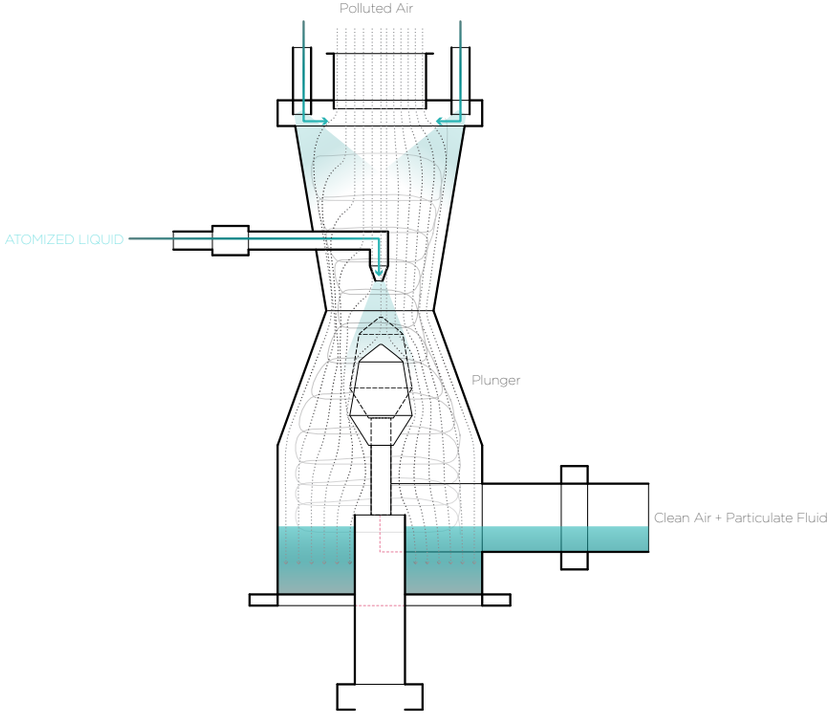


SPRAY TOWER

Countercurrent flow exposes the particul-lates scrubbing liquid, as they move up through the tower, the particulates confront nozzles spraying liquid to catch them.

Polluted Air -> Cyclone -> Misting -> Particulate Mist Seperation --> Cleaner Air

Pollution Control Devices -> Wet Scrubbers--> Spray Tower

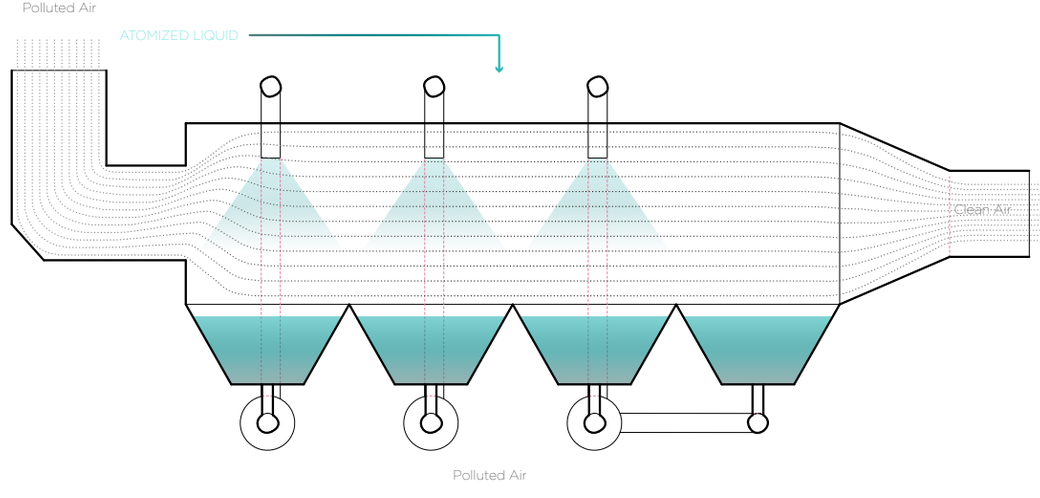


VENTURI W/ ADJUSTABLE THROAT PLUNGER

The size of the throat area is varied by moving a plunger, up or down in the throat, creating turbulance in the throat, to remove particles more efficiently.

Polluted Air -> Mister -> Particulate Pool -> Cleaner Air + Particulate Fluid

Pollution Control Devices -> Wet Scrubbers --> Venturi



CROSSCURRENT SPRAY TOWER

Can be used to collect both Particulates and gaseous pollutants but are more effective in removing gas pollutants through wet deposition.

