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Internship reading and experience.

This summer I was an intern with the Indiana Department of Environmental Management (IDEM). My department was air quality permitting. In this position, I was able to learn about the ways Indiana monitors and controls air pollution. I also read two books to compliment what I was learning as I worked, I read *An Air That Kills* by Jhon Reiuwerts, and *Poison Spring* by E.G Valliantos. In this paper I will first talk about my experience at IDEM then I will compare the US, Britain and Chinas using knowledge gained in school, at my internship, books, and other research. First, I will talk about pollution events that promoted response and then some of the policies that came from these events. Then I will compare the current systems in place to monitor air pollution in each nation. Then I will go over where the pollution comes from and what makes up that pollution. After that I will discuss some of the issues with current monitoring techniques.

My personal experience.

I worked at the Indiana Department of Environmental Managements or IDEM as a permitting intern. IDEM was established in 1986, and currently has over 900 employees, IDEM's mission is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial and government activities vital to a prosperous economic. They do this through a multitude of programs including permit programs that define pollution limits for companies. They also inspect and monitor facilities and enforce penalties if regulations are broken. IDEMs goal is to Provide quality environmental oversight and technical assistance. IDEM is broken into 6 major areas, the first three are very similar in structure but deal with Water, Land, and Air. The office of program support deals with government programs from EPA coordination to local recycling programs. The office of chief of staff are the managers of different divisions, the Finance division and HR among other things. Finally, the office of legal counsel works with all of the departments to protect the state and prosecute those who break IDEM permits and rules. The 3 main departments Water, Land, and Air. All have the same sub areas within them. First Writes air

permits for all sizes and types of operations and helps regulated entities understand their environmental responsibilities. There were 8 PR sections for permitting each one would work with a different industry, like saw mills and asphalt plants. They did this because each type of machine and material used had different regulations, so it was split the number of rules you need to know. For example, I worked with 40 CFR 60, subpart IIII frequently since my section worked with generators and this rule was for emergency generators. Then inspectors go to permitted facilities, and checks that companies have the correct equipment and emission estimates. If a problem is found, then they are notified, and a fine or more severe punishment is given. Companies can try to appeal the issue and can set up meeting with IDEM personnel from many different areas. The over all goal is to ensures that Indiana meets federal and state air quality standards. All of these departments follow the federal clean air act and other federal laws, but the state government also puts more stringent permeators for companies.

I was stationed at the downtown Indianapolis headquarters which brought a lot of challenges for me just because of location. I have always worked in my home town or on a construction site on a lake. So this was the first time I worked and had to deal with a city on a daily basis. Getting lunch by myself or meeting for lunch with a semi strict time frame in such a busy place was new. Talking with coworkers, attending and participating in office activities like retirements and health challenges. I also had to drive an hour and 15 minutes to and from work every day. I got to make my own schedule I could be in the office any time between 6am and 6 pm with any amount of time for lunch we just had to have 7.5 hours every day. We were also able to flex up to four hours a week. I typically worked from 7:30 to 3:30 with a half an hour lunch.

I was responsible for processing and completing permits for Indiana business's looking to build and expand. I was in the office of air quality. I was assigned to PR2 which handles boilers, combustion units, and parts washers our section leader was Trip Sinha, who had a PhD in chemical biology. We worked with the same machinery because then I had to know a dozen rules well instead of having to

know hundreds of rules. I drafted permits from small companies with less than 10 workers to giants like Cummins and city hospitals. Permits ranged from 4 pages to over 40. Depending on the permit that is assigned to the company. Permits range from Operations permits to large title V permits that required public notice in public libraries, and in the local new paper. The important thing when writing a permit is to make it "practically enforceable and assure compliance". I worked on many technical documents citing rules and excel worksheets. I also went on a compliance visit for a recycling facility for the Covanta incinerate. The permit was for a facility that laid out ash caught from the incinerate and then pulled out valuable metals for recycling. But we had an issue finding the facility, so we went to the Covanta incinerator, where they told us that the facility was permitted but never built due to economic reasons. It turned out that I wasn't even supposed to go on the trip, but the compliance officer grabbed the wrong intern. I also got taken on a new employee trip to see where IDEM Air builds and monitors its sites all around the state. At this facility I was given tours of engineering, monitoring, and research facilities. But I also was taken to the only monitoring site in Indiana that has every type of pollutant monitoring system at it.