Polluted Air -> Fluid Spray + Particulate Pool -> Cleaner Air

Pollution Control Devices -> Wet Scrubbers -> Crosscurrent Spray Tower

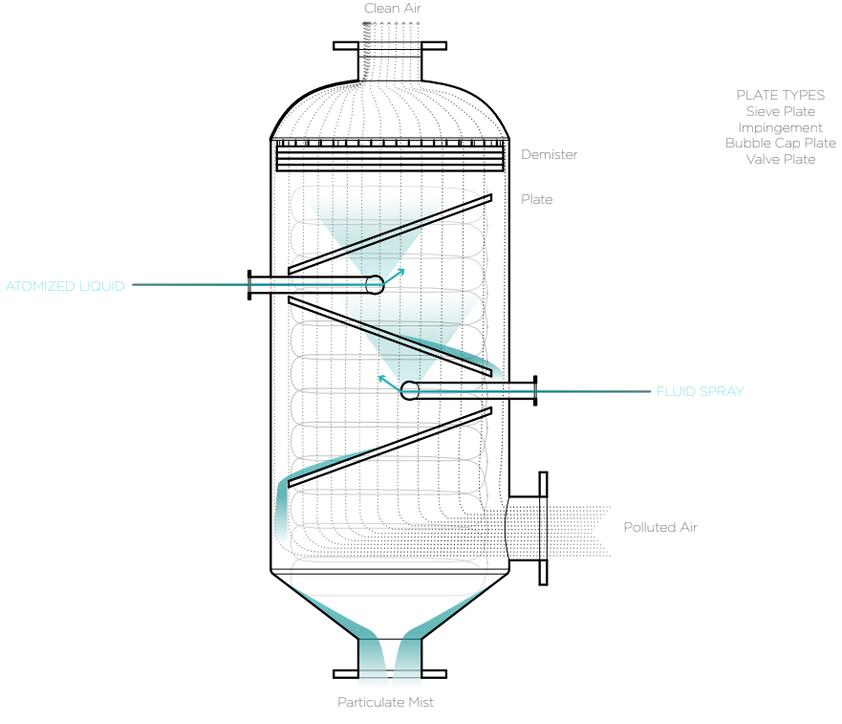
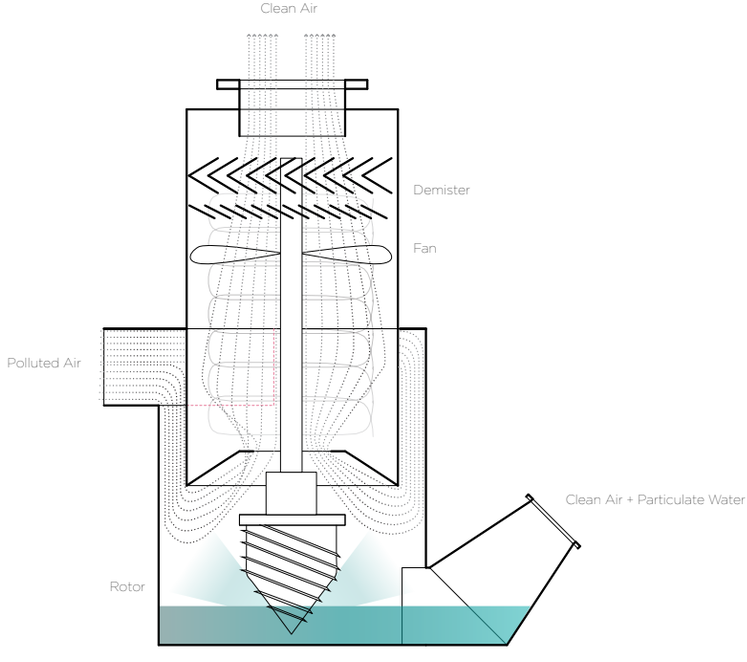


PLATE TOWER

Pollutant collection occurs on plates that atomize the liquid. Plate towers are very effective in removing gaseous pollutants and can be used simultaneously for particle removal.

Polluted Air -> Cyclone -> Misting -> Particulate Pool Seperation-> Cleaner Air

Pollution Control Devices ->Wet Scrubbers --> Plate Tower

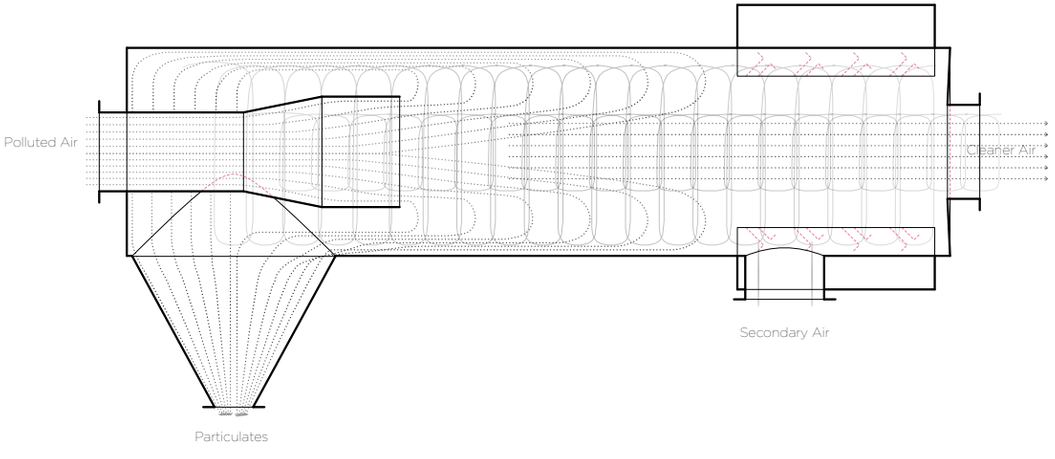


INDUCED SPRAY

This is mechanically aided scrubber that drives a rotor (used to atomize water) and a fan, for creating an updraft. These systems are advantages for requiring less space, although power requirements are higher.

Polluted Air -> Fluid Spray + Particulate Pool -> Fan -.> + Cleaner Air

Pollution Control Devices -> Mechanically-aided Wet scrubber--> Induced Spray

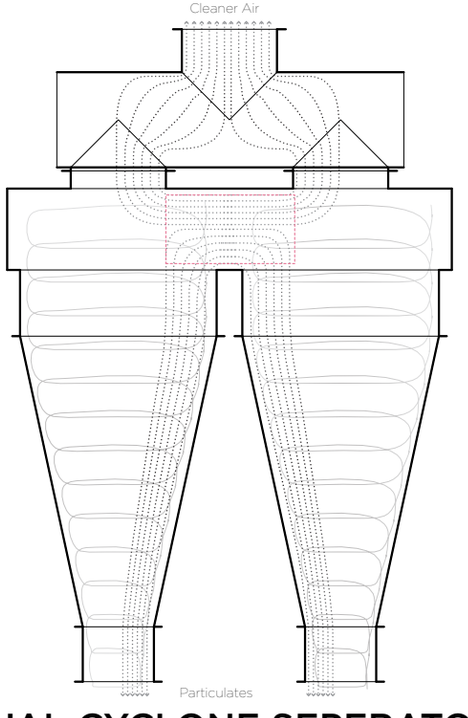


HORIZONTAL CYCLONE SEPERATOR

Can be used to collect both Particulates and gaseous pollutants but are more effective in removing gas pollutants through wet deposition.

Polluted Air -> Inner Cyclone -> Outer Cyclone ->Particulate Separation -.> Cleaner Air

Pollution Control Devices -> Dust Collectors -> Inertial Seperators -> Secondary Airflow Separator



DUAL CYCLONE SEPERATOR

A centrifugal dust collector uses cyclonic action to strikes particles against its walls which are then collected in a hopper below. Multiclone seperators allow for many connections, assuring most dust is collected.

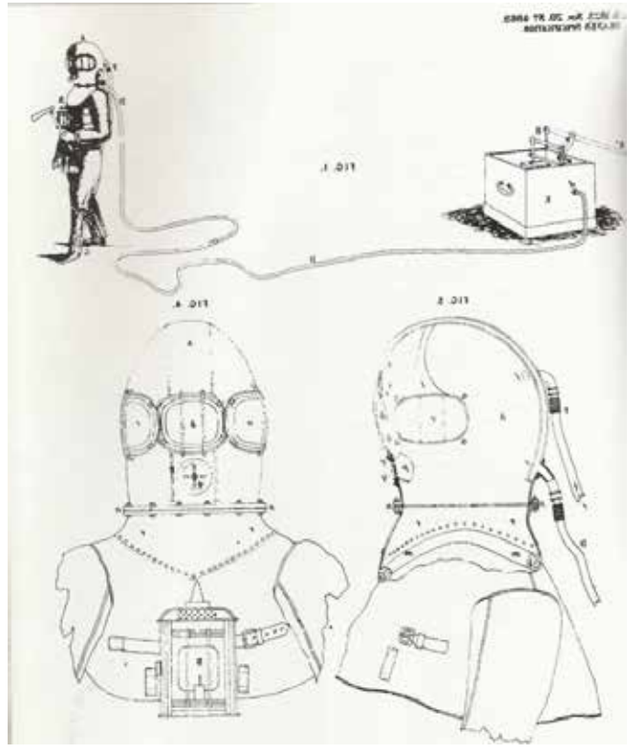
Polluted Air -> Cyclone -> Particulate Separation -> Cleaner Air

Pollution Control Devices -> Dust Collectors -> Inertial Separators -> Multiclone Seperator

COMBATING MALIGNANT AIR

Beijing's air is oppressive. It limits public interaction and destroys street activity.The experience of urban living is lost in Beijing due to the presence of pollution.

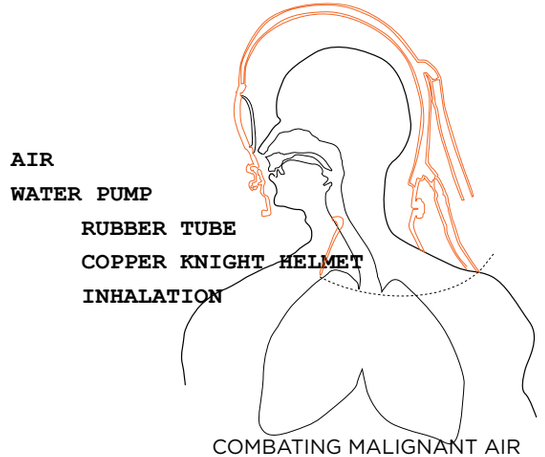
Li Guixin is the first individual to sue the government for failing to fix air pollution problems. The man from Shijiazhuang said, "the reason I'm proposing compensation is to let every citizen see that amid this haze, we're the real victims." Although he is not a resident of Beijing, the frustration with air pollution in China is clearly evident. Although the central government has recently promised $275bn towards the issue in the next five years,



SMOKE PROTECTOR JOHN & CHARLES DEANE

1823

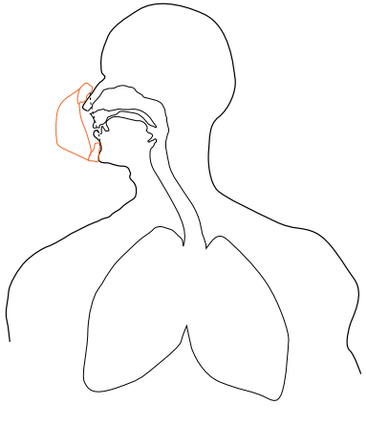
An old copper knight in-armor helmet attached to a fire brigade water pump is invented in reaction to a stable filled with trapped horses.



THE CHARCOAL AIR-FILTER OF JOHN STENHOUSE

1854

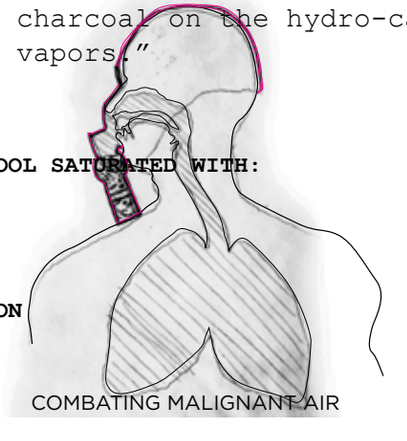
A copper-framed mask with powdered wood charcoal inbetween.

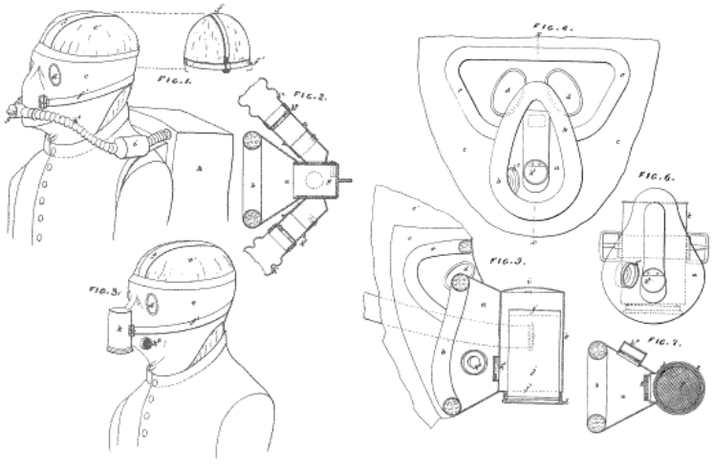


JOHN TYNDALL'S FIREMAN'S RESPIRATOR

1871

A respirator "consisting of a valve chamber and filter-tube about four inches long, connected to a wooden mouthpiece. The respiratory agency consists of cotton wool saturated with glycerin, lime, and charcoal; the lime absorbs the carbonic acid, the glycerin acts on the smoke particles, and the charcoal on the hydro-carbon developed in vapors."