I also attended workshops and training session for the newly hired employees. I was at all but 3 of the training sessions for the summer. The new employee information sessions were taken by all new employees since the previous session the year before, and by anyone wanting or needing a refresher. These training sessions were for information from all PR groups, so I learned about woodworking operation, asphalt plants, and many other industrial facilities. I was given the internship through a program called the Governor's Public Service Summer Internship Program which held guest speakers like the governor himself and workshops like office etiquette. I also communicated with industry representatives like plant environmental managers, and consultants hired by companies, I would ask for emission standards if they didn't send it or if clarification was needed. Many times the company would send a completed emissions sheet instead projected emissions, we had to do all of our own calculations

to check. At the end of my internship I helped with the beginning stages of creating a state search database. This Search engine was for community comments and IDEM responses. The purpose was to stop duplicates and allow better organization of comments. I reviewed over 70 pages of public comments and replies categorized by topics, like public health, school proximity, etc. The permit that the comments were for was a cement manufacturing plant in southern Indiana that was changing its combustion from oil to oil plus hazardous waste. The company's property was against the local school's land, and the school was under 700 yards from the plant. I reviewed comments from local people, local groups, and larger state groups along with IDEMs responses to these comments.

I was able to explore a future career path and gain valuable experience about the environmental industry. The first and possibly most important thing I learned was I do and don't like in a job. I was able to experience an office setting and see how it works for the first time I gained knowledge of emission stands though writing permits and reading handbooks. I also got to learn a little bit of the chemistry and health effects involved with pollution. Finally, I got to make contacts in the industry and experience a few different positions.

#### Policy background

The history of air pollution control starts much further in the past than may be expected. King Edward I put a ban on burning sea coal in the 13th century because of it burnt very dirty and smoky which caused what we know as smog today, but this had little effect. The first government policy as we would think of today came about in 1848 and was passed by the British parliament to regulate both water supply and smoke dispersion at a local level, this was done to try to stop the spread of cholera. The Public Health Act in 1875 had a section on smoke reduction. In 1956 the Clean Air Act was introduced which included smoke control, chimney height requirements and forbid dark smoke release from chimneys. The Clean Air Act was then extended in 1968 to include more rules on dark smoke

emission. In 1989 the Air Quality Standards regulations were passed which added limits on SO<sub>2</sub> and PM along with lead and NO<sub>x</sub> gases. The 1990 environmental protection act aimed at controlling the emissions of large polluting industries and gave local authorities the power to bring smaller emission sources under control.

In the US Chicago was the first city to create an ordinance that regulated smoke discharge in 1881, many cities like Cincinnati and St. Louis followed suit within a few years. The only issue is this ordinance was not taken seriously and no punishments came from it besides non-substantial fines. The first smoke inspectors office in the US was in Pittsburgh in 1906, which made a noticeable decrease in emissions. A large break through occurred in 1915 when the US supreme court ruled that limits could be put on sulfur and other harmful gases released from a business. This was brought about from a case against the Tennessee Copper Co. from the state of Georgia which complained of deforestation and citizens becoming ill from the fumes released and then blown over the border. The court said that the gasses released must be reduced and that a Vanderbilt University would conduct inspections to insure compliance. In 1928 the US Public Health Service first began to check cities for pollution by checking the amount of sunlight that made it through the haze. The US Public Health Service also conducted the first US air pollution conference in 1949. The first purely air pollution bill passed by the federal government was the Air Pollution Control Act of 1955 which gave funding for research of air pollution sources and magnitude along with the first air pollution legislation. In 1963 the clean air act allowed research of air pollution control techniques for the first time. The 1967 Air Quality Act added the ability to enforce the transport of air pollutants across state boundaries along with an expansion of research. The Clean Air Act of 1970 was the most comprehensive legislation to date it established ambient air quality standards, and required states to come up with a plan to meet those standards. It also gave source performance standards for new and modified pollutant sources, along with increased enforcement authority with the

authority to control vehicle emissions. The 1990 amendments added 189 toxic pollutants to national emission standards and also established permit program requirements.