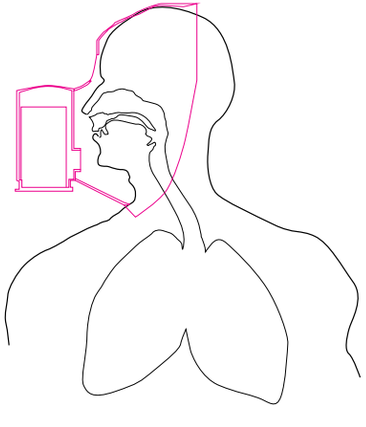


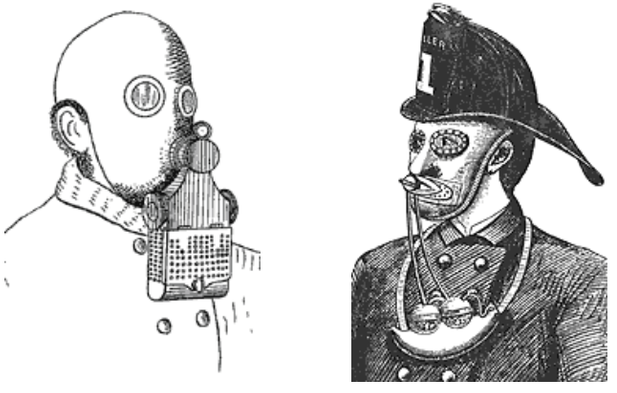


BARTON'S RESPIRATORS

1874

It included a rubber-and-metal face cover, head harness, glass eyepieces, rubber-coated hood, and one-way valves for exhalation and inhalation. A metal canister on the front of the mask contained alternating layers of filtering materials: charcoal, lime, and glycerin-soaked cotton wool.

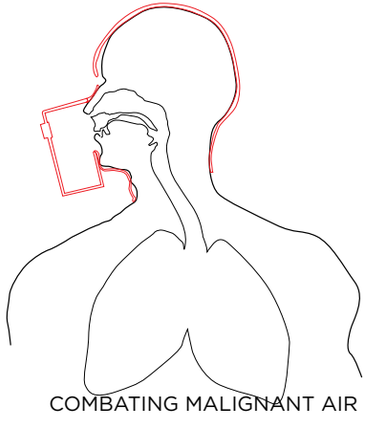


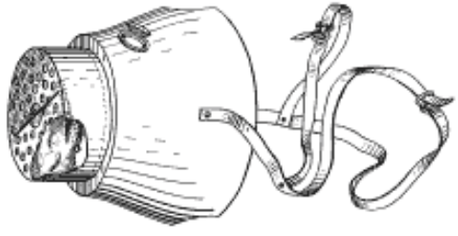


NEALLY'S SMOKE-EXCLUDING MASKS,

1877

It included a rubber-and-metal face cover, head harness, glass eyepieces, rubber-coated hood, and one-way valves for exhalation and inhalation. A metal canister on the front of the mask contained alternating layers of filtering materials: charcoal, lime, and glycerin-soaked cotton wool.

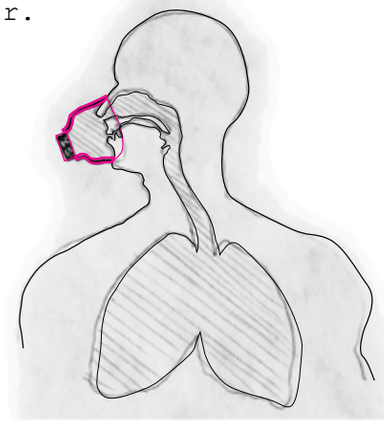


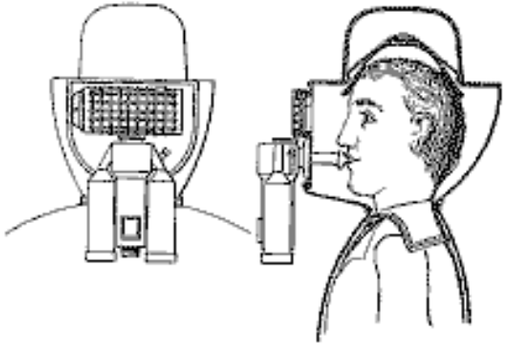


CUP MASKS

1879

Hutson R. Hurd in 1879 to "prevent the admission of poisonous or noxious gases, or particles of dust or other matter, into the throat and lungs." Such masks, vaguely resembling pig's snouts when worn, fit over the mouth and nose and were secured to the head with straps. A check valve on the side or top of the casing allowed the escape of exhaled air.

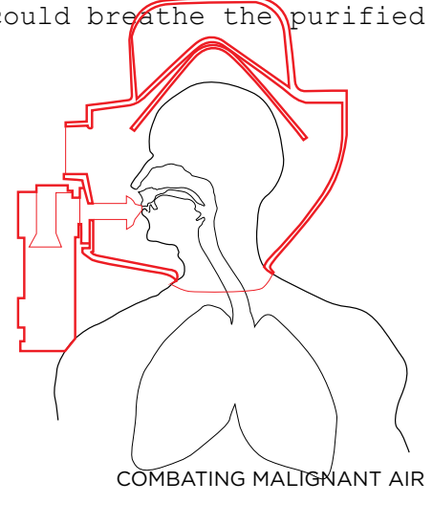


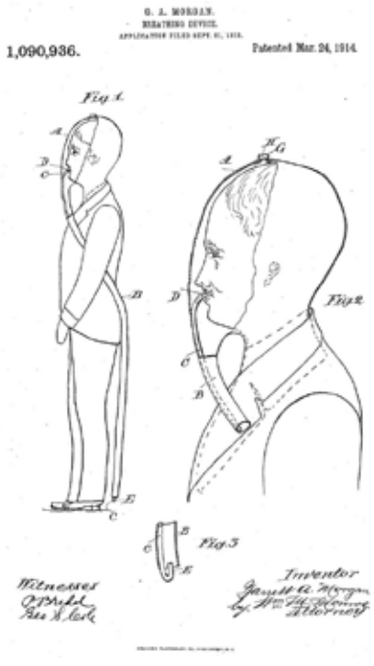


LOEB RESPIRATOR

1891

A triple-chambered metal canister, carried on the waist, enclosed a filtering system containing liquid chemicals and several layers of granulated charcoal and porous wadding. A flexible hose tube connected the canister to a mouthpiece through which the wearer could breathe the purified air.

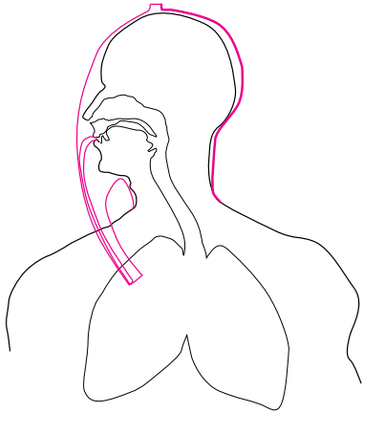




SAFETY HOOD AND SMOKE PROTECTOR

1891

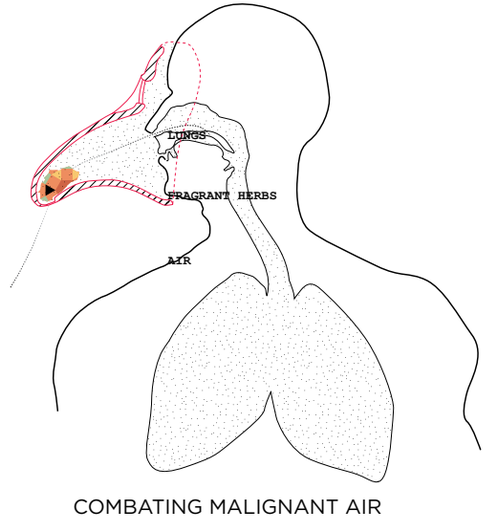
"This device had a cotton hood with two hoses which hung down the floor, allowing the wearer to breath the air found there."



PLAGUE DOCTOR'S MASK

17th C

Used to combat miasmatic air, Plague doctors were amateur medical professions Plague Doctors often wore these beak -like masks which were filled with aromatics.
Aromatics included ambergris, balm-mint leaves, camphor, cloves, laudanum, myrrh, rose petals and storax. Through these masks, paranoia and fear were lulled through sensual replacements



COMBATING MALIGNANT AIR

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Wang, Y., J. Hao, M. B. Mcelroy, J. W. Munger, H. Ma, D. Chen, and C. P. Nielsen. "Ozone Air Quality During the 2008 Beijing Olympics – Effectiveness of Emission Restrictions." *Atmospheric Chemistry and Physics Discussions 9*, no. 2 (2009): 9927-9959.

Mayer, H. "Air Pollution In Cities."*Atmospheric Environment 33*, no. 24-25 (1999): 4029-4037.

"Deep structural change… is the consequence of economic opening-up, new trading partners, and change of political conditions, e.g. democratization."

Chan, Chak K., and Xiaohong Yao. "Air Pollution In Mega Cities In China."*Atmospheric Environment 42*, no. 1 (2008): 1-42.

Discusses impact of regional influence, geography, climate, location, population trends, effects of coal-based energy.
"China is currently considered to be the ENGINE of the world's economic growth.
Coal accounts for more than 70% of the total energy consumption, and emmissions from coal combustion are the major anthropogenic contributors to air pollution in China.
From 1980-2005 the urban population in China increased from 19.6% to 40.5%.
High T and RH conditions in the summer favor the transformation of air pollutants, resulting in some episodes with high concentrations of secondary pollutants."

Streets, David G., Zuopan Li, Zifa Wang, Yuanhang Zhang, Xiaoyan Tang, Kebin He, Jiming Hao, Carey J. Jang, Joshua S. Fu, and Qiang Zhang. "Air Quality During The 2008 Beijing Olympic Games."*Atmospheric Environment 41*, no. 3 (2007): 480-492.

We estimate that about 34% of PM2.5 on average and 35-60% of ozone during high ozone episodes at the Olympic stadium site can be attributed to sources outside of Beijing.
Emissions from these nearby sources, as well as more distant ones, undergo chemical reactions during transport on the prevailing winds, forming secondary species that pervade the entire region and add to the local pollution.

Hao, Jiming, Litao Wang, Minjia Shen, Lin Li, and Jingnan Hu. "Air quality impacts of power plant emissions in Beijing." Environmental Pollution 147, no. 2 (2007): 401-408.

There are six power plants at present and the total generating capacity is 2920 MW. They provided around 48% of the total electricity consumption in Beijing in 2000 and in 2008 the electricity provided from the plants outside Beijing area will increase to 55%.

http://oilprice.com/Latest-Energy-News/World-News/Beijing-Cracks-Down-on-Pollution-Banning-New-Refining-Steel-and-Coal-Plants.html

"China is the largest polluter on the planet and the problem of smog in some of its major cities has been well documented over the past year or so. In January 2013 smog was so bad in Beijing that visibility was reduced to less than 200 metres, grounding flights in and out of the city, closing highways, and forcing many people to stay indoors."

http://www.sacbee.com/2014/01/20/6086710/letter-from-beijing-pollution.html

"Yet as a country where there is little rule of law, China has no comprehensive system of monitoring, permitting and regulating sources of air pollution. Unlike most environmental agencies in the United States, it can't track a pollution problem back to its source or sources and correct it."

http://www.theguardian.com/environment/chinas-choice/2014/jan/16/china-beijing-air-pollution-hazardous#_

"High levels of air pollution have become commonplace in Beijing and other Chinese cities, especially during winter months when temperatures drop and more coal is burned when heating systems are switched on. This combined with stagnant air conditions leave many cities covered in a dense layer of smog for days at a time."

"Pollution levels reached more than 20 times the levels considered unhealthy by the World Health Organisation and the the city's residents, especially children and the elderly were advised not to go outdoors. Early on Thursday morning levels of fine particulate pollution known as PM2.5 reached around 500 micrograms per cubic metre"

http://en.paperblog.com/china-s-new-sng-power-plants-will-emit-a-lot-of-greenhouse-gas-661604/

"SNG, power plants that are being planned in China would produce seven times more greenhouse gas emissions than conventional natural gas plants. These SNG power plants will also use up to 100 times the water as shale gas production, according to a new study by Duke University researchers.
SNG power plants would also emit hydrogen sulfide and mercury, which, if not properly scrubbed and treated, are potentially harmful to human health."

http://aqicn.org/city/beijing/

Beijing Air Pollution: Real-time Air Quality Index (AQI)

https://twitter.com/BeijingAir

Air Transmissions Beijing

http://www.businessinsider.com/china-pollution-is-blanketing-americas-west-coast-2014-1