When the third Chinese constitution was constructed in 1978 an environmental commission was included for the first time. The first laws were rolled out by this commission a year later in trial form. These laws became formally adopted in 1989 after many changes and most of which relaxed the rules. Since then over 30 laws having to do with environmental protection have come out most of which have been seen as ineffective because of their basic and difficultness to practically enforce. Then near the turn of the century Beijing adopted new rules and measures to decrease air pollution. These measures include using cleaner burning coal, installing scrubbers on exhaust pipes, the increase in dust control, and the implementation of new vehicle emission standards. These changes did not make a significant change in air quality, but it did provide evidence of techniques that did have some impact even if it was small. China operates on five-year plans where economic and social goals are set for the next five years. During the 2006 to 2012 five-year plan it was established that SO<sub>2</sub> emissions would be reduced by 10% and this goal was made. This was a step in the right direction but the pollutants that really plagued the county like Particulate matter, and ozone became worse.

#### Monitoring system

The air pollution monitoring system in the United Kingdom starts with 389 different local authorities, they monitor the air and if a problem spot is found then an air quality management area is set up with fulltime monitoring. They must also lay out a twelve-month plan on how the situation can be improved. In the United Kingdom there are 158 monitoring stations according to the Department for Environmental Food and Rural Affairs. This may seem like a lot but in Indiana alone there are 87 monitoring stations. To put that in to perspective the United Kingdom has over double the land area and over ten times the population. This suggests that they may be lacking on monitoring. The United

Kingdom sets up their monitoring stations to have "full coverage" for PM 10, No2 and a few other pollutants. This is hard to believe with the low number of stations for the size of the country. In Indiana the stations are set up in high population areas along with industrial areas and other areas of high pollution. Another issue in the United Kingdom all monitors must be 4 meters off the ground, when I was an intern I saw three monitoring stations and all of them were on top of trailers or set on towers, so they were also 4 meters or higher. This is a flaw because it is not monitoring the pollutant levels at the height that living things are breathing that air in. It is a small detail, but it doesn't accurately show how much pollution a person is breathing in. Many of these pollutants originate at ground level so they are more abundant at lower heights. Chinas National Environmental Monitoring Center reportedly has over 1,000 monitoring stations alone, along with over 600 cities now monitoring their air locally with some cities having up to 50 stations. According to Thermo Fisher the company that supplies a large amount of the sensors they typically supply SO<sub>2</sub>, NO<sub>x</sub>, CO, O<sub>3</sub>, and PM analyzers. For China's monitoring systems it was difficult to find information on their location but most photos I saw were stations on top of buildings, this obviously would be an issue because the amount of pollutants at ground level is much higher especially ground Ozone and PM. Another issue in China has huge amounts of corruption, officials have been known to use water sprayers and stuff analyzer intakes with gauze to falsify readings. This can be do to new pressures put on officials to reduce pollution for advancement opportunities.

### What causes the pollution

What causes the pollution we deal with every day? In the United Kingdom automotive pollution is the largest contributor. These pollutants are primarily NO<sub>2</sub>, CO, particulate matter and a little SO<sub>2</sub>. NO<sub>2</sub> can also be made in another way besides burning fossil fuels, it can be made when nitrogen and oxygen in the ozone are heated up to high temperatures and fuse them together. SO<sub>2</sub> is known to cause COPD. With IDEM I worked with manufacturing, hospital, biomedical pollutants. One of the scariest and