"We've outsourced our manufacturing and much of our pollution, but some of it is blowing back across the Pacific to haunt us," co-author Steve Davis, a scientist at University of California Irvine, said."

http://earthobservatory.nasa.gov/IOTD/view.php?id=80152

At the time that the January 14 image was taken by satellite, ground-based sensors at the U.S. Embassy in Beijing reported PM2.5 measurements of 291 micrograms per cubic meter of air.
The World Health Organization considers PM2.5 to be safe when it is below 25.
Also at the time of the image, the air quality index (AQI) in Beijing was 341. An AQI above 300 is considered hazardous to all humans, not just those with heart or lung ailments. AQI below 50 is considered good. On January 12, the peak of the current air crisis, AQI was 775 the U.S Embassy Beijing Air Quality Monitor—off the U.S. Environmental Protection Agency scale—and PM2.5 was 886 micrograms per cubic meter."

http://www.reuters.com/article/2013/01/14/us-china-air-pollution-idUSBRE90D0CL20130114

…one newspaper called for a re-think of a "fixation" on economic growth.
China's media are under tight Communist Party control and usually steer clear of controversy, but news organizations are more free to report on pollution, partly because it can't be hidden from the public.
"How can we get out of this suffocating siege of pollution?" the People's Daily, the official newspaper of the Communist Party, said in a front-page editorial.
Users of China's Twitter-like microblogs complained extensively.

http://www.theatlantic.com/china/archive/2013/09/is-the-air-quality-in-beijing-worse-than-ground-zeros-after-9-11/279589/

I would personally rather breathe the air at the World Trade Center," said Thomas A. Cahill, Professor Emeritus of Physics and Atmospheric Science at the University of California, Davis, after reviewing the Beijing data I had tabulated. Cahill began monitoring PM2.5 levels a few blocks from Ground Zero starting in October 2001. He also conducted research on air pollution in Beijing in April of 2001. "It was bad then," he told me. "It's worse now."
"In October 2001, I would rather have them breathe that air rather than, day in, day out, breathe the air in Beijing, in part because I know the air is going to get better in New York, and the air is not going to get better in Beijing."
What does pollution this severe portend in terms of public health? If Beijing fails to clean up its air quickly, its population of some 20 million could expect "decreased life expectancy, a lot of preventable death. You're going to have a lot more disability, which is a tremendous social cost," as Hofstra's Moline told me. "You're going to have a lot of people having heart disease who aren't going to be able to work anymore.

http://www.npr.org/blogs/health/2013/04/02/176017887/chinas-air-pollution-linked-to-millions-of-early-deaths

More than 1 million people are dying prematurely every year from air pollution in China, according to a new analysis.
They found that in China, approximately 1.2 million people die prematurely from exposure to outdoor air pollution.
In fact, about two-thirds of all the deaths from air pollution are now occurring in Asia, most of them in China. And air pollution has become the fourth leading cause of death in China.

http://www.npr.org/2011/12/07/143214875/clean-air-a-luxury-in-beijings-pollution-zone

While Chinese officials have blamed climactic conditions for what they describe as the "heavy fog," green groups say the real reason is the hangover from China's three decades of runaway growth — emissions from coal-fired power plants, industrial emissions and vehicle exhaust fumes
Inside the living room, where the kids construct dens out of sofa cushions, the level of air pollution — or, more specifically, fine particulate matter — was an estimated 208 micrograms of PM2.5 per cubic meter.

The researchers used air quality readings from 91 Chinese cities from 1981 to 2000, as well as health data from China's disease surveillance system from 1991 to 2000. For cities north of the Huai river, where the pollution is worse, they found lower birth rates, as well as higher adult mortality rates for respiratory-related diseases like heart disease and lung cancer.
Even the state-run China Daily admitted this week that the smog was a "severe hazard," quoting a health official as saying that the lung cancer rate has increased in Beijing by 60 percent during the past decade, even though the smoking rate has not increased."

http://www.theatlanticcities.com/neighborhoods/2012/02/one-month-beijing-smoking-5-cigarettes/1186/

No one would call Beijing a healthy city.
More specifically, on an average day in Beijing an average adult inhales a total of 1.8mg of PM2.5 particles from air pollution, which is 1/6 of the average 12mg of PM2.5 particles inhaled from an average cigarette. Yes, that's a very strange number, but if I've done the math correctly, it is indeed true." Says Dr. Richard Saint Cyr, a family practitioner in Beijing.

http://www.bbc.com/news/science-environment-27027876

Dr Yuan Wang said: "Since the Pacific storm track is an important component in the global general circulation, the impacts of Asian pollution on the storm track tend to affect the weather patterns of other parts of the world during the wintertime, especially a downstream region [of the track] like North America."

http://www.forbes.com/sites/panosmourdoukoutas/2013/01/31/why-china-cannot-solve-its-pollution-problem/

China has developed a comprehensive environmental policy similar to that of the world's second producer of carbon dioxide, the US; and it was the host of last UN's conference on climate change. The problem, however, is that by contrast to the US — where the polluters are private companies — in China, by and large the polluters are government companies—State Owned Enterprises (SOEs) and Town Village Enterprises (TVEs).
Furthermore, SOEs and TVEs are "units" rather than true enterprises. They provide employment for unionized workers and financial support for local schools and hospitals. This makes any government action against these corporations too costly for the communities they serve — and eventually non-enforceable.

http://www.nytimes.com/2013/03/22/world/asia/as-chinas-environmental-woes-worsen-infighting-emerges-as-biggest-obstacle.html?pagewanted=all&_r=0

Even as some officials push for tighter restrictions on pollutants, state-owned enterprises — especially China's oil and power companies — have been putting profits ahead of health in working to outflank new rules, according to government data and interviews with people involved in policy negotiations.
The companies regularly ignore government orders to upgrade coal-burning electricity plants, according to ministry data. And as with the oil companies, the power companies exert an outsize influence over environmental policy debates.

Another problem is the low penalties: fines are generally capped around $16,000, not much of a deterrent, said Ms. Zhou, the Greenpeace representative. She said the violating factories "should be required to stop production temporarily — that would then force companies to take this seriously.

http://uk.reuters.com/article/2014/01/07/china-coal-idUKL3N0K90H720140107

We estimate China's total coal production capacity will be 4.7 billion tonnes by 2015 - I think the government figure is a big underestimation."
China approved the construction of more than 100 million tonnes of new coal production capacity in 2013 - six times more than a year earlier and equal to 10 percent of U.S. annual usage - flying in the face of plans to tackle choking air pollution.

http://qz.com/157015/this-map-shows-where-the-chinese-coal-plants-that-kill-257000-a-year-are/

But even if their pollution levels hadn't before indicated it, coal emissions have been killing Shanghai residents prematurely for a while now. In fact, Shanghai's 22 coal plants cause 4,370 premature deaths a year, according to an interactive map by Greenpeace, a non-governmental organization. Beijing's 10 plants cause only 1,004 deaths a year.

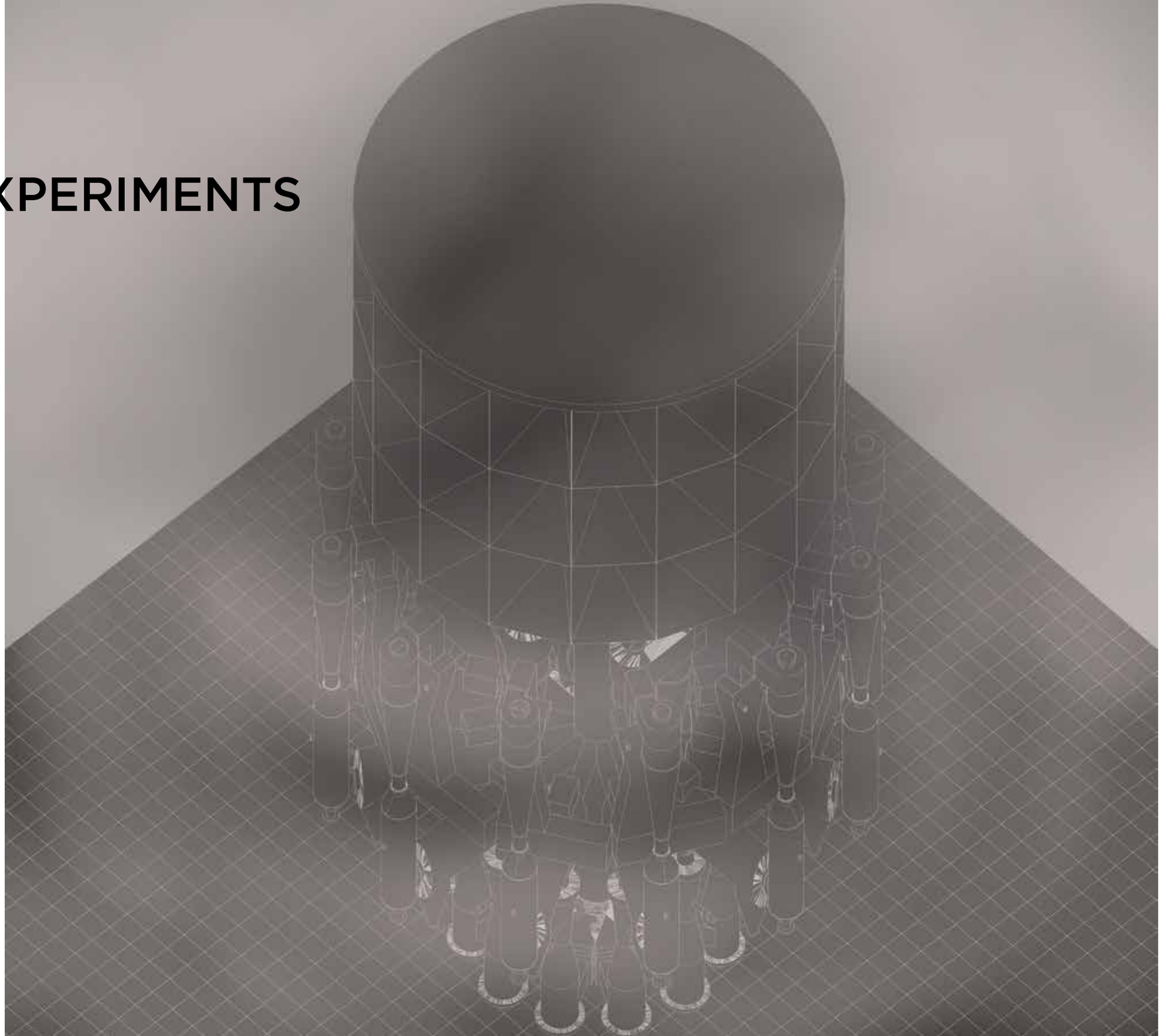
http://www.telegraph.co.uk/news/worldnews/asia/china/10555816/Chinas-airpocalypse-kills-350000-to-500000-each-year.html?_ga=1.165124351.159401285.1393965181

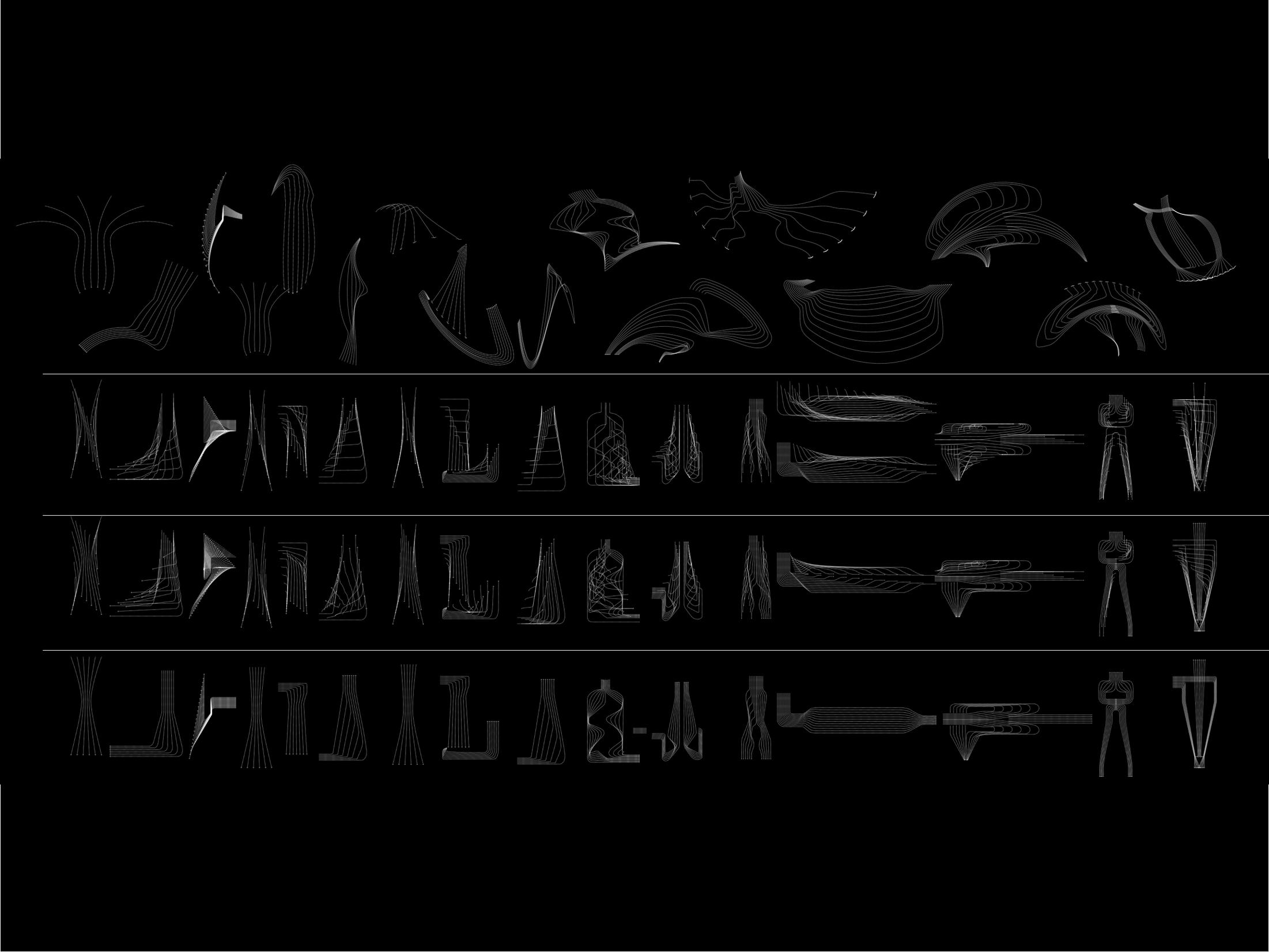
He added that air pollution has become "the fourth biggest threat to the health of Chinese people" (behind heart disease, dietary risk and smoking) and that lung cancer is "now the leading cause of death from malignant tumours in the country"

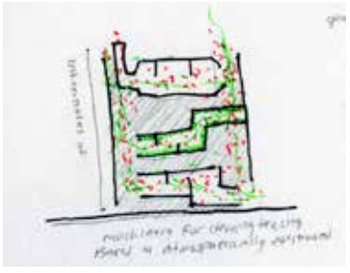
http://damiankahya.cartodb.com/viz/48ebb66c-61bc-11e3-b4c2-a3a0bac688ee/embed_map?title=true&description=-false&search=false&shareable=true&cartodb_logo=true&layer_selector=false&legends=true&scrollwheel=true&sublayer_options=1&sql=&zoom=3&center_lat=34.95799531086792&center_lon=111.09374999999999&_ga=1.165018879.159401285.1393965181

China coal plant emissions by health impact

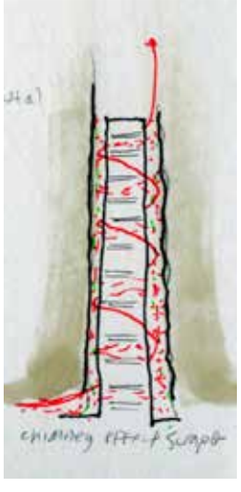
EXPERIMENTS

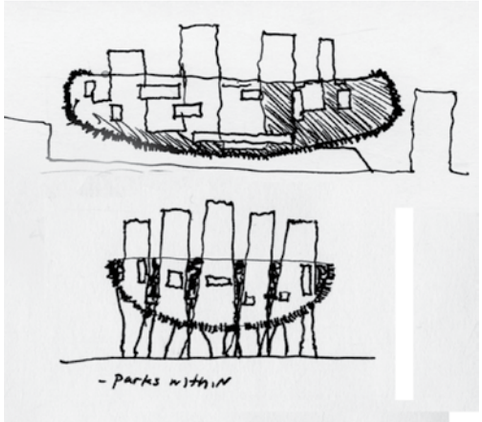







LINKS for the ground

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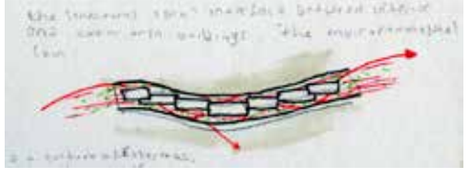
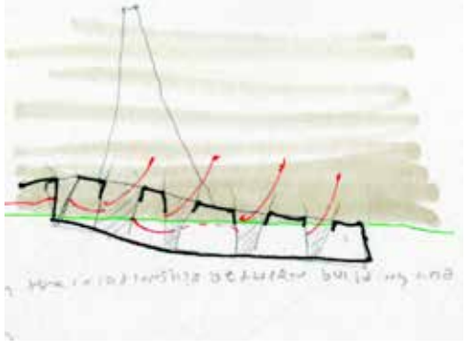
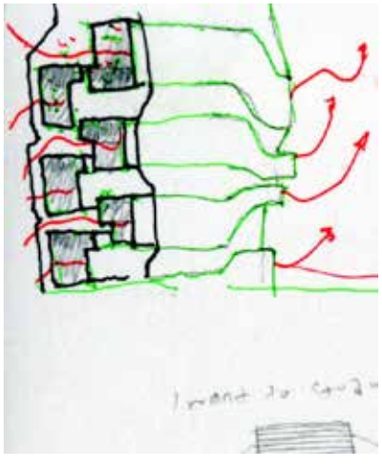





PUBLIC SPACE



MATTERS OF AIR

FRANKLIN ROMERO JR

LYDIA KALLIPOLITI
RYAN LUDWIG