most monitored pollutants I looked at was particles matter in three different categories Over all PM, and PM10, and PM2.5. PM10 is inhalable particles that are 10 microns to PM 2.5 micron. PM 10 and smaller particles can get deep into your bronchi and can even get absorbed into your bloodstream through your alveoli. These pollutants include including things like fly ash, and oil smoke. PM 2.5 contributes heavily to hazy conditions, and can be made up of things like carbon monoxide, mineral dust, and soot, Affecting children's lung development along with causing numerological defects. These different pollutants can cause serious health problems that have huge impacts. Chinas major air pollution contributors come from coal burning power plants which make up 70% of energy production, and more recently vehicles emissions especially in urban areas. Coal power plants in China are the largest contributors to CO2, SO2, NOx and PM emissions in the world. Vehicle emissions have also contributed significantly because of the density of automobiles in huge mega cities which can lead to catastrophic pollution events.

#### Historical Events.

The US, UK, and China have all had pollution events that could be considers crisis which lead to new regulations or stricter enforcement. In October 1948, Donora, Pa., was enveloped in a lethal haze. Over five days, nearly half of the town's 14,000 residents experienced severe respiratory or cardiovascular problems. Photos show Donora's streets hidden under a thick layer of smog. A warm air pocket had passed high above the town, trapping cooler air below and sealing in pollutants. This pollution was caused by steel and zinc smelters. By the end of the disaster nearly 40 people had died. This was an unusual situation at the time but it was an indicator of trouble ahead from industrial processing and manufacturing. During the great smog of 1952 thousands of Londoners died from inhalation, this happened when cold windless weather conditions mixed with air pollutants like coal smoke from heaters and industry formed a thick layer of fog. This was a significant event leading up to the clean air act in 1956. Much like in the United Kingdom, ecological disasters lead to the clean water

act and even the formation of the EPA and organizations like IDEM. In 1969 the Cuyahoga River became heavily polluted to the point where it was able to be catch fire. Then more than 20 million Americans participated in the first earth day in April of 1970. The mixture of ecological disasters and a change in public opinion lead to the creation of the EPA and the clean air act in December of 1970. For China these pollution events have been much more recent, in the early months of 2013. A extremely thick haze covered many cities in eastern China, this haze was predominantly made up of PM 2.5. This caused low visibility and an increase in respiratory problems especially in children. This crisis caused a shift in public opinion, especially after large discrepancies were found in China's Beijing reading and the US embassies readings. Exact number cannot be put on how many people died as a result of this, but the Global Burden of Disease study estimated that 1.2 million people die prematurely each year from pollution exposure in China. This extreme level of pollution causes economic loss equivalent to one to seven percent of China's GDP. (Zhang S.Q 2011). Through these different events it is clear that we need to start making decisions about the safety of our environment before the decision is forced by ecological disasters. Peoples and the environments health is more important than keeping large companies profits high. We have come very far since the time of those tragedy through new policy and technological innovation. We have removed harmful heavy metals like lead from fuel and other everyday objects. We also have come up with emission lowers like low NOx burners, filters, and scrubbers. But we must always strive to do more and have less of an impact on the environment around us.

Problems with tackling air pollution in the US and UK have to deal with infringing on people's civil liberties and how industries are affected by changes in policy. People do not want to have change a part of everyday life due to emission control. Others believe that pollution control will hurt or even close some industries and jobs could be lost. This also leads to Politian's not supporting bills with pollution control because their constituents could be negatively affected. Another issue is the suppression of

information in the past. EPA scientist have been harassed and even demoted when their scientific findings would have an impact on big business.

Environmental policy enforcement in the past was relaxed and there was very little incentive for local officials to enforce and meet regulation requirements. This has led to the system being viewed as weak and corrupt. In fact, officials have been caught spraying misters in front of sensors, and stuffing sensors with gauze so that reading are below actual levels. Until recently environmental regulation has not been a factor in promotions, which focused souly on economic and social policies. But in 2006 several environmental and energy targets were set as mandatory. This means that these targets must be reached by government and local officials or they will have no chance of advancement, therefore giving them incentives to comply.

